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ATLIS Report No. 10

CRITERIA FOR EVALUATING THE EFFECTIVENESS OF LIBRARY OPERATIONS AND SERVICES.

PHASE I: LITERATURE SEARCH & STATE OF THE ART

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February 1967

Final Report on Phase I of Contract DA-28017-AMC-3483 (A)
for Picatinny Arsenal, Dover, New Jersey

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PHASE I: LITERATURE SEARCH & STATE OF THE ART

by

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and

B. A. Cohrssen

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ABSTRACT

This report summarizes the findings of a search in the library and management sciences literature to determine the standards and methods of evaluating the efficiency and effectiveness of library services and operations. A matrix was used to show which management techniques, either analytical or operating, may be applicable for evaluating the efficiency or effectiveness of the library components and determine criteria for them. A chart was used to show the relationship of library operations to activities and how they both support the library's goal.

Existing criteria and standards were found to be unsatisfactory because only some aspects of libraries lend themselves to quantitative measurement, such as number of items cataloged, ordered or found in a period of time. The quantitative measurement of the value of a library service or product such as a literature search, bibliography or current awareness service seemed more difficult to assess.

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I. INTRODUCTION

The purpose of this overall contract study under the ATLIS (Army Technical Library Improvement Studies) project 02/001 is stated in the ATLIS pamphlet as follows: "This work unit will develop criteria for evaluating technical library operations and services, including: performance standards, standard operating procedures, and application of these to improve service effectiveness.

"The need for specific criteria to cover such areas as: acquisition, cataloging, collection maintenance, user services, and others will be determined."

The effort will be divided into three phases:

PHASE I - State-of-the-art: Conducting a literature search reflecting the current state-of-the-art, covering:

a. Library standards.
b. Methods of evaluating libraries.

PHASE II - Data gathering and evaluation.

PHASE III - Establishing criteria.

The present narrative discusses the findings of PHASE I in which the contractor is charged to search all applicable literature and thereby to assess prior work on the subject, and to establish the current state-of-the-art.

To perform the PHASE I task, it became evident almost immediately that certain terms and concepts had to be defined, and search approaches explained. Statements of the objectives of the study enunciated in the contract work scope include "to establish criteria which can be used for the evaluation of Army Technical Library operations and services," and, "provide a method of measuring or testing the criterion with the purpose of determining library effectiveness."

It is necessary to remind ourselves of the differences between "operations" and "services" and to distinguish between "efficiency" and "effectiveness." Whereas the term "operations" connotes performing a practical task aimed at yielding a product for internal use of the library, the term "services" connotes performance of a task having an end product for external use and may even be identified as the end product. Typical "operations," for example, are the acquisitions task, cataloging, and management. Typical "services" are literature searches, abstracts and index-publications, and current awareness bulletins. Perhaps unfortunately, some activities seem to partake of the nature of both operations and services as in the case of "circulation services." Sometimes operational tasks are referred to as "technical services."

Any number of definitions may be found for "efficiency" and "effectiveness." For example, WEBSTER'S SEVENTH NEW COLLEGIATE DICTIONARY gives the definition for efficiency as, "effective operation as measured by a comparison of production with cost (as in energy, time, and money)." The connotation of this definition is that efficiency is a measure of the number of units of production per unit of time or per unit of cost. The word "efficiency," therefore, was chosen to mean a quantitative measurement. Library operations, such as cataloging, indexing, and answering telephones, can be measured for their efficiency. This approach was also taken by W. Goffman and V. A. Newill (155).*

On the other hand, it was decided to think of "effectiveness" as the extent or degree to which a particular library service has fulfilled the goal or objective for which it was performed. For example, it is quite appropriate to inquire regarding the "effectiveness" of library services such as a bibliographic search. How well did the findings of the search fulfill the needs of the client? These ideas were also advocated by Kertesz (217). It appears that effectiveness can have no exact quantitative measure, but rather only a relative one. A number of attempts to measure effectiveness have been reported. For example, the effectiveness of sales of a consumer item is referred to commonly as an alleged measured item.

* Numbers in parentheses are references to Abstracts (Appendix A), or Supplemental References (Appendixes B and C).

Recently Booz, Allen (49) completed a study which attempted to evaluate the effectiveness of mechanization schemes in Department of Defense libraries and information centers. Their study summarized the bases used for evaluating the effectiveness of various schemes and suggested that they be rated according to management expectations or user needs. Other studies of libraries have offered suggestions for improving effectiveness (101), given standards to measure effectiveness (261), or have stated that the effectiveness of a library is measured by the value added to its parent company's flow of ideas or products (454). But these studies produced no quantitative standards. In areas unrelated to libraries, technical efficiency was measured as the ease with which operating groups were able to learn to use equipment (305). Computer installation effectiveness was measured by using the statistical analysis method of stepwise multiple regression (23). The effectiveness of research and development, particularly in the DOD (Project Hindsight) has received much attention. Patents applied for as an indicator of creativity, has been used as a measure of effectiveness of R. & D. (180).

Criteria or standards are needed to measure how well tasks have been accomplished, to evaluate long-range planning (334), to evaluate the solutions developed to satisfy objectives (93), and to measure R. & D. efforts. Criteria

would also provide guidelines for effective library service, according to L. A. Martin (269). In addition, C. G. Stevenson (406) believes that library criteria aid management in understanding the library, give the library profession status, and aid the library administrator in planning.

Although there is some danger of oversimplification, it is believed from the foregoing discussion that the term "efficiency," as it will be used in this study, should connote quantitative parameters. Furthermore its use should be restricted to evaluation of library operations. The term "effectiveness," unfortunately, is less quantitative, and will pertain chiefly to library services.

Examining for a moment a definition of the word "criterion," taken from WEBSTER'S SEVENTH NEW COLLEGIATE DICTIONARY: "a standard on which a judgment or decision may be based," a question arises as to whether this standard should be something specific and "tailor-made" to a particular library, or if the evaluative measurement should perhaps be attained through comparison of the particular library with other libraries. An immediate reaction to such a question might be that comparison with other libraries, perhaps by means of multiple regression analysis techniques, would embody a danger of establishing, not standards of excellence but, rather, standards of mediocrity.

On the other hand, consideration of such a question leads again to the thought that one should distinguish between the kinds of entities for which criteria are sought. It is quite possible that successful measures could be developed for library operations through a comparative technique, whereas meaningful criteria for library services could only be attained by assessment against dimensions such as the purpose or mission of either the library or its parent organization.

If one now thinks in terms of the systems analysis approach, and attempts to relate the various library operations and services to the library mission, to the goals and objectives of the library, to the activities the library carries out, and to the processes it goes through to accomplish these ends, it may be possible to determine, not only which entities could be evaluated for each library as an individual organization, but also those which may be compared and measured with the same entities in other libraries.

Before commencing the literature phase of this contract, and while preparing the approach to the problem, the idea occurred that one way to evaluate library effectiveness would be to weight library inputs and processes (operations) in proportion to their contribution to the library, and, where possible, to assign costs.

In order to accomplish this in a logical fashion, one should determine such items as library mission, goals and objectives, activities, and operations. The following are possible examples and are meant to be typical rather than all-inclusive:

MISSION - To be a single source of all published information in the field of "X" research and development.

GOALS AND OBJECTIVES

1) Collect all applicable published information.
2) Maintain it under bibliographic control.
3) Disseminate it, or products resulting from processing it.

ACTIVITIES

1) Provide circulation services.
2) Provide reference search services.
3) Prepare bibliographies.
4) Provide "current awareness" services.
5) Provide question-answering services.
6) Others.

OPERATIONS

1) Acquire documents
2) Catalog documents.
3) Store and retrieve documents.
4) Search catalogs and other sources.
5) Others.

Activities are defined as the actions which convert goals and objectives from rather static concepts into dynamic and meaningful library outputs (products or services). Therefore, the aim here is to establish criteria for the effectiveness of activities in fulfilling the mission-oriented goals and objectives, and for the efficiency of operations, as they contribute to activities.

This concept may be displayed as in Figure 1, illustrating, for a library designated as Number One, the relationship of operations to activities, showing both of them as they support mission and goals, and blocking out requirements in dollars and relative contributions in rating units.

The chart in Figure 1 illustrates the concept. It does not attempt to develop the idea completely nor does it prove that the concept is either feasible or practical. It is simply a way of thinking. It is the background with which the contractor approached the literature and, in a sense, is what the searchers were seeking. Little, if anything, was found quite along these lines.

This type of approach will permit a determination of the relative values of operational inputs toward providing a given service. Although these values must be assigned arbitrarily, this should be done by an experienced librarian, and the values will be close approximations. This will

also allow assignment of costs on the basis of values chosen. The data can then be analyzed by computer methods to determine the optimum distribution of costs. When such analysis has been performed completely for all designated operations and services, the total costs must agree with the total library budget.

LIBRARY DESIGNATION: NUMBER ONE

MISSION: TO BE A SINGLE SOURCE OF ALL PUBLISHED INFORMATION IN THE FIELD OF "X" RESEARCH AND DEVELOPMENT.

GOALS AND OBJECTIVES:
1. COLLECT ALL APPLICABLE PUBLISHED INFORMATION.
2. MAINTAIN IT UNDER BIBLIOGRAPHIC CONTROL.
3. DISSEMINATE IT, OR PRODUCTS RESULTING FROM PROCESSING IT.

LIBRARY ACTIVITIES OR SERVICES

LIBRARY OPERATIONS	REFERENCE SEARCH SERVICES	CIRCULATION SERVICES	BIBLIOGRAPHIES	100% TOTAL
	TOTAL A RATING 700	TOTAL B RATING 900	TOTAL C RATING 500	
DOCUMENT ACQUISITION	$ Cost 50	$ Cost 800	$ Cost 70	$ Cost
DOCUMENT CATALOGING	$ Cost 240	$ Cost 100	$ Cost 250	$ Cost
DOCUMENT STORING AND RETRIEVAL	$ Cost 10	$ Cost 0	$ Cost 10	$ Cost
CATALOG OR OTHER SOURCE SEARCHING	$ Cost 400	$ Cost 0	$ Cost 170	$ Cost

Ratings - Rating in arbitrary units of A's, B's and C's simply shows relative contribution of an operation to the different services output.

TOTAL DOLLAR BUDGET OF THE LIBRARY

Figure 1

If this type of analysis were performed for a number of similar libraries, it would be possible to judge each library for the contribution each type of operation makes to each kind of service. However, one may also visualize that it is possible to compare each type of operation in one library with its counterpart in other libraries. It should be kept in mind that the weightings and costs of the various operations as they contribute to certain services will probably vary widely from library to library. This variance will be a function of the particular libraries' missions as well as their goals and objectives.

Because the concepts of efficiency and effectiveness play such a large part in the modern management aspects of many major industrial governmental undertakings, it became apparent that the literature search of PHASE I of this contract could not be restricted to the literature germane only to library operations and services. Indeed, in searching that particular body of literature, it was incumbent on the searcher to be alert to discussions of modern management techniques already applied to libraries. However, knowing in advance that little such work has been done, it also became the responsibility of the contractor to search out the literature on modern management, whether or not already applied to library matters, to determine if such management methods and techniques have, within their

framework, any applicability toward establishing criteria for measuring library operations and services.

Thus, to facilitate the search of the literature, the subject was divided into two parts: the library and information sciences, and the management sciences. The library science group examined the various aspects of library services and operations. The management science group explored a major segment of available management techniques and methods which might possibly be applied to establishing new criteria, or perhaps strengthening existing criteria, to evaluate library operations and services. The library science group analyzed the various components of a library, its administration, its technical and reader services, and all other aspects, and attempted to arrange them into individual systems, all performing as links in a chain. In order to organize the problem, the components and other characteristics of libraries were arranged as provided in Appendix D.

In all cases, therefore, the library science group was alert to references on the evaluation of all aspects of library operations and services. All available standards that are currently in use as specifications against which libraries are measured or rated were also sought.

The library and management science groups examined the literature published from 1950 to June 1966. The ref-

erences were gathered from runs of several individual journals as well as from several secondary sources such as: LIBRARY LITERATURE, APPLIED SCIENCE AND TECHNOLOGY INDEX, MANAGEMENT INDEX, PSYCHOLOGICAL ABSTRACTS, DOCUMENTATION ABSTRACTS, two Defense Documentation Center demand bibliographic searches, several published bibliographies, business and research libraries' card catalogs, and many standard texts. (See Appendixes B and C.) The results of the search are expanded upon in Section II which follows.

II. STATE-OF-THE-ART LITERATURE SEARCH

A. LIBRARY SCIENCES

1. Library mission and its placement in the parent organization.

The overall goals of an organization usually determine the goals of each of its parts. The mission is defined in terms of the organization's purpose and the major tasks it is expected to perform (409). It is this directive, either written or implied, which determines the endeavors of the library. The special librarian, moreover, must administer the library to support the organization's programs and goals, according to E. M. Sable (378). The mission not only affects the various levels of service the library provides (487), but also the functions it will perform (158), particularly in a military library (322). The goals of the library, whether or not set up by the administering organization, should include a statement of end purpose, whether it is to save time or money or add to general creativeness. Lawrence Papier (332) discusses cost criteria for judging a mission. And cost, time and performance measures were used by the Arthur Andersen Company (14) to judge how effectively an organization performs its mission. So far, however, no criteria have been devised which can satisfactorily and quantitatively measure how

effectively an organization or a technical library is carrying out its mission.

Since it is assumed that the mission of a parent organization determines the objectives of the library, the various aspects of the library were examined - its administration, technical services and reader services. In each case, it was noted how they had been evaluated or what standards had been used.

Although the position of the military library in the parent organization has been surveyed, there is no indication given as to the efficiency or effectiveness of the library because of that position (81).

2. Budget allocated to the library.

Budget determination has long been a problem. It can be established, for example, by determining a fixed amount, based upon the total sales of a company (135), a certain percentage of the research budget (482), or the number of persons served (235). Or the budget can be based on the type and extent of services provided. Program budgeting or performance budgeting (136), (223), (274) analyze the costs of a service. This provides management an insight as to where funds are going, and permits the library administrator to communicate the cost of each service and plan for future budget requests. Staff caliber and status depend greatly upon the extent of funds available to pay

library staff salaries, according to Susan V. Billingsley (43). Salaries usually account for well over 50% of the budget (9), (158). Equipment and facilities account for another large part of the budget, especially in the initial setting up of a library (328).

Library budgets have also been determined by several additional means:

a. Job order cost accounting - determining the costs of a particular job order, as a literature search;

b. Process cost accounting - determining the cost on the basis of the processes the product passes through, knowing unit costs for each process, such as cataloging (62);

c. Cost carriers - library services or materials which accrue costs;

d. Cost centers - the geographical locations or functions where costs originate (53);

e. Direct costs and indirect costs (20), (468);

f. Fixed costs - building, maintenance or administrative costs;

g. Variable costs - cataloging, reference and circulation (274);

h. Cost of being ready and cost of services; this system estimates that the services cost

25%; the rest has been obligated before any service begins (71).

The effectiveness of the budgets and the manner of their evaluation have been investigated by:

a. Research divisions, which evaluate their budgets according to the number of scientific publications written (publish or perish), the cost per patent application, or formulas developed per man-week (91).

b. Libraries, which conduct surveys or make comparisons with other libraries (261).

The American Library Association feels that a library that meets the standards in its collection and staff would be enabled, by an increase in the budget, to surpass those standards (9).

3. Library staff.

The general qualifications for library staff personnel are similar to those for any other part of the organization. Personal characteristics, such as adaptability, loyalty, and tact, pertain to both professional and non-professional personnel (60), (321). Ideas on what the professional qualifications of the professional personnel should be vary according to the type of clientele served, as well as the function performed. In the scientific library,

scientific knowledge has been stressed more than library training or knowledge (21), (256). Generally, however, library personnel should build and maintain interest and enthusiasm in the library so that it is a creative part of the organization.

The library administrator should know management techniques; the cataloger, a subject specialty plus cataloging techniques (105), (381). Just how well professionals perform in the job they are doing, or how well they adapt themselves to another one, is part of the problem at hand. The U.S. Civil Service Commission recently published its classification of professional level positions in government libraries.[1/]

The non-professionals on a library staff are usually considered to be persons not trained in library sciences. These constitute, in most cases, the clerical staff. (In this study also, the term non-professionals indicates clerical staff.) The qualifications of such personnel comprise clerical and secretarial skills. These are described in the U.S. Civil Service Commission Library Technician Series, GS-1411.[2/]

1/ U.S. Civil Service Commission. Guide for the classification of positions providing professional-level library and information services. Washington: Government Printing Office, 1966. (TS60) Librarian Series, GS-1410.

2/ U.S. Civil Service Commission. Position classification standards. Washington: Government Printing Office, 1966. (TS62) Library Technician Series, GS-1411.

The subject of the qualifications of professional personnel suitable to staff libraries and information centers appears to be very controversial. Although it is not nearly so difficult to define libraries and librarians, it becomes very difficult to define information centers, information specialists and documentalists. Because there are so many types of information centers and varieties of libraries, the qualifications of personnel to man these organizations vary accordingly. Lowell Hattery (166) feels that scientific information personnel should have professional competence in a subject, managerial ability, and knowledge of literature resources and information handling equipment. A study performed by George Washington University (147) examined the training requirements for future scientific and technical information systems. It was found that the personnel required for these information analysis centers must possess an extensive educational and research background in technical subjects. These persons would be supplemented by technical librarians specializing in document processing. Finally, Bloomfield (45) compares a technical library and a technical information center and describes how they complement each other. The U.S. Civil Commission has devised the GS-1412 [1/] Series to describe those professional personnel in the library who do not qualify as librarians.

1/ U.S. Civil Service Commission. Guide to the classification of positions providing professional-level library and information services. Washington: Government Printing Office, 1966. (TS60) Technical Information Service Series, GS-1412.

The size of the staff should bear some relationship to the types of functions performed, the number of users served, and extent of services (21). An Auerbach Corp. study showed that manpower requirements in libraries will increase because industry and management are becoming aware of the value of information. Automatic devices will not replace librarians but rather will increase their efficiency (25). The Army has determined that there should be one librarian and one or two library assistants for every 1500 users for the general or recreational post library.[1/] Herner and Heatwole found that a technical library staff needs about 3.2 professional and 3 clerical positions per 400 users (482).

A Special Libraries Association survey in 1959 showed that half of the library staff's time is required for administration and supervision, reference, cataloging and literature searching (337). Job descriptions were found to be one way of assuring that professional personnel were not using time on clerical jobs (69).

Job descriptions for each position should be prepared by the immediate library supervisor, in view of the fact that this person has the best knowledge of the skills required, and the working conditions of each position (344).

1/ U.S. Dept. of the Army. Library operational guide. Army library program. Washington: 1961. Dept. of Army Pamphlet, 28-30. p. 15.

Furthermore, a library manual can be a valuable aid in preparing the job descriptions, determining job training necessary, and providing background on staff policies (147), (459).

How can the performance of the library staff be evaluated? In some cases, for non-professional clerical work in the library, standard times have been determined (449). In most cases, it is difficult to make a strict division of labor in professional work to evaluate how well each person is functioning. It is easier sometimes to classify jobs according to the degree of difficulty in accomplishing the work. This method of classification has not been found to be adequate, however, for after a person does one job long enough, the job may become routine.

Job performance can sometimes be measured by achievement--the relationship between work performed and the personnel needed for that performance (61). Some of the methods used to evaluate the effectiveness of personnel are:

a. Acquaintance rating - how well the individual is known by his judge.

b. Numerical rating - performance rated by a number.

c. Paired comparisons - relative proficiency of one employee compared with that of another (132).

d. Rating of junior employees by senior employees, which has a tendency to place everyone near the top (162).

Most of these measures are quite inadequate because they lack quantitative aspects as criteria for evaluating a professional person and his effectiveness (109).

4. P' sical layout.

The geographic location of the library in relation to the users, and the amount of space in the library for both the staff and its users are known to affect the amount of use made of a library. There are some basic guides for determining the amount of space, as well as the type and amount of equipment, needed for various library sizes and operations. These are described by K. S. Metcalf and C. M. Lewis (484), (483). The library should be in a location that can attract and serve the greatest possible number of people. A large library should be located in an area where shipping and receiving facilities can be accomodated easily (149). There should be good working conditions including heating, lighting, and air-conditioning facilities. Space requirements should be determined by the number of people on the payroll, although it usually is determined by the equipment used by the personnel (140). It is desirable, however, that there be at least 150 square feet per staff member (300). The space

should be arranged so that a working area is set aside for the library staff, and adequate reading and working space is available for the users (10), (29). The space should be organized to permit an efficient and flexible flow of work and materials. ACRL advocates that college libraries have a seating capacity in the library for about 20% of the total student population (182).

The type of equipment needed, such as shelves, typewriters, and working tables, is usually selected in accordance with the needs of the library at the time. Papers by Lewis (483) and Binns (475) provide good guides to equipping a library. Many reports discuss the most economical types of shelving, the amount of space published literature takes up per year, and the basic furniture standards set up by U.S.A. Standards Institute (formerly ASA). Other equipment in the library, such as microfilm readers and electronic data processing equipment, have been discussed in relation to how they save space or time in running a library operation (1),(38),(49),(75),(102) but no evaluative criteria have yet been devised to measure their overall effectiveness and efficiency.

5. Library contents.

The composition and extent of library collections should be determined by the mission of the organization and the type of clientele served. Assuming that a collection contains properly systematized material which is relevant to a subject, and that there is an adequate staff, users should

be able to obtain most of the information or other help that they need. There have been many studies done by Cleverdon and others on relevance, recall, and efficiency (86), (89), (415). Using these concepts for analysis might be helpful for evaluating a library collection. So far, however, library collections have been evaluated chiefly by:

a. Impressionistic methods - judgments by scholars in the field (183).

b. Comparing with standard checklists (183).

c. Analyzing the basis of use (183), (214).

d. Measuring expenditures over a given period of time and comparing them with those of other institutions (183).

e. Determining the value of each document to the user (15).

f. Measuring the number of books per potential user (ACRL Standards for College Libraries).

g. Studying circulation figures (73), (386), (473).

So far, however, no method has been devised which can evaluate the effectiveness of the collection. According to A. L. Brown (61), book and periodical collections generally are difficult to assess because each library's needs and objectives are different.

6. Library contents control.

Library contents control or technical services may be

considered the input operations of the library system. It is the efficiency of the input which determines how quickly one is able to supply data and information, or output, to the library clientele. The library staff performs the central processing unit operations, as a computer would in a data processing operation. Operations research studies of library operations, according to Saul Herner (169), provide a quantitative method of analysis, and also develop rules to apply to future operation problems. In the past, operations research studies have tried to measure the efficiency of library catalogs (232), (429).

Acquisitions and weeding are important operations in the library system. The head librarian, or library administrator, is ultimately in charge of acquiring the library's collection for fulfilling its mission. Several guides exist which aid the librarian in determining what material should be acquired or weeded. These include:

a. Acquisitions.

(1) Degree of accessibility or frequency of use (143).

(2) An admissions committee to develop criteria for acquisition (84).

(3) Information specialists identify material which librarians should purchase (424).

b. Weeding.

(1) Material obsolete, or not of current interest (39).

(2) With infrequent circulation and little use, the collection can be reduced by 60-70% and still satisfy over 99% of the requirements (432).

Edward G. Strable (487) outlines what he considers minimum, intermediate and maximum levels of acquisition functions. No record has been found that acquisitions have been evaluated as to their efficiency or effectiveness in relation to the total organization.

Among other library operations cataloging stands out in importance. Cataloging is considered to be the "process by which one transfers certain technical information about the book to a card according to rule."* It is interesting to note that Battelle Memorial Institute found that it is quicker to prepare its own catalog cards than to buy prepared ones from the Library of Congress (151). The IBM Center library uses a mechanical processing system which speeds up the cataloging, provides circulation records, and saves about 17 man-hours per 100 items processed (117). Some federal government libraries

* Strauss, L. J., Strieby, I. M., Brown, A. L. Technical and scientific libraries: their organization and administration, New York: Interscience, 1964. p. 159.

and special information repositories are using the IBM 870 Document Writing System. This is a data processing system that automatically handles and prepares most of the records required, including catalog cards, printed forms, and reference data (201).

Attempts to measure the efficiency of subject catalogs include assessment of the probability of success using the catalog, and comparison of the cost of the catalog with the cost of finding the material without the catalog (429). Effectiveness or efficiency of an information system has been expressed in terms of recall and relevance (415). Economic efficiency involving preparation costs, acquisition costs, the probability of producing the required answer, frequency of searches and the potential value of information has been felt to be the only satisfactory basis for comparing systems (86).

A study by the American Library Association reviewed investigations on evaluating cataloging, and resulted in three approaches: 1) quantitative--user centered, 2) qualitative--catalog centered, and 3) comparison of actual catalog with ideal subject catalog (244).

Proposals have been made by E. H. Langenbeck (232) to cut the costs of cataloging in government agencies, and by Cresap, McCormick and Paget to improve cataloging procedures at the New York Public Library (218), (301).

The latter attempts aimed at making cataloging procedures more efficient, and then measured their efficiency. No standards, however, have been set up which can evaluate how effective the cataloging procedures are.

Classification is the system used to group together and arrange materials on the same subject. The most popular are the Dewey Decimal System and the Library of Congress System. However, special subject matter collections sometimes require their own systems.

Among the important characteristics of a reference retrieval system, according to Pauline Atherton, are: 1) multiple access approaches, to find the literature, and 2) the ability to retrieve the material (22). That system can be successful, however, only if a suitable classification system also exists.

Computer Command and Control Company (95) decided that the ideal automated classification system must 1) be useful, 2) be easy to update, maintain, and use, 3) insure that elements within a class are content-related, 4) insure that elements cover entire spectrum of available information, 5) permit integration of various classification approaches, 6) lend itself to mechanical accumulation of data, 7) be flexible, 8) provide all-directional information flow.

Cataloging and classification schemes are the indexing and filing systems of information centers. Relevance, recall, and efficiency have been used to measure information systems (85), (86), (89), (415). These studies assumed that all the articles in the collection on a subject were relevant and good articles. Further, they assumed that the total number of articles in the system on a particular subject is known, so that when one receives a number of documents on recall, he can determine the system's efficiency. All the suppositions are relative and do not provide quantitative measures of a natural system.

7. Library services.

Library services or reader services can be considered the outputs of a system. Library users have indicated that a library should satisfy the following requirements:

a. Current awareness of facts discovered by previous workers, and services which will keep them abreast of contemporary discoveries (346).

b. Aid in locating information, depending upon the user's skills (92), (360), (396).

c. An efficient form of information (331).

d. A reliable source of information (168).

Those requirements are met by the following services:

Reference.

Reference is probably the most frequently used

reader or user service. Reference requirements vary with type of user. Researchers such as physicists need information on specific types of research, (22), (346) while management needs technical information for decision making (179). The users commonly want readily accessible, highly selective, complete, authoritative material (164). To judge the worth of reference service, W. Budington (63) declares it is necessary to determine the cost of answering the question or acquiring the information without the librarian or library service available.

Circulation.

Circulation may be considered either a technical service or a reader service. Circulation, or routing techniques or methods of routing new materials or lending library items, particularly journals, can vary, depending upon the size of the organization being served. A survey of the Space Guidance Center (411) showed that the engineering and research staff, which was 30% of the population, accounted for over 50% of the circulation, and that 25% of the collection was always on loan.

Some of the circulation techniques in use are:

a. Circulation of tables of contents of periodicals, letting the readers decide which articles they want to see (228), (354).

b. Circulation of journals to a predetermined list of users (65).

The objectives of a circulation system should be speed, efficiency, knowledge of book location and simplicity (123). Circulation of library materials in a sense is an abbreviated or a coarse system for selected dissemination of information. Circulation figures may give an inadequate picture of collection use, because they do not show the use of materials in the library (473). No real quantitative measures exist for evaluating the efficiency of circulation methods or the effectiveness of their services.

Reader current awareness.

Reader current awareness services can be supplied in many different forms. Abstracts, bulletins on acquisitions, and especially, systems for selective dissemination of information (200) have become important in keeping the technical man abreast of new information and techniques in his field.

Bibliographic services and translations.

Bibliographic services and translations are usually considered to be services a library should supply to the users. Whether these services should be provided in-house or done outside the library or its parent organization depends upon the need for each particular service.

Information guides.

In order to increase the client's facility in utilizing the library, there should be a provision to acquaint him with the library's services, and to relieve the library staff of routine questions. For example, "how-to" guides may be prepared for the library users (47), (147). It would be interesting to measure how effectively the library satisfies the client's needs before and after he has used a library guide or gone through a brief library training session.

How well these services satisfy users' needs is not known scientifically. The clients usually complain, however, either to the library staff or to management. In this way, service inadequacies may be corrected. Some organizations have library committees composed of library users (346), and other organizations conduct surveys to determine consumer satisfaction (31), (166), (407), (453).

How successful have the libraries been in accomplishing what the users want? Among methods which have been used to determine this are:

a. Frequency of use, which establishes a level of accessibility to the literature (143).

b. Number of uses made per day of any service, measured in the unit, item-use-day (283).

Several indefinite criteria have been proposed to evaluate how effectively libraries are serving their users, including:

a. Measurement of the relevant and non-relevant documents retrieved and not retrieved (219).

b. Performance index ratio of the amount of material used to the amount of material requested (261).

No really good means appear to exist which can completely measure the value to the user of reader services. But if services are available to users and are not utilized there should be good reasons why the anomaly exists.

8. Library standards.

Both the American Library Association and the Special Libraries Association have devised standards which provide measures to evaluate certain aspects of a library quantitatively, but they do not measure the effectiveness

of the library. In some cases, efficiency of an operation or work measurement is mentioned. The A.L.A. has designed standards for public libraries, derived from many statistics gathered in the 1950's.[1/] Although these standards pertain to public rather than technical libraries and are more than ten years old, articles which discuss their value are included (10), (340), (472). The A.L.A. standards for college libraries are more recent than those for the public libraries and are geared to a more specialized user, as is a technical library. These are outlined briefly in the following paragraphs and comments regarding their quality, adequacies and inadequacies are noted.

a. A.L.A. Standards for College Libraries, 1959.

Functions of the college library

The library should be the most important intellectual resource of the academic community. Its services should be geared to the purposes of the college's general program and its specific educational objectives.

Structure and government

If a college has a library committee, its authority should be clearly defined. It should

1/ American Library Association. Public Libraries Division. Public library service: a guide to evaluation, with minimum standards. Chicago, 1956.

be concerned with general policy and not executive matters. The librarian should be directly responsible to the president, having faculty department head status.

Staff

At least 3 professional librarians are needed for effective service. Factors which determine staff size include student enrollment, type of library organization, size and character of collection, prevailing teaching methods, number of hours the library is open, and arrangement of building. All library staff should have faculty status, salary and privileges.

Budget

The librarian should be in charge of planning and administering the library budget. The budget should be determined in relation to the total budget of the organization for educational and general purposes, with a minimum of 5% of the total university budget. At least twice as much should be spent for salaries as for books.

Collection

The collection should meet curriculum needs and demands of graduate and undergraduate students,

and should keep the faculty abreast of modern scholarship. It should contain standard works and bibliographies in all major fields of knowledge. Weeding and acquisitions should be done with faculty advice. Holdings should be checked with standard bibliographies. The size of the collection is determined by the curriculum, number of students, and the need of faculty for more advanced materials. The library should contain at least 50,000 volumes. A general guide is: up to 600 students, 50,000 volumes; for every additional 200 students, 10,000 additional volumes.

Building

The building should be centrally located and functionally designed with at least 125 square feet per staff person. Shelf space should allow for the collection to double in size.

Quality of service and its evaluation

A measure of the quality of service is a continuous evaluation of the statistical records of the circulation department. A joint faculty and library staff evaluation of the library's resources is another approach.

These standards are basically deficient because they do not measure how efficiently library operations are per-

formed or ultimately how effective library services are. In fact, Felix Hirsch (182) had recommended that the building be able to seat 30% of the student body and provide shelf space to allow for 10 years growth. Both of these items were left out of the final standards.

b. Special Libraries Association Objectives and Standards, 1964.

Objectives

The objectives of the library should clearly describe the users it serves and the services it is to provide. To be effective, the standards must be periodically reviewed and revised according to changes in the organization's activities and in library technology.

Staff

The functions, responsibilities, and qualifications of the library administrator and other staff members are described. A library degree or three years professional library experience are the minimum technical qualifications for an administrator. A division of professional and non-professional functions is necessary. There should be 2 or 3 non-professionals to every professional, but this depends upon the size of the collection and the number of users.

Collection

The library should contain only those materials, in volume and in extent of subject matter coverage, that best serve the clientele. The collection should be organized for effective use.

Services

Services such as reference, indexing, circulation, translation, and current awareness, are given as functions which the library performs to further the objectives of the organization it serves.

Budget

The library administrator should make the recommendations for budgetary support. It is his responsibility to determine the scope and extent of the library's services, their costs in terms of staff, equipment, supplies, and materials. Salaries should amount to no more than 79% of the budget.

Appendix

General space requirements for aisle areas, levels of recommended illumination, and standard specifications for stack and shelf areas are given.

The Special Libraries Association standards have been discussed by librarians administering all types and sizes of

libraries. Their opinions as to the inadequacies of these standards include such comments as:

a. Gordon Randall (355) would make these modifications:
   - six to one circulation to acquisition rate
   - at least one journal and fifteen books per user
   - one staff member to 100 potential or 75 actual users
   - literature collection, rather than salaries, should have first priority.

b. Helen Loftus (254) believes that qualitative standards should be the principal consideration. In order to set standards, one should list major functions, define those functions in detail, then formulate standards for each function. Functions are based on management expectations.

Suggestions have been made on how to organize a military library (58). Newspaper libraries utilize categories and standards established for their type of organization (66).

How are standards set up? What is their basis? Performance or work measurement standards have been methods of evaluating job performance for some time. There are many articles on performance standards in the

management science literature. Phil Carroll (76) and Elaine Woodruff (465) have discussed how performance standards can be applied to a library to measure the efficiency of some of its operations. Cost rating, another management technique, has been used indirectly to measure performance (30).

The U.S. Office of Education is now setting up a weighting system to evaluate the deficiencies of college libraries, in order to grant them aid to improve their quality under the Higher Education Act of 1965. Criteria to be used will include rate of acquisition and size of library collection per student enrollment.[1/] So far, standards have been applied to the library only. They should also be applied to the library in the framework of its total environment.

9. Summary of library literature search.

In this search of the library literature, the purpose was to seek out articles dealing with the efforts of librarians to measure their success in (a) performing duties normal to the operation of a library, and (b) providing library products and services which maximally fulfill the purpose for which the library exists. It became evident rather early that there is a good deal of difference between gauging the success of certain routine

1/ Per conversation with Robert Havlik, U.S. Office of Education, Dec. 1966.

tasks, such as those involved in acquiring journals, textbooks and other documents, and actually assessing the potential of the same texts, journals and documents as a reservoir of knowledge useful to the needs of the parent organization or user. For example, although the ability of a cataloger to catalog according to standard methods can be measured quantitatively, the output service or product resulting from a literature search can only be qualitatively assessed against the written, spoken or implied requirements of the user. What this amounts to is a notable difference between measuring the "efficiency" of performing certain standard library operations, and measuring library "effectiveness" by placing suitable and preferably quantitative parameters on the rather vague concept of maximal response to service or product demands. This is compounded by the fact that, by their very nature, such demands often must be couched in ambiguity, rather than specificity.

The search was more productive of methods to evaluate "efficiency" of library operations than it was of suitable ways to evaluate the "effectiveness" of library services or products. Some examples justifying this conclusion might be recalled from the body of this paper. To wit, certain libraries find it more efficient to employ mechanical processing rather than manual methods to speed up

cataloging and provide circulation records. But no good way was proposed by which to measure quantitatively the potential of a catalog to respond to a searcher's needs. On the other hand, some suggestions were made that cataloging and classification schemes could be gauged by "recall" and "relevance." Yet these latter yardsticks are far more subjective and qualitative than they are objective and quantitative.

The efficiency of a system in circulating journals or other documents to a specified population of users at a certain rate and within certain time limits can assuredly be measured, and measurements of such efficiency have been performed. But no record was found of a suitable and adequate measure of the effectiveness of such a library service in assisting to carry out the mission of either the library or the parent organization.

The efficiency of providing reference services has been measured and the value of providing such services has been gauged by comparing reference service costs against the cost of obtaining the "same" information if the library service were not available. But the effectiveness of reference and reader services in fulfilling the needs of users has not been adequately judged.

Standards have been set for such items as the number of volumes which should reside in a library; this, for

example, could be a function of the number of real or potential users. But the actual use made of these volumes by the user, or the effectiveness of their contents in responding to the user needs, has not been adequately determined.

The number and qualifications of staff for a given size library have been expressed in certain standards. Furthermore, standards for performance of work have been prepared. And the efficiency of the staff in handling services and putting out products can be standardized. But the effectiveness of their services and products for their users has not been assayed satisfactorily.

In short, without burdening the question, the literature search has produced information discussing measures of efficiency in performing certain tasks against a background of specific standards, where such standards may be expressed in terms of time, units of production, costs, and similar considerations. But where evaluations are sought, in which the entity being evaluated is ambiguous or does not lend itself to expression as a precisely defined unit, the literature has not produced any appreciable number of usable concepts.

It appears that in these latter cases, unless arbitrary standards are set up by agreement, the classical

approaches to evaluation will have to depend upon efforts to improve definitions of such entities as library mission, goals and objectives, activities, and operations. If such items can be defined very precisely there may be reason to believe that success in achieving the parameters of the definitions might be some measure of effectiveness.

B. MANAGEMENT SCIENCES

As discussed in the introduction, the generalized approach to the literature search pursued leads not only to classical methods for evaluating library operations and services, but also to ideas of any techniques or methods which had been developed for evaluating other types of organizations or functions. Although the literature of the management sciences is voluminous, a great deal of its information has been "re-worked" repeatedly. That is to say, there is a great number of textbooks and reports, on various aspects and phases of the management sciences, which discuss the same methods and techniques. An analysis of this literature sifts the ideas down to a smaller but still considerable number of distinct common denominators.

The management sciences section attempts to present these many methods and techniques according to acceptable schemes of organization developed in the field. Overriding the individuality of any method or methods is the attempt to approach the problem systematically and analytically. As discussed in the introduction, the concept developed before the literature search began viewed the Army Technical Library as a system. The rather

elementary concept was kept in mind that a system reduced to its simplest form comprises some modification of:

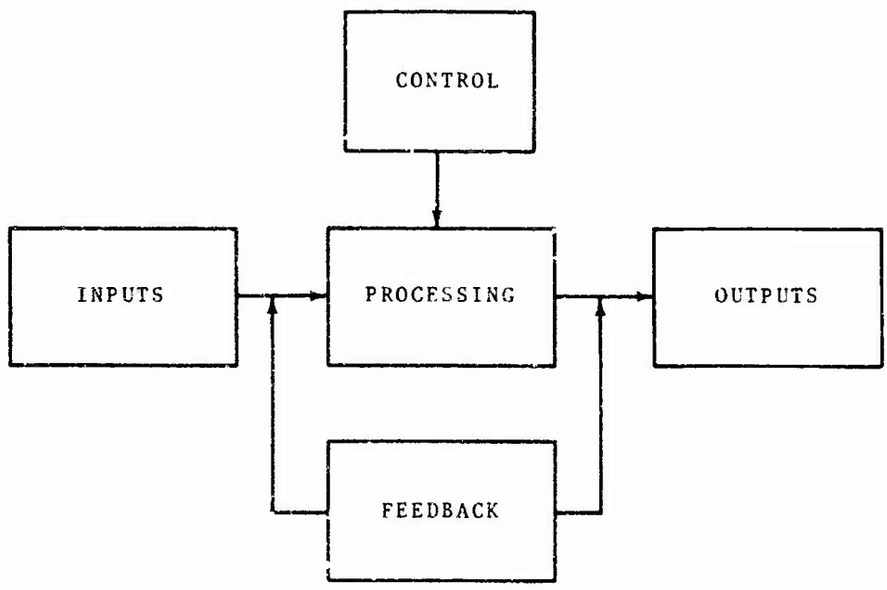


Figure 2

The systems analysis technique as it might be applied to libraries may be visualized from many references in the field, such as that by Quade.[1/] He points out that this technique is a rational method of searching for and evaluating alternatives to select a preferred course of action. Although it is based as much as possible on scientific, quantitative methods, it also makes use of expert intuition and judgment. Thus its results are considered more as recommendations than final conclusions.

1/ Quade, E.S. Systems analysis techniques for planning-programming-budgeting. Santa Monica: Rand Corp., 1966. Paper p-3322. Noted in Operations research/management sciences international literature digest service. Executive sciences Institute, Inc., 1966. p. 555.

The systems analysis approach consists of five elements: (a) Objectives to attain; (b) Alternative ways to achieve objectives; (c) Costs allocated to particular alternatives; (d) Models of the essential elements of the system; and (e) Criteria to measure the relative degree of desirability of alternatives.

The management techniques and methods discussed in the following sections are viewed as they might contribute to this general analytical approach to develop ideas for measuring efficiency and effectiveness of library operations and activities.

1. Schools of management.

One method of discussing the field of management is in terms of the various approaches to, or schools of, management as identified by Harold Koontz of the UCLA Business School.

a. The management process, or classical, school adopts a functional approach. Principles are formulated and an analysis of the functions of the manager are made. This approach considers management an art rather than a science, since its techniques and applications can be improved by identification of general principles related to functions. These principles can be found in areas such as:

(1) Work measurement and simplification.*

(2) Motion and time study.

(3) Method study.

(4) Plant layout.

(5) Process charting.

b. The mathematical, or operations research, school is a recent approach to management problems, in which model building and mathematics are emphasized. The fundamental premise is that managerial relationships can be reduced to a logical process and studied by mathematical symbols and relationships. Some of the techniques used here are:

(1) Linear programming.

(2) Simulation.

(3) Information theory.

(4) Game theory.

(5) Monte Carlo method.

(6) Matrix theory.

(7) Systems analysis.

(8) Queuing theory.

c. The human behavior, or human relations, approach is oriented toward psychology, and involves getting things done with and through people by dealing with individual motivation and cultural problems. This

* See Appendix E - Glossary of management science terms, for definition of management science terms used.

school is concerned with:

(1) Incentives.

(2) Environment.

(3) Creativity.

(4) Orientation.

(5) Superior/subordinate relationships.

(6) Utilization of personnel.

d. The social system school views management as a system of cultural relationships, with an emphasis on a social system in which the relationships must be studied and integrated. The individual is looked upon as a member of the organization, and the group is the focal point of the study. Subjects studied here are:

(1) Group behavior.

(2) Methods of organization.

(3) Types of organization.

(4) Flexibility.

(5) Organization system.

Some techniques used are linear responsibility charts and organizational schematics.

e. The decision theory school utilizes several different approaches to decision-making. The basic approach is econometrics, where decisions are made on the basis of selection from alternatives. Some tools of the decision theory school are:

(1) Econometrics.

(2) Break-even analysis.

(3) Input-output analysis.

(4) Cost-effectiveness analysis.

f. The empirical approach sees management as a study of experience. The case method, in which the student is exposed to situations and formulates possible decisions and policy from case information, has evolved from this approach.

2. Synthesis and utilization of management processes.

It can be seen from this delineation that the various schools of management provide not only analytical techniques which may be useful in developing criteria, but also operating techniques which may eventually be recommended as criteria for library operation.

In Phase I, an objective study was made of the characteristics of various schools of management. From these schools, the techniques or aspects that are discovered to be most relevant will be selected.

Some of the techniques appear to have greater applicability than others. Until the functions of the library can be observed and delineated in detail, the proximate degree of applicability will not be apparent. Final recommendations in Phases II and III, however, will be furnished only after the selected techniques have been analyzed and evaluated.

3. The matrix.

This research indicates that the techniques and methodologies of management have never been identified and brought together for use in the analysis of a library. Therefore, it has been necessary to search management literature to find the techniques and methodologies which are applicable. The literature was found to be so extensive that it was considered advisable to construct a matrix, Figure 3, to prevent redundancy and to maximize coverage of applicable data.

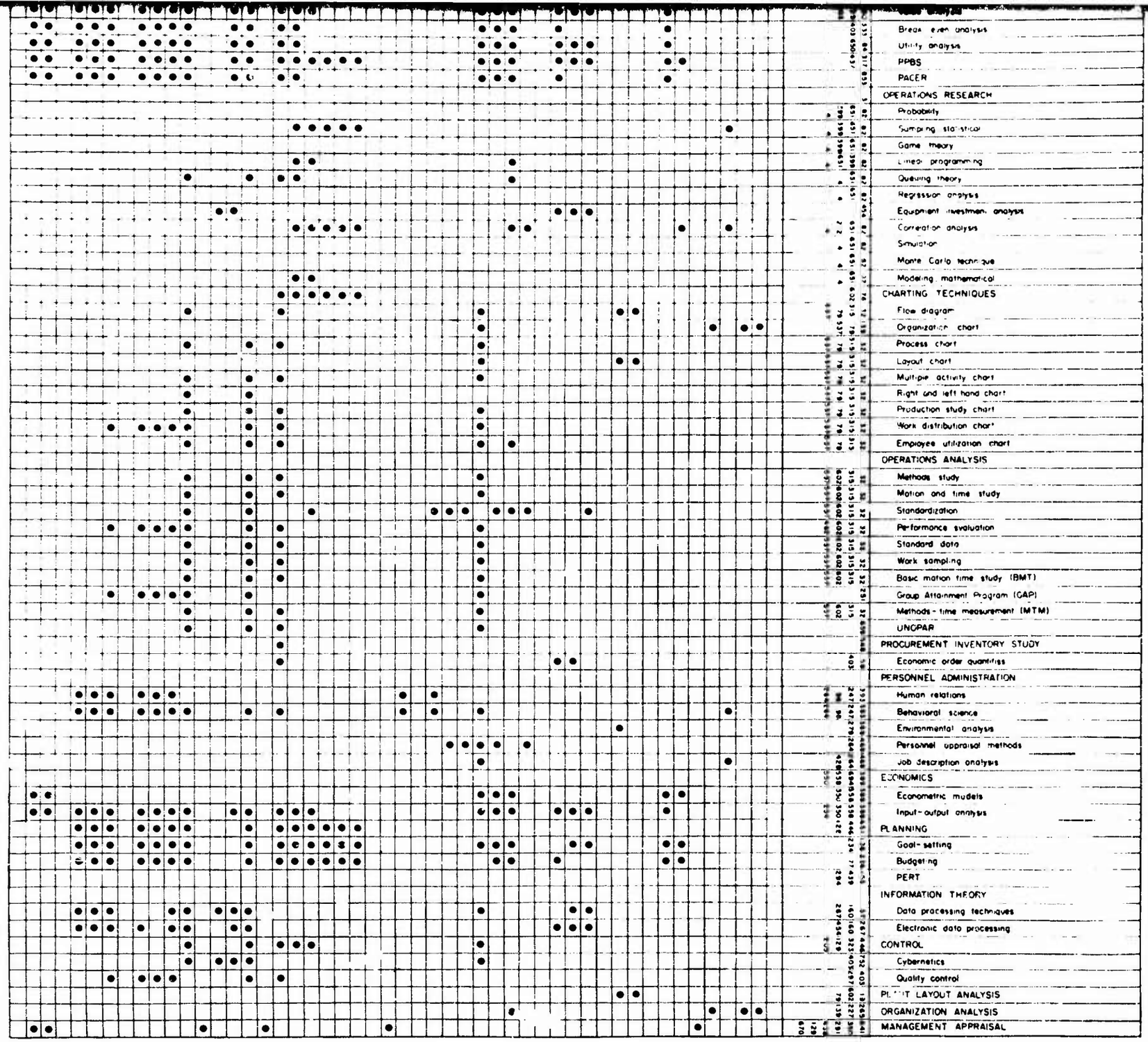
The matrix enables rapid identification of techniques that relate to all aspects of library services and operations being studied, and allows consideration of all the major techniques which could be applied to the functional areas. This will facilitate evaluation by indicating where more than one technique might be used, suggesting combinations of methods, and indicating where innovation is required, to provide a satisfactory method. It will also consolidate the scattered techniques into workable categories, and, finally, assist in identifying nonstrategic library functions, or areas where evaluation and control would not be compatible with cost effectiveness or operational efficiency.

Numbers relate to references in Appendix A or C.

MANAGEMENT TECHNIQUES

POTENTIAL LIBRARY APPLICATIONS	Systems analysis	Cost effectiveness	Cost accounting	Value analysis	Break even analysis	Utility analysis	PPBS	PACER	Operations research	Probability	Sampling statistics	Queuing theory	Linear programming	Queuing theory	Regression analysis	Experimental analysis	Input output analysis	Monte Carlo techniques	Matching mechanisms	Human factors techniques	Flow diagram	Organigram	Process chart	Journey chart	Multiple activity chart	Right and left hand chart	Evaluation study chart
LIBRARY MISSION AND PLACEMENT IN ORGANIZATION																											
Definition of mission of parent organization	●																						●				
Definition of mission of library	●																						●				
Types of clientele served												●					●										
Placement of library in parent organization	●																						●				
BUDGET																											
Relationship to budget of parent organization							●										●										
Allocations for materials and services			●	●	●	●	●	●																			
PHYSICAL LAYOUT																											
Geographic location																						●			●		
Space size and arrangement																						●			●		
Equipment																											
Type				●		●	●									●											
Amount			●	●		●	●									●											
Cost			●	●	●	●	●	●								●											
STAFF																											
Qualifications																	●										
Size	●			●	●	●	●	●					●	●			●										
Salary			●	●	●	●	●	●																			
Utilization	●		●	●	●	●	●	●														●	●	●	●	●	●
Professional activities																											
Educational activities																											
Training programs		●	●																								
Administrative aids			●																								
Incentive programs			●																								
CONTENTS																											
Collection																											
Orientation to mission							●				●						●				●						
Orientation to clientele							●				●						●				●						
Orientation to services provided							●				●						●				●						
Composition		●		●			●				●		●				●			●	●						
Extent		●	●	●	●	●	●	●			●		●	●			●			●	●						
Procurement and maintenance methods	●	●	●	●	●	●	●	●						●							●	●		●		●	●
CONTENT CONTROL																											
Cataloging, classification, and subject heading assignments	●	●	●	●	●	●	●	●						●										●		●	●
Automation applications to operational procedures		●	●	●	●	●	●	●								●											
Special systems application to subject matter control			●													●											
SERVICES																											
Circulation	●	●	●	●	●	●	●	●						●								●		●		●	●
Bibliographic	●	●	●	●	●	●	●	●																			
Editorial assistance	●	●	●	●	●	●	●	●																			
Translations	●	●	●	●	●	●	●	●																			
Special services																											
Preparation and dissemination of listings, abstracts, extracts, etc	●	●	●	●	●	●	●	●																			
Predetermined routing of new material	●				●	●	●	●																			
Selective dissemination of listings or articles	●		●	●	●	●	●	●																			
ADDITIONAL AREAS OF CONSIDERATION																											
Contract performance			●	●	●	●	●	●																			
Research in library operations			●	●	●	●	●	●																			

Figure 3


Break even analysis
Utility analysis
PPBS
PACER
OPERATIONS RESEARCH
Probability
Sampling statistical
Game theory
Linear programming
Queuing theory
Regression analysis
Equipment investment analysis
Correlation analysis
Simulation
Monte Carlo technique
Modeling mathematical
CHARTING TECHNIQUES
Flow diagram
Organization chart
Process chart
Layout chart
Multiple activity chart
Right and left hand chart
Production study chart
Work distribution chart
Employee utilization chart
OPERATIONS ANALYSIS
Methods study
Motion and time study
Standardization
Performance evaluation
Standard data
Work sampling
Basic motion time study (BMT)
Group Attainment Program (GAP)
Methods - time measurement (MTM)
UNOPAR
PROCUREMENT INVENTORY STUDY
Economic order quantities
PERSONNEL ADMINISTRATION
Human relations
Behavioral science
Environmental analysis
Personnel appraisal methods
Job description analysis
ECONOMICS
Econometric models
Input-output analysis
PLANNING
Goal-setting
Budgeting
PERT
INFORMATION THEORY
Data processing techniques
Electronic data processing
CONTROL
Cybernetics
Quality control
PLANT LAYOUT ANALYSIS
ORGANIZATION ANALYSIS
MANAGEMENT APPRAISAL

The matrix displays fourteen categories, which are the titles of the various management areas selected during the literature search. The categories contain either operating techniques or analytical techniques, or both. The operating techniques, if applicable, will be used as criteria of effectiveness or efficiency of libraries while the analytical techniques will be used to study library functions and operating characteristics. In other words, these will be used to study, develop or justify criteria.

Some of the categories have been expanded to demonstrate the kinds of techniques that can be found in that area. None of them have been expanded fully, for to do so would make the matrix unmanageable in size. The techniques that are included are for the most part ones that appear to be useful in developing criteria. Several were also included to demonstrate the extent of the literature search, although they seem to have no applicability at this time.

It will be apparent that the categories are only a convenient method of grouping appropriate techniques, and that, within a given category, no one technique is subordinate to any other.

4. Management techniques.

a. Analytical techniques. A preliminary selection of some of these techniques has been made. The following

discussion explains the reasoning used in determining their applicability.

System analysis.

It was decided at the beginning of the study that this basic approach would be used to segregate and delineate the individual functions of the library. Systems analysis will show the interfaces between functions and their relationship to the overall objectives and goals of the library. This concept has been expanded to include the relationship of the library to the parent organization and the mission of that organization. A suggested approach is the Planning-Programming-Budgeting System (PPBS) as discussed in BULLETIN 66-3, issued by the Bureau of the Budget, October 1965.

Cost effectiveness.

Cost effectiveness will be a valuable tool in determining or selecting the alternative library functions needed to attain the objectives of the library. Bringing these objectives into perspective and relating them to total costs and benefits gained should lead to a determination of the most effective allocation of library resources. It is easy, however, to neglect relevant costs and to

develop fallacious concepts with this technique. But it should be possible, for example, to obtain the necessary data, perhaps by user studies, or document requests, for cost-effectiveness analyses in such activities as reference searches. The amount of time spent on searches as a function of number of references located, and the number of documents actually used by the client, should prove amenable to cost-effectiveness treatment.

Value analysis.

This is a system which can be used for analyzing the individual operations of the library. Value analysis results in an evaluation of a product or process in terms of its cost, worth and possible alternative methods. This is quite similar to cost effectiveness.

Break-even analysis.

This is a valuable tool for determining relationships which exist between fixed and variable costs, income, and volume. Although income is fixed by allocation, in the case of the Army Technical Libraries, it is likely that a workable analysis can be made of the costs, relating them to volume and fixed income.

Linear programming.

This technique can be used to analyze library

collections, showing the optimum mix of various subject areas by plotting these subjects according to volume of use and measuring the relationships to determine how much material should be allocated in each area. Linear programming can also be used to determine the best location of departments within a new library, to analyze relocation alternatives in an established library, and to determine optimum library location in large, multibuilding complexes. The problem of centralizing or decentralizing library acquisitions also might be analyzed by linear programming.

One example of the application of linear programming is the so-called "CRAFT" technique (Computerized Relative Allocation of Facilities Technique) (538). The examples utilized by Buffa, Armour, and Vollman in their discussion of "CRAFT" include a typical machine shop, a movie studio, a warehouse, and a hospital. It is not difficult, however, to visualize that the discussion could just as readily have included a library, with its services and operations.

Queuing theory.

This operations research technique can be applied in determining the best type of library layout

and the staff size needed to operate efficiently and effectively.

Rank correlation analysis.

This statistical method has many applications in the development of criteria. By ranking all of the libraries in this study according to the relative strengths of the functions they have in common, it may be possible to discover significant relationships between these functions and overall library effectiveness. Another possible use is in the analysis of user reactions to the library services. By ranking data obtained from user surveys, one might develop significant relationships between services expected and services received.

Charting techniques.

Charting or diagramming the activities and functions in the library may prove to be the most useful technique in this study. Flow diagrams and process charts can graphically depict physical activities within the library and aid in determining the most efficient operation. Network charts show the events and relationships within a system. Linear responsibility charts demonstrate the functional relationships between positions within an organization and can also show the relationship of an organization within a larger organization. Layout charts are used in facilitating the proper allocation of space within a building or office.

Operations analysis.

The techniques used in operations analysis (e.g.,

work measurement and simplification) result in standard times and standard data, which are developed through the use of time study. These results form an important part in the development of criteria for physical output.

Economic order quantities (EOQ).

Although the methods used in EOQ are normally thought of as being operational techniques, they hold promise as an analytical tool for the evaluation of procurement policies in the library.

Personnel appraisal methods.

Appraisal methods should distinguish between personality factors and job-related activities, and should include both in proper perspective. The difficulty in using present appraisal methods is their application to creative personnel, and in deciding if the appraisals are objective, pertinent, and reliable as performance indicators.

Other techniques.

Other analytical techniques may also be applicable, and will be subsequently analyzed, although the techniques in the preceding sections seem to have the greatest promise. Some of these are:

(a) dynamic programming
(b) modeling
(c) simulation
(d) game theory
(e) Monte Carlo theory
(f) basic-motion-time study (BMT)
(g) chrono-cyclograph
(h) micro-motion studies

(i) multiple activity chart
(j) memo motion
(k) Marsto-chron
(l) right and left hand charts
(m) string diagrams or wire models
(n) universal operator performance analyzer and recorder (UNOPAR)
(o) econometric models
(p) methods-time measurement (MTM)
(q) input-output analysis
(r) information theory
(s) program evaluation and review techniques (PERT)

Finally, it should be noted that, in some instances, combinations of the techniques identified in these sections might be required, to provide insight and guidance to the problem.

b. Operating techniques. The following discussions explain the selection of certain operating techniques that may be applicable as criteria.

Cost accounting.

Cost accounting is an excellent control device, commonly used in industry, which allocates the various costs of doing business to the units produced or sold. As used in the library, cost accounting could develop a cost figure for every book loaned or for every service performed.

Planning-Programming-Budgeting-System (PPBS).

PPBS, now used by the Department of Defense, could be the most useful operating tool, since it seems to be all-inclusive. Because it is already compatible

with DOD procedures, it would probably be simple to initiate. In addition, it requires long-term planning, with the selection of urgent goals, and the determination of effective performance.

Production, Allocation and Control of Expending Resources (PACER).

This system, developed by Minneapolis-Honeywell, Inc., may be a workable cost control system for the entire Army technical library system since it stresses decentralized authority with centralized control. Effective cost control in non-profit organizations can be instrumental in providing broader opportunities and more efficient and productive operations.

Most organizations assume that cost control is a normal process. The budget is primarily a planning tool and is only a general implementing device for cost control. The budget, once it is established, is a passive tool and records only actual, as distinct from authorized, expenditures. The budget, as a resource restriction, only indirectly fosters cost control. Cost reduction must be part of a continuing program, rather than a sporadic effort. The solution to the shortcomings of existing cost control methods is to establish functional responsibility for cost control.

Group Attainment Program (GAP).

GAP, developed by Lockheed Aircraft Corp., may have usable elements which can aid in monitoring the output of the library. Instead of emphasizing individual output, as in manual production situations, GAP measures the production and costs of groups engaged in mental activities.

5. Summary of management literature search.

Evaluation, an appraisal process, determines the value or amount of a specific factor. The evaluation procedure may be objective, based on numerical concepts, or it may be subjective, derived from non-quantifiable elements. Evaluation can also differ among evaluators due to the inclusion of conscious or subconscious prejudice.

Evaluation and measurement could be applied to library objectives and standards. Determining objectives is relatively easy, but establishing standards is extremely difficult in a dynamic environment, since the work is usually creative and non-repetitive, and precedent has limited applicability.

Ideally, management would like a system where all relevant factors could be identified and quantified. Many of the decision elements are, to some extent, quantifiable, such as projected return on investment, recoupment or pay-out time, net activity value and estimated

costs as opposed to anticipated benefits. Components which comprise these decision elements can be segregated and given quantitative values. Many formulas for deriving such quantitative data have been publicized. However, quantification gives management only a general idea regarding operational goals, and fails, on two counts, to satisfactorily resolve the selection process:

(a) the accuracy and relevance of data,

(b) the significance of non-quantifiable elements which management must consider.

Techniques for measuring the physical output of workers have been developed and used with moderate success. As a result, performance efficiency can be reasonably ascertained, and control methods employed. However, there have been no comparable developments or accepted methods for measuring the productivity and contribution of people engaged in mental or creative work. Performance evaluation and control have consequently been inadequate in creative situations. In essence, this results in measurement or active control of relatively inexpensive personnel, and conjecture, with little control, in the case of comparatively high-priced people. Even though it is difficult to assess or appraise the contribution of mental activities, management is still responsible for evaluating both the

quantity and quality of the organization's performance. As a prelude to evaluation of any type of productivity, appropriate methods for measurement must be developed and applied. It is paradoxical that scientists usually deal with measurable facts, but the actual measurement of the scientist's own performance thus far seemingly has defied accurate measurement.

It can be stated, therefore, that these analytical techniques may result in criteria that can be of general guidance to library management. This is important, since the dynamic operations of the library must be reflected in an equally dynamic or flexible set of controlling criteria. Regardless of how flexible the criteria are, however, a constant review will be necessary if they are to give meaningful results and reflect the current status of library functions.

III. CONCLUSION

The foregoing literature search and narrative state-of-the-art summarizes the findings of the contractor during Phase I of the ATLIS project. The search represents an examination of the major aspects of the literature in the library and management sciences on the measurement of efficiency and effectiveness, in services and operations.

The history of efforts to evaluate critically the efficiency of library operations and the effectiveness of library services leaves the investigator still groping for satisfactory methods. However, if one analyzes the functions, activities, operations, services, personnel, physical quarters, equipment, and other related aspects of libraries, it soon becomes evident that certain items lend themselves to quantitative measurement a good deal more readily than others. It appears easier, for example, once a given method of cataloging is adopted by a library, to measure quantitatively the ability of catalogers to produce a given number of cataloged units in a given number of time or cost units with a specified limit on errors. On the other hand, it does not appear equally simple to measure quantitatively the value of a library service or product such as a literature search

or its resultant bibliography. How effective, for example, is the search or bibliography in fulfilling the objective of the user who requested the service? This latter type of problem, then, is of a different species and does not lend itself readily to measurement in, or expression by, numerical values. This difference then, is really the crux of the situation, giving rise to this particular investigation of the ATLIS project.

There probably is no good reason to expect that any of the usual criteria found in the literature will long satisfy the growing need to have defensible criteria for evaluating library operations and services. There is, however, a good amount of evidence that the techniques and methods developed by modern management sciences in the recent past will offer a fresh, fascinating, and, hopefully, substantial approach toward developing significant criteria.

Having the background of this literature search, the task now progresses into a phase of validation of data from prior library surveys and the development of limited amounts of critical new data through visits to, and examination of, selected Army Technical Libraries. This will be followed, in the final phase, by origination of new criteria, plus a program of testing and evaluation.

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APPENDIX A

ABSTRACTS

(The following abstracts as well as the literature cited in Appendixes B and C represent the sources covered in the literature search for ATLIS Report No. 10. References for all parenthetical numbers found in the body of the report will be found in these three appendices.)

1 Abrahams, Paul W., Lipp, Michael F., and Harlow, Jacques. QUANTITATIVE METHODS OF INFORMATION PROCESSING SYSTEM EVALUATION. Bedford, Mass.: Directorate of Computers, L. G. Hanscom Field, United States Air Force, 1963. AF 19(628)-2842, Project 2801, Task 280105.

The objective of this study was to develop practical methods for specifying the characteristics of a data processing system and for comparing the performance of different systems. The methods cover both functional characteristics dealing with the problem-solving ability and engineering characteristics, characteristics of machine organization and operational behavior.

The functional characteristics are specified in terms of macro operations that represent particular sample problems. Associated with these macro operations are parameters that serve to specify the macro operation completely. The selected macro operations cover both commercial and scientific data processing.

The engineering characteristics include factors such as configuration, word length, overlap, time for various operations and logic.

In a computer procurement, the purchaser specifies his requirements in terms of functional characteristics. The bidder then selects a computer configuration and describes its performance in terms of either engineering characteristics or functional characteristics; the choice depends upon which of two different evaluation methods are used. The advantages and drawbacks of the methods are discussed in detail.

2 Abruzzi, Adam. WORK MEASUREMENT, NEW PRINCIPLES AND PROCEDURES. New York: Columbia Univ. Press, 1952.

An analysis of inadequacies in present procedures of work measurement and an attempt to provide objective principles and procedures based on the rules of the scientific method.

The inadequacies of current estimating procedures include the following. Process standardization criteria are subjective and insufficient. The usual time-study estimating procedures consist of a limited number of successive readings during an arbitrary period on a single, arbitrarily chosen operator. Statistical stability and variability in production rates are not considered and the estimates obtained have little or no verification value.

3 Ackoff, Russell L., and Rivett, Patrick. A MANAGER'S GUIDE TO OPERATIONS RESEARCH. New York: John Wiley & Sons, 1963.

A guide for the executive who must decide whether or not to introduce operations research into his firm. Discussion of what operations research is, what it does, how it can be used, and what is likely to be involved if it is introduced into the company.

4 Ackoff, R. L., Gupta, S. K., and Minas, J. S. SCIENTIFIC METHOD: OPTIMIZING APPLIED RESEARCH DECISIONS. New York: John Wiley & Sons, 1962.

This text reflects a sophisticated effort to reduce decision-making to a scientific process using mathematical models and techniques of sampling, measurement and statistics. Emphasis is on model design, correlation methodology, and testing the solution, with controls. Includes a philosophical treatment of the ideals of science in society.

5 Allen, K. S. Management methods in libraries: a symposium. Administrator's viewpoint. MEDICAL LIBRARY ASSOCIATION BULLETIN. 49:514-516, 1961.

Management methods as represented by cost analysis, development of administrative abilities and the rapid acceptance of technological change are managerial techniques designed to increase efficiency and produce a better product. They are valid concepts whether applied to running a business or to administering a library.

6 Allen, Thomas J., and others. TIME ALLOCATION AMONG THREE TECHNICAL INFORMATION CHANNELS BY R&D ENGINEERS. (Research Program on the Management of Science and Technology) Working Paper. Cambridge: Massachusetts Institute of Technology, Alfred B. Sloan School of Management, 1966. No. 184-66.

Report concerns research on the manner in which individual engineers and scientists allocate their time and the effect of this allocation on the projects' outcome. Research conducted involved three general categories of information gathering: (a) outside consultation, (b) staff consultation and (c) literature search. Data were gathered by four means.

1. Time allocation forms.
2. Before-and-after interviews with individual engineers.
3. Periodic tape-recorded progress reports by project manager.
4. Solution development records.

Percent of total time spent in all phases of information gathering activities varies greatly over duration of projects. Higher rated teams are relatively stable in all phases of information gathering while lower rated teams initially spend far more time gathering information than they do in the later stages and fluctuate more throughout project. Subsystems characterized by greater uncertainty receive a higher percent of information gathering time than subsystems where uncertainty is lower.

7 Amber, George H., and Amber, Paul S. ANATOMY OF AUTOMATION. Englewood Cliffs, N. J.: Prentice Hall, 1962.

Stressed here are the principles and methods of production and automation rather than equipment design details, resulting in a basic foundation in the principles and philosophy of automation, without neglecting conventional non-automatic methods.

Also discussed are the approaches to automation and some of the factors which must be considered, the control system and the modes and types of control, cybernetics and information theory.

8 American Institute of Certified Public Accountants. Evaluation of internal control. In AUDITING STANDARDS AND PROCEDURE. New York: Author, 1963. p. 27-31.

Internal control may be characterized as either accounting or administrative. Accounting controls are concerned with safeguarding assets and reliability of financial records; administrative controls consist mainly of procedures leading to operational efficiency. Characteristics of a satisfactory system of internal control would include:

1. Organization plan which provides proper division of functional responsibilities.

2. System of authorization and record procedures which affords reasonable accounting control over assets, liabilities, revenues and expenses.

3. Sound practices to be followed in performance of duties and functions of each organizational department.

4. Responsible personnel.

An important element in any plan of organization is organizational independence of the operating, custodial and internal auditing functions. Responsibility within divisions must conform with managerial policy requirements. A satisfactory system must include media for records control of operations, such as forms, procedure manuals, and charts of accounts.

A properly functioning system of internal control depends upon effective organization planning, adequacy of the procedures and practices, competence of officers and department heads as well as key employees. Management has the responsibility for devising, installing and supervising an adequate system of internal control. Any system may deteriorate if not reviewed periodically and under continual supervision. An internal audit staff provides a means of surveying the effectiveness of and adherence to prescribed procedures.

9 American Library Association. COSTS OF PUBLIC LIBRARY SERVICE IN 1956. Chicago: Author, 1956.

Gives illustrative budgets for library systems serving 50,000 to 200,000 people, and shows the per capita expenditures required for each. The recommended proportional distribution of the budget for minimum support is: salaries, other than maintenance, about 2/3 of total; books and related materials (including rebinding), about 1/5 of total.

A library that meets ALA standards in collection and staff and is able to surpass standards by means of additional expenditures, may then put disproportionate increases in one or another budget category.

10 American Library Association. Physical facilities: guide to evaluation, with minimum standards. ILLINOIS LIBRARIES. 39:311-14, 1957.

Summary of ALA guidelines in the building or renovation of public libraries. Considerations that apply to special libraries include:

1. Planning. (a) Define objectives, activities and requirements of organization before planning program. (b) Locate sections readers use most in proper functional relationship--book and reading areas, lending desk, catalog, information and service stations. (c) Locate areas for receiving, cataloging and physical

preparation of materials in proper relationship, on one floor if possible. (d) Consolidate points of supervision of readers.

2. Physical characteristics. (a) Lighting should provide at least 50 ft. candles on reading surfaces, evenly distributed, without glare. (b) Sound control should be provided by acoustical treatment, proper covering, partitions, etc.

3. Flexibility. To plan for future growth of library: (a) keep fixed walls at minimum; (b) locate stairways, elevators, book lifts, plumbing, air-conditioning to allow for changes in library arrangement.

11 American Library Association. PUBLIC LIBRARY SERVICE--A GUIDE TO EVALUATION WITH MINIMUM STANDARDS. Chicago: Author, 1954.

Outline of public library standards having a direct relation to quality of facilities and services, prepared by ALA Public Libraries Division Coordinating Committee on Revision of Public Library Standards. Specific standards define minimum adequacy rather than goals, are based on best professional opinion checked by statistical study where needed and possible. Among those applicable to special libraries are:

1. Library program focused upon clear and specific objectives.
2. Materials selected, retained and discarded in light of conscious objectives. Written policy statement covers selection, maintenance of material.
3. Systematic removal of non-useful material.
4. All positions part of career service; appointments and promotions based on merit, clear ladder of advancement.
5. Requirements, duties and responsibilities clearly defined and differentiated. Professional and non-professional distinguished.
6. Professional qualification 5 years formal education beyond secondary, including graduation from library school.

7. Standardized government practices observed-equitable pay scales, inservice training, etc.
8. Physical location and facilities planned for maximum economy and effectiveness. Machine work used wherever justified by budget and nature of work.
9. Physical facilities fit program or service.
10. Physical characteristics: (a) Lighting should provide at least 50 ft.-candles on reading surfaces, evenly distributed, without glare. (b) Sound control provided by acoustical treatment, proper covering, partitions, etc.

12 American Management Association. THE MANAGEMENT OF SCIENTIFIC TALENT. New York: Author, 1963.

This book is an accumulation of articles on the establishment and management of a research and development system. The section on "Staffing and Compensation" is of value in gaining some insight into the desires of research and development professionals. This is necessary if the library is to serve the research organization effectively.

13 American Management Association. MEETING THE DEVELOPMENT NEEDS OF TECHNICAL MANPOWER. (AMA MANAGEMENT BULLETIN, No. 45). New York: Author, 1964.

Delineates the problems encountered in identifying technical manpower needs and existing potential in the organization, based on actual situations. Suggests the use of a continuing educational program to avoid technical obsolescence of currently employed individuals, and an on-the-job training program.

14 Andersen, Arthur, & Co. RESEARCH STUDY OF CRITERIA AND PROCEDURES FOR EVALUATING SCIENTIFIC INFORMATION RETRIEVAL SYSTEMS. Washington: National Science Foundation, Office of Science Information Service, 1962. NSF-C218 (AD-273 115)

Discusses means of evaluating scientific information storage and retrieval processes. Criteria for evaluation must evolve from the aims and objectives of the activity to be evaluated. An essential part of scientific information retrieval is reduction of information source objects to knowledge elements. Two evaluative methods are described:

1. Cost and time measurement. Evaluative criteria include (a) classical subjective criteria of relevance, reliability, system and user learning, and flexibility; (b) objective definitions for these subjective criteria (difficult to develop); (c) objective criteria which can subsume many of the non-objective criteria, such as amount of usage, dollar cost per month or per search, time to process and inquiry or reference.

2. Performance measurement through simulation. Outlines use of model which permits manipulation of the operating variables of a system.

Conclusions of study include: (a) cost and time criteria are necessary for any evaluation; (b) performance simulation is an important mechanism for learning about systems; (c) subjective criteria should be integrated with evaluation systems; (d) additional research is needed in requirements, criteria and measure of performance.

15 Anderson, Alan A. GUIDELINES FOR THE UTILIZATION OF STATISTICIANS IN THE DESIGN AND EXECUTION OF INFORMATION RETRIEVAL SYSTEM EVALUATION STUDIES. Dayton: System Development Corporation, 1966.

Defines criterion measure as a scale which represents an acceptable standard against which all other measures of system performance are evaluated by analytical techniques. For example, document value to the user is an underlying concept for a criterion measure. Criterion measure is an important variable, so early in the discussions between user and statistician the logic of the criterion measure must be determined.

16 Anderson, A. A. MULTI-LEVEL FILE STRUCTURE AS A FRAME OF REFERENCE FOR MEASURING USER INTEREST. Presented at the International Advanced Study Institute on the Evaluation of Information Retrieval Systems at the Hague, Netherlands, 1965. (AD-636 832)

The logic of a multi-level file structure as a frame of reference for measuring user interest was tested in an exercise using 39 subject specialists to evaluate a random sample of 444 documents drawn from a population of approximately 50,000 documents. The measure (accessibility scale) proved to have low reliability (.44) but yielded correlations as high as .75 with a cross validity of .68 with sets of 5 to 7 independent variables in the regression equations.

17 Anderson, Pete. Keeping track of information. PRODUCT ENGINEERING. 55:253, 1958.

In a large company the function of storing and providing ready access to technical data may be handled by a technical library and auxiliary services such as centralized files, literature searching and the preparation of specialized reports. In a small company it may be limited to a technical library service. Too often it is considered easier to repeat investigative work than to do a complete literature search on any one subject. The modern technical library should contain the most up-to-date information practically available on all subjects pertaining to the company's field of research. It should circulate current publications of interest to the research staff. Many companies have seen fit to develop special information groups which can be made part of the service groups brought together under the research administrator or administrative assistant. In addition, permanent, centralized files are of great value. These files should maintain not only the laboratory notebooks and other reports, but also physical examples from research programs.

18 Anthony, R. N. MANAGEMENT CONTROLS IN INDUSTRIAL RESEARCH ORGANIZATIONS. Cambridge: Harvard Univ., Press, 1952.

In examining the behavior of an organization, it is useful to distinguish between the objectives towards which the organization aims and the means used to reach these objectives. An appraisal of objectives involves not only ethical considerations and value judgements, but also an appraisal of the means of achieving these objectives, which can be made in terms of a single criterion efficiency.

Usually the appraisals on which performance decisions are based are entirely subjective; that is, no objective criteria or formal techniques are used in the process.

19 Apple, James M. PLANT LAYOUT AND MATERIALS HANDLING. New York: Ronald Press, 1963.

This text discusses the arrangement of physical facilities and manpower required to manufacture a product, since the overall objective is to plan the arrangement of facilities and personnel so that the manufacturing process may be carried out in as effective a manner as possible. This objective calls for a minimum of movement on the part of both materials and personnel, and a minimum of time and process for any individual part. The shorter the amount of time a piece of material spends in the plant, the less opportunity it has to collect charges against it in terms of labor and overhead costs.

Thus the problem becomes the planning and integrating of the path of component parts of a product to obtain the most effective and economical relationship between man and equipment and the movement of material from receiving through fabrication to shipment of the finished product.

In conjunction with plant layout, the materials handling area is studied with regard to the following breakdown of components: (a) motion, (b) time, (c) place, (d) quantity, and (e) space.

20 Aro, Barbara, Gripton, Judith, and Strashem, Carol, Eds. COST ANALYSIS STUDY: TECHNICAL SERVICES DIVISION UNIVERSITY OF DENVER LIBRARY. STUDIES IN LIBRARIANSHIP, No. 4. Denver: Univ. of Denver, 1965.

Report of an appraisal of operational costs on the basis of time and work measurement in the University of Denver Library, Technical Services Division. For processes studied, see abstract of D. Wynar.

A major objective of study was establishment of qualitative and quantitative norms for technical service costs, which would (a) provide realistic basis in budgeting for determining costs and future needs, (b) provide impartial evaluation of what daily output and achievement should be, (c) indicate needs for procedural improvements and provide means for evaluating effects of change.

Specific objectives were (a) balance work load and responsibility, (b) improve operating efficiency, (c) develop processing standards, (d) provide basis of production figures for planning needs.

In conducting a cost effectiveness study, supervisors should (a) study work descriptions and write instructions and classifications of activities to fit particular library, (b) provide full explanation to library staff of purpose of study and method of keeping time and activity records, (c) allow orientation period and place less emphasis on early data at least six months to collect representative data, (e) submit data to conventional statistical analysis by professional statistician, (f) submit analysis and conclusions to all staff members, (g) examine comparative studies of other libraries.

21 Ashworth, Wilfred. Staffing of special library. LIBRARIAN. 49:175-181, 1960.

Discussion of staff and administrative considerations for special library, with data from ASLIB survey.

1. Organizational position. Two thirds of libraries attached to dept. of research, research manager or senior technical executive. Advantages of library under administrative or managing director are: (a) emphasizes avail-

ability to entire company; (b) minimizes monopoly by department using it most; (c) can spread into commercial and marketing fields. Enthusiasm of director in executive charge of library most important.

2. Staff size. Determined by (a) scientific content of company field of operations; (b) efficiency of company communication network; (c) kind and scope of service needed; (d) organization size. Optimum balance must be found between time spent by research and by information personnel on literary searches. Library staff should do three-fourths of total literary research.

3. Qualifications. Scientific qualifications predominated over library qualifications. Staff must have both but not necessarily in one individual.

22 Atherton, Pauline. Indexing requirements of physicists. In THE LITERATURE OF NUCLEAR SCIENCE: ITS MANAGEMENT AND USE. Oak Ridge: U.S. Atomic Energy Commission, Division of Technical Information Extension, 1962. p. 215-218. TID-7647

Some of the basic characteristics of an efficient reference retrieval system for physics literature have been determined from a study of the requirements physicists would impose upon such a system. The following performance characteristics were considered necessary:

1. Report of specific types of research.
2. Multiple access approaches.
3. Identification of all aspects of research reported and the emphasis of the research.
4. Retrieval of references to current literature at 3-4 month intervals. This would satisfy 75% of the requests made by the physicists in the study.
5. Retrieval of references to past literature as far back as 1940. This would satisfy about 60% of the requests made in the study.

23 Auerbach Corporation. AN APPROACH TO COMPUTER INSTALLATION PERFORMANCE EFFECTIVENESS EVALUATION. By N. Statland and others. Bedford, Mass.: U. S. Air Force Systems Command, Directorate of Analysis, Deputy for Advanced Planning, Electronic Systems Division, 1965. (AD-617 613)

The process for computer installation performance effectiveness evaluation operates on a set of specifications, its computer complex, and administrative and financial performance. This analysis provides objective measures of performance, efficiency based on both quantitative and qualitative data, and standards for measuring installation effectiveness. Specifications and characteristics are collected via questionnaires, in four categories: computer hardware, extended machine (hard and soft ware interaction), software evaluation and problem specification.

The application of statistical analysis to effectiveness evaluation would give:

1. A weighting factor for each variable.
2. The degree of relationship between the weighted variables and the dollars expended.
3. A preliminary standard for each installation based on the variable uncovered as significant and their relative importance.
4. A comparison of the actual dollars expended to the calculated standard dollars, revealing the degree of deviation of the actual from the standard.
5. The relationship of the significant variables and the dollars expended expressed in terms of an equation.

Stepwise multiple regression analysis is utilized to determine the relative significance of various data elements and to calculate their relative weights.

24 Auerbach Corporation. DOD USER NEEDS STUDY PHASE I. VOL. I. By Lawrence H. Berul and others. Washington: Advanced Research Projects Agency, Department of Defense, 1965. SD-219 (AD-615 501)

Report of study to determine how DOD scientists and engineers acquire and use scientific and technical information. Critical incident interviewing technique was used to isolate a recently completed task and define the characteristics of the information acquired and used in performance of that task.

The goal of future information systems should be to provide the right information to the right person, at right time and place, in the right form. To achieve this goal, it is necessary first to define the user's information needs.

Study revealed that components of DOD formal information systems were not widely utilized. The following improvements are suggested:

1. Publicity and training. Lack of effective publicity resulted in lack of awareness of available services. Suggests increased publicity, instruction of technical personnel in use of technical services.
2. Engineering data systems.
3. Utility of search aids. Examination of use and applicability of current awareness and search aids to obtain a qualitative measure of their ability.
4. R&D Projects Directory.

25 Auerbach Corporation. A STUDY OF MANPOWER REQUIREMENTS FOR TECHNICAL INFORMATION SUPPORT PERSONNEL. Washington: Dept. of Labor, 1964. (AD-607 893).

A study undertaken by Auerbach Corporation for the Department of Labor to determine the future manpower requirements for technical support personnel to scientists and engineers in the communications equipment industry. One of the areas examined was the library. The manpower requirements in this area

are not high, but will increase greatly because:

1. Industry is becoming aware of the value of information centers.

2. Automation is not replacing librarians but increasing the ability of the information center or library to serve the engineer more quickly and effectively.

26 Axelson, K. S. RESPONSIBILITY REPORTING. New York: Peat, Marwick, and Mitchell, 1961.

Discusses the concept of responsibility reporting which identifies results with the executive responsible for producing such results.

The areas of interest are:

1. Responsibility reporting.
2. The responsibility concept in accounting.
3. Maintaining a proper balance in business management.
4. Organization problems in responsibility reporting.
5. Basic organizational planning to tie in with responsibility accounting.
6. Organization planning.
7. Management reporting.
8. Guide for preparing internal financial and operating reports.
9. Performance measurement through standard costs and budgetary control.
10. Cost reports and analysis of results.
11. Case studies.

27 Bach, Harry. Scientific literature use: a survey. SPECIAL LIBRARIES. 48:466, 1957.

A comparative study of reports by J. D. Bernal, Saul Herner, and D. J. Urquhart on the information-gathering methods of scientific personnel showed that:

1. Pure scientists do their own literature searches; the applied scientist has them done for him, and references evaluated, extracted, and summarized.

2. The pure scientist uses advanced textbooks and research periodicals; the applied scientist uses security-classified research reports heavily.

3. Pure scientist get 70% of their data from domestic sources and 30% from foreign sources; the applied scientist obtains 90% from domestic sources and 10% from foreign sources.

4. Three-quarters of the papers required by research workers are contained in 100 journals.

5. Seventy percent of scientific personnel consult journals less than five years old.

6. References cited in the literature are important indirect sources; most abstracts are utilized during the first 12 months of the original literature's existence.

28 Bain, James. A self-appraisal for project managers. DEFENSE INDUSTRY BULLETIN, 2:3-6, October 1966.

Four steps to aid in becoming a better manager are:

1. Achieve balanced emphasis on executive, management, and leadership functions and skills.

2. Set realistic objectives, programs and policies. Plan for the future, not just to forecast but to control. Get immediate subordinates to assist in setting objectives and policy.

3. Solve your own management problems. Do not usurp delegated responsibility and authority by solving and approving subordinates' problem solving.

4. Communicate and motivate. Use both mass communication and man-to-man techniques to get people to believe what they are doing is important. Commend them for any job well done.

29 Baker, Marjorie O. How to start a small technical library. SPECIAL LIBRARIES. 46:103-108, 1955.

The basic problems, such as library location, space requirements, staffing, maintenance and administration, which must be answered when a library is being set up, are discussed. The following suggestions are made:

1. Locate the library in a convenient, quiet, well-ventilated, well-lighted place with sufficient allowable floor load.

2. Conserve space by using steel shelving, microfilm storage, separate storage and stack areas, and by expanding stack holdings vertically. Allow reading space for personnel.

3. Choose a librarian trained in library science and experienced in the executive administration of libraries. The librarian should be directly responsible to the person in charge.

4. The library should serve the organization three ways: (a) provide information; (b) save time of executives, scientists, engineers; and (c) save money.

30 Barcan, Arthur. Scientific records management for office cost reduction. In Albert Newgarden, Ed., TECHNIQUES OF OFFICE COST CONTROL. (AMA MANAGEMENT REPORT No. 26) New York: American Management Association, 1959. p. 68-73.

The standards used in rating costs and values in paperwork should be:

1. Quantitative and measurable.
2. Reliable for varying sizes and types of organization.

3. Based upon available data in order to reveal promptly how the paperwork actually rates in organization-wide performance.
4. Positive goals for immediate accomplishment.

In rating paperwork operations, management needs the answers to the following key questions:

1. What are present costs?
2. How many clerical employees are on the payroll?
3. How many records are being created and maintained?
4. What are the present space requirements for records in office and storage?
5. What should they be in each case?

Any system should be evaluated in terms of the following basic considerations:

1. How much does it cost?
2. How fast is customer service?
3. What data is available for prompt management action?

31 Bare, Carole E. Conducting user requirement studies in special libraries. SPECIAL LIBRARIES. 57:103-106, 1966.

User requirement surveys help to determine whether the objectives of a library are being met, provide a feedback system, and reveal users' needs. Librarians and administrative personnel must be involved in planning and interpreting the study, but a neutral team may be used to administer the survey. Content, communication channels, delays, special features, and centralization vs. decentralization are items to be examined by a combination of methods such as questionnaires, user diaries, and interviews. To ensure widespread participation:

1. Most questions should require yes or no answers.
2. A few narrative-answer questions should be included.

3. Survey should include all present and potential users, request some demographic data.
4. A few diaries and 15 to 35 interviews should be included.

The data should be communicated to participants in the study as soon as possible to ensure their interest and feeling of joint responsibility for library success.

32 Barnes, Ralph M. MOTION AND TIME STUDY APPLICATIONS, 4d ed. New York: John Wiley & Sons, 1961.

This text points out that the study of body movements is a valuable approach to the problem of finding better ways of doing work. The performance of manual work in an effective manner presupposes some understanding of the inherent capacities and abilities of the human body. Therefore, investigations involving manual work, which were made by engineers, physiologists, and psychologists, were studied, and the most useful findings were included in this book.

Process analysis, operation analysis, standardization, work sampling, and activity charting are some of the areas discussed.

33 Basil, H. Operating a technical library. ILLINOIS LIBRARIES. 35:214-217, 1953.

The Crane Company library manual lists their library services as: (a) over-the-counter service, (b) literature searches, (c) abstracts and bibliographies, (d) translations, (e) circulation, (f) loans, (g) interlibrary loan service, (h) editing the library bulletin, (i) special assignments.

Administrative work includes: (a) brief statement of objectives, (b) classification and cataloging, (c) photostats and pamphlet files, (d) orders and subscriptions, (e) processing incoming literature, (f) binding, (g) microfilms, (h) library notebook and printed forms, (i) correspondence and library hold-

ings, (j) location of library holdings, (k) equipment.

The library should keep in touch with other libraries through such facilities as SLA.

34 Bass, Bernard M. Ultimate criteria of organizational worth. PERSONNEL PSYCHOLOGY. 5:157-173, 1952.

Suggests that the ultimate criteria of organizational worth be expanded. The success of programs for improving the selection, placement, training, job methods and human relations should be evaluated by the extent to which they increase the worth of the organization to its members and society as a whole. This policy is in tune with labor legislation and labor relations and is probably more acceptable to the trade unionist than the "productivity" approach to evaluation. It may have more support from management than might be apparent at first, although this has not yet been researched.

35 Batchelder, R. W. The scope and value of the microcard. SPECIAL LIBRARIES. 43:157-161, 1952.

Describes the microcard and discusses its value in reducing library costs in four basic areas:

1. Cost of text. Where available, microcards cost 1/4 to 1/2 price of published works.
2. Cost of cataloging. Cards are imprinted with Dewey Decimal System and Library of Congress classification. Titles permit filing alphabetically by title or author, numerically by subject, have blank space for special cataloging needs.
3. Cost of storage. 50 letter-size pages can be printed on one side of 3x5 inch microcard. 100 cards occupy 1 inch of file. Savings apply to maintenance costs as well as space and stacks.
4. Cost of binding. Completely eliminated for journals available in microcards.

Physical limitations of microphotography materials are also discussed. Should generally be used only where one or a few copies are required and the reference factor is low. Equipment to read cards costs about $225.

36 Bauer, Charles K. The library as a part of the operations research team. In Special Libraries Association, TRANSACTIONS OF 47th ANNUAL CONVENTION. Pittsburgh, 1956.

Outlines the role of the information specialist and the library in operations research effort:

1. Collecting data in relation to exact scope and aim of study.

2. Screening reports for technical staff to keep amount to minimum.

3. Locating unpublished information; knowing procedures for procuring classified, proprietary and other hard-to-obtain data.

4. Anticipating data needs for future studies.

To achieve these, the information specialist and library must (a) be fully informed of scope and aim of operation research office; (b) keep constantly in touch with other operations research offices, government agencies, private industries and special librarians; (c) organize acquisitions program for anticipated needs as well as live material; (d) collect bibliographic material for anticipated needs.

37 Becker, Joseph. INFORMATION STORAGE AND RETRIEVAL: TOOLS, ELEMENTS, THEORIES. New York: John Wiley & Sons, 1963.

This textbook on automatic data processing includes a review of existing techniques of scientific data handling. It goes into the theory of ADP without delving into computer technology and discusses use of computers--their advantages and failings--as used in information storage and retrieval.

38 Becker, J. System analysis - prelude to library data processing. ALA BULLETIN. 59:293-296, 1965.

A systems analyst working in a library will generally: (a) Study the library's objectives. (b) Look at the overall picture, rethinking the entire process. (c) Analyze the source, movement and utilization of data, and prepare flow charts. (d) Clarify management's decision-making needs. (e) Plan implementation carefully. (f) Be sensitive to staff attitude and explain that automation will not replace personnel but will free them for more professional work.

At Pennsylvania State University, paperwork was greatly simplified by making a master IBM card at the time a book is ordered, and updating it for all status changes that occur. The computer performs all the bookkeeping functions.

39 Bedsole, Danny T. Formulating a weeding policy for books in a special library. SPECIAL LIBRARIES. 49:205-9. 1958.

Describes weeding policy at the main library, United Aircraft Corporation. Considerations in weeding were: subject not of current interest, duplication, item not checked out in last 7 years, obsolete or suspended material, poor physical condition, preferable works available. Means of weeding were: discarding, historical collection, transfer to branch or affiliated library.

The following general guidelines were used:

1. Material retained: series in which each volume largely unique in content (possibly in historical collection), back copies of standard reference works with important unique information (possibly in historical collection), old editions of handbooks and subject matter reference books very similar to newer editions.

2. Discarded: back issues of business and trade directories.

3. Transferred: duplicates of titles no longer in heavy demand, extra copies of older handbooks and standard reference works.

40 Bennet, C. L. DEFINING THE MANAGER'S JOB. New York: American Management Association, 1958.

This report presents the results of a survey conducted among 140 compan' · which have considerable experience in the preparation of managerial position descriptions.

The first part describes in detail the survey of company practices insofar as the description of the manager's job. The second part provides a guide to some detailed position descriptions of managers on all levels. The summary provides statements of common responsibilities, definitions of authority and the limits of authority of managers on various levels.

41 Berg, Charles J. Performance standards for clerical, administrative, technical and professional personnel. MANAGEMENT BULLETIN. 49:42. 1964.

Methods used to measure work measurement include historical records and estimates, logs or time records, work sampling, stop watch studies, predetermined time standards (MTM, MCD, OMC).

Benefits of measurement include cost reduction (between 10-30%), increased productivity of work force, work simplification and methods improvements, effective control of personnel costs, supervisory and employee training and development.

Manufacturing companies calculate:

10% of sales dollar to productive labor
40% of sales dollar to materials
40% of sales dollar to organization and policy matters
10% of sales dollar to profits before taxes.

42 Bernal, J. D. Scientific information and its users. ASLIB PROCEEDINGS. 12:432-438, 1960.

Discusses the need to classify users by functional type. Types discerned are:

1. Researcher. Information directly related to his field generally not available in published form. Needs current ancillary information about such things as apparatus and measuring methods, and stimulation of general scientific reading.

2. Practical user.

3. User writing articles. Exhaustive information about a topic, or archival material for data tables. Student reading included here, generally requires more copies rather than more books.

4. Science historian. Historians' needs are best met by comprehensive libraries in science and technology. Librarians should not retain old material of purely historical importance for this very small group.

5. Chance reader. Motivated purely by curiosity. Every type user may sometimes fit in this category.

Information serves as a suggestive function and a reliability function. Too much insistence is often placed on reliability. Information which is wrong still serves suggestive function for others so long as it is not considered infallible.

43 Billingsley, Susan V. Industrial libraries - some personnel problems not found in books. PERSONNEL JOURNAL. 170-173, Sept. 1961.

Providing optimum salary and status for library staff increases the possibility that the company will secure a first-rate librarian and thus a first-rate library service. Selection of the right in-

44 Bishop, Philip C. The application of administrative engineering techniques to paperwork production operations. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT No. 41) New York: American Management Association, 1960. p. 135-139.

A work measurement plan is necessary for an office manager to plan and operate his function effectively. Four different clerical-work measurement approaches are discussed. These are based on time-study and/or work sampling.

1. Man power utilization studies: concerned with the standard number of people needed. Scheduling and utilization of men and machines are also important.

2. Cost standards: determine on a continuing basis, the best economic balance of the entire function with respect to both labor and non-labor expenses. Basic time standards are developed. Appropriate practical labor dollar value is assigned to various types of work performed and time standards are converted to dollars. Standard cost is incorporated in this type of measurement but not used to measure individual effectiveness.

3. Measured-daywork plans: utilized where there is a need to measure individual and/or group performance on a continuing basis. Standards used in this type of measurement are expressed in terms of time only. No attempt is made to measure non-labor costs.

4. Wage incentive plan: based on individual performance. Standards are established using same techniques as in the other work measurement applications. Where labor productivity increases by paying a share of the value of increased productivity to the worker, the total cost is decreased.

45 Bloomfield, M. ROLE OF THE TECHNICAL LIBRARY IN SUPPORT OF AN INFORMATION CENTER. Culver City, California: Hughes Aircraft Company, 1964. TM-804 (AD-609 825)

Report on differences, similarities and interrelationships of a technical information center and a technical library. Close proximity to the library, its personnel and resources was cited as a major reason for the center's effectiveness. The information center's activity consists of acquiring, storing, indexing, analyzing and synthesizing data. The library provides assistance to center staff through acquisitions, location of requested material from its collection of books and periodicals, reproduction of documents and related services. The library also distributes a biweekly bulletin listing latest acquisitions and classified lists of reports.

The experience and education acquired by members of the information center in the use and interpretation of scientific data provides an opportunity for library staff to grow in experience and become more knowledgable. Both library and information center are seen to benefit from their interation. In this way the library staff can have a better understanding of the needs of the organization and provide for them.

46 Blunt, Charles R., and others. A GENERAL MODEL FOR SIMULATING INFORMATION STORAGE AND RETRIEVAL SYSTEMS. State College, Pa.: HRB-Singer, Inc., 1966. (AD-636 435)

Presents the results of a research effort to explore the use of computer simulation as a quantitative tool for planning, analyzing and evaluating information retrieval systems. Three elements were considered as measurements of the "energy" necessary to produce the desired output from the total file. These were:

1. Quality of presentation. An effective system should be sensitive to users' information needs. A request should be answered with a complete output of relevant information within the desired time. If this quality is defined as system effectiveness, then effectiveness is a

judgement and a difficult measure of an intelligence system's performance.

2. Cost of operation. The sum of the operating costs of each function plus maintenance and support costs incurred to maintain the operations. The value of an information system and its costs are not necessarily in proportion nor are they measureable in the same manner.

3. System response time. The time lapses between statement of information and reception of output satisfying the need of the user.

Parts of the system considered in the model are: (a) operations, (b) linkages, (c) service units, (d) availability, and (e) processing load.

47 Bonn, George S. Training laymen in use of the library. In Ralph R. Shaw, Ed., THE STATE OF THE LIBRARY ART. V.2, Pt.1. New Brunswick, N. J.: Rutgers Univ., 1960. p. 61-62.

Objectives of training in efficient use of library include:

1. Early training to make later school, college or adult use more effective.
2. Developing self sufficiency and security in using library.
3. Assuring maximum use of library resources.
4. Enabling students to satisfy own interests and bibliographic needs.
5. Making library knowledge part of general education.
6. Enabling students who will become teachers to teach library use.
7. Meeting accreditation standards which frequently require such training.

48 Booth, Andrew D. The efficiency of certain methods of information retrieval. INFORMATION AND CONTROL. 1:159-164, 1958.

Methods are discussed for the retrieval of items of data which are stored as entries in a table in the store of the computer. The average number of look-up operations required to find an entry is computed for several methods. It is shown that if advantage is taken of the relative frequencies with which the different entries are looked up, the average number of look-ups may be substantially reduced. The results are applied to the problem of using a computer as a mechanical dictionary.

49 Booz Allen Applied Research, Inc. STUDY OF MECHANIZATION IN DOD LIBRARIES AND INFORMATION CENTERS. Cameron Station, Va.: Defense Supply Agency, Defense Documentation Center, 1966. DSA-7-15489 (AD-640 100)

Summarizes on-site study of mechanization in DOD libraries and information centers. Factors providing a basis for evaluating the effectiveness of mechanized information schemes include: through-put characteristics, including response time for retrieval requests; types, nature and frequency of inputs and outputs; cataloging rate; resource requirements such as manpower needs, operator skill level, space and layout; number of files stored in computer and materials on the shelves; file capacity, level of detail, and breadth of subjects; file organization, load and updating time; error rate; inter-arrival time of various demands upon the system, such as requests to catalog and retrospective search requests; backlog of requests; cataloging backlog; number of users accommodated by process; number of requests; number of queries adequately satisfied; recall and relevance of search output; user satisfaction.

Measures should be taken for worst, average and best cases, compared to management expectations and user needs.

50 Borko, H. THE CONCEPTUAL FOUNDATIONS OF INFORMATION SYSTEMS. Santa Monica: System Development Corporation, 1965. SP-2057 (AD-615 718)

Information systems consist of collections of recorded information, custodians who organize and maintain the collection, retrieval procedures and users. The conceptual foundations for these systems are derived from mathematics, engineering, behavioral science and the many other disciplines which together make up information science. The concepts are the theoretical formulations or principles concerning methods of storing, indexing and retrieving information which are used in the design of information storage and retrieval systems. Seven concepts are enunciated. These deal with the (a) information system need, (b) equipment, (c) user responsiveness, (d) language processing, (e) indexing, (f) classification and (g) storage. The system design implications of each concept are discussed separately and then organized together to form an information storage and retrieval system of the future called BOLD.

51 Borko, Harold. EVALUATING THE EFFECTIVENESS OF INFORMATION RETRIEVAL SYSTEMS. Santa Monica: System Development Corporation, 1962. (AD-288 835)

Suggested methods for evaluating the effectiveness of information storage and retrieval systems are: (a) user satisfaction, (b) relative comparison of one system with another, and (c) comparison of a system against an ideal or absolute standard. For purposes of evaluation, a document retrieval system is conceptualized as a problem in sampling statistics where one must select from a store of documents that set which would provide a response to a search question so as to maximize the amount of relevant material and minimize the amount of irrelevant material retrieved. Results of three experiments comparing the effectiveness of different indexing systems are reported along with two studies evaluating retrieval effectiveness by means of computer simulation models.

52 Bornstein, Harry A. A paradigm for a retrieval effectiveness experiment. AMERICAN DOCUMENTATION. 12:254-259, 1961.

Discusses past studies of retrieval effectiveness and proposes a new criterion. Study by Cleverdon evaluated effectiveness in terms of efficiency in responding to questions generated from document itself. Swanson's study analyzed retrieved information for degree of relevance to discipline concerned. More pragmatic criterion of evaluation is proposed - the judgement of the user in evaluating relevance of retrieved information for his specific problem.

Two major characteristics are associated with indexing rationale: (a) Index is basis on which a store of information is searched for relevant information. (b) All indexing rationales have additional information such as cross references and subject headings to enable user to screen out unwanted references.

Criteria for comparing relative efficiency of indexing rationale are:

1. Amount of relevant, partially relevant, peripherally relevant and nonrelevant information given in response to question.

2. Amount of time inquirer spends in examining response.

Procedures to be used are:

1. Assembling and editing information store.

2. Collecting requests for information.

3. Supplying information responses to inquirer.

4. Measuring inquirers' reactions to information supplied by various sources.

53 Bouman, G. P. Cost analysis in company libraries. BIBLIOTHEEKLEVEN. 36:281-290, 1951.

Summarizes study to establish a method of determining performance costs in and by a company library.

Two concepts in determining costs are: (a) cost carriers - products for benefit of which accruing costs are made, and (b) cost centers - geographical or functional locations where costs originate. A model library cost distribution statement is provided, with cost apportioned by cost centers and subcenters. A time study is necessary to ascertain labor costs in the functional areas.

It is pointed out that cost calculation is a tool rather than a goal. Value is not based on production costs but on replacement value.

54 Bourne, Charles P. METHODS OF INFORMATION HANDLING. New York: John Wiley & Sons, 1963.

An aid and reference work on design of information systems. Provides an illustration of the tools, equipment and methodology applicable to the problems of information processing, storage and retrieval in the library and other areas within government and industrial organizations.

Lists the following points to be considered in evaluating an existing indexing method or selecting a new system:

1. Type of ultimate user (needs, habits and approaches).
2. Type of immediate user (librarian or customer).
3. Characteristics of file collection (current and expected size, rate of growth, variety and complexity of subject matter, format of file material).
4. Availability of other existing indexes for same types of file material.
5. Complexity of required accuracy of searches to be conducted (current awareness, comprehensiveness).
6. Number of searches expected and required response time.
7. Current user and librarian attitudes toward existing indexing system and form of display.
8. Resources available for developing the system, converting backlog of material to new system or new method of display, and maintaining the routine operations.

55 Bourne, C. P., and others. REQUIREMENTS, CRITERIA, AND MEASURES OF PERFORMANCE OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS. Washington: National Science Foundation, 1961. (AD-270 942)

Applied electronics researchers and metallurgists were interviewed to measure and rank several requirements for information. The most important factors were type and form of search product, file materials, user, and system management. Measurable requirements were time taken in obtaining search products, age of information, format of search product, and irrelevant material.

Three separate, complementary tools were developed for analysis and evaluation of information retrieval systems: (a) coarse screening procedure, (b) performance-evaluation procedure, and (c) cost analysis procedures that use computer programs to simulate operation of candidate systems to determine their operating costs over wide ranges in operating conditions.

A general functional model of a storage and retrieval system was developed for use by these cost analysis programs, consisting of (a) system conversion or establishment, (b) acquisitions, (c) input, (d) search, (e) maintenance of indexing information, (f) re-file or return of borrowed material, and (g) handling document requests and interlibrary loans.

Evaluation techniques consisted of preliminary screening, general performance evaluation by quantitative measurement of user's requirement, and reduction of requirements to a common denominator such as cost.

56 Bourne, Charles P., and Ford, Donald F. Cost analysis and simulation procedures for the evaluation of large information systems. AMERICAN DOCUMENTATION. 15:142-149, 1964.

A computer program has been written and used which simulates the several-year operation of an information system and computes estimates of operating costs, equipment, and personnel. The program has been used in the analysis of several large systems, and is a proven

tool for systems with so many components and interrelated operations that an equivalent manual analysis would be cumbersome, time consuming, or impractical. The simulation and analysis procedure has four steps:

1. Formal description of the candidate system--time and cost data, a statement of interrelationships, and constants.

2. Computation of estimated monthly operating costs.

3. Representation of monthly costs as a single cost figure.

4. Extension of the analysis to many different operating conditions.

The candidate systems are examined under different operating conditions to determine: (a) under what circumstances one system might be less expensive than another, and (b) what the range of costs and personnel requirements of a system would be for a range of operating conditions.

57 Breckner, N. V., and Noah, J. W. COSTING FOR SYSTEM ANALYSIS. (CNA RESEARCH CONTRIBUTION NO. 21) Washington: Center for Naval Analysis, Franklin Institute, 1966. NONR 3732(00) (AD-636 273)

Discusses the use of systems analysis in comparing alternative system proposals for achievement of a mission, to discover which, on quantitative grounds, is preferred and to reveal variations that are decidedly inferior and avoid gross inefficiencies. Two fundamental forms of analysis are:

1. Specified level of effectiveness-analysis of way to achieve it most economically.

2. Specified cost-analysis of effectiveness of various system variations.

Cost categories are used to separate expenditures by particular resources, activities and causes that determine their amount. Costs are generally divided into recur-

ring and non-recurring, with major categories under these such as R&D and initial investment (non-recurring), and operations and maintenance (recurring). Cost categories assist in estimating cost time-streams, which serve several purposes:

1. Some elements of cost are deferred or omitted unless time-patterning costs are called for.

2. Decision-makers must anticipate when and what type of expenditures will occur.

3. Expenditures in different years concern decision-makers even when total cost over a period is given.

Systems analysis topics which assist in decisions regarding force-structure procurement and development planning include: (a) use of historical data, (b) cost-quantity relationships (c) estimating procedures.

58 Brode, Mildred H. Standards in internal organization of military libraries. 'HIRD MILITARY LIBRARIANS' WORKSHOP. Monterey: U.S. Navy Postgraduate School, 1959. (AD-479 447)

Traces steps to be followed in organizing military technical library:

1. Determine kinds and quality of service needed to support research, based on mission and activities of parent institution or activity.

2. Estimate programs, size and type of internal library organization; size and nature of collection; reference tools; bibliographic, indexing, abstracting and translating services needed.

3. Determine numbers and qualifications of staff, space and equipment requirements.

Functions of library fall into two main groups: readers' service and technical processing and service. Suggests a survey to gather recommendations for requirements for adequate service.

59 Broom, H. N. PRODUCTION MANAGEMENT. Homewood, Ill.: Irwin, 1962.

This text discusses management of the production function in a manufacturing concern, including new developments in operations research, automation, and guides to the efficient and practical planning of an installation, particularly in the following areas:

1. Organization.
2. Materials handling.
3. Plant layout.
4. Plant maintenance.
5. Production planning and control.
6. Economic order quantities.
7. Process inventory control.
8. Quality control and inspection.
9. Methods engineering and motion study.
10. Work sampling.

60 Brophy, A. L., and Gazda, A. M. Handling the problem staff member. ILLINOIS LIBRARIES. 43:750-763, 1960.

Discussion of the problem employee with reference to library personnel. Summarizes personality studies by Alice I. Bryan (THE PUBLIC LIBRARIAN, N.Y.: Columbia University Press, 1952) and R. R. Douglass (The Personality of the Librarian, Ph.D. dissertation, University of Chicago, 1957). Discusses the personal characteristics of a model librarian.

Implications for personnel management: Studies provide guideline in creating work situations to fit individual abilities, interests, personality, values, and role aspirations.

61 Brown, A. L. Measurement of performance and its relationship for special library service. SPECIAL LIBRARIES. 50:379-384, 1959.

General consideration of performance standards in libraries. Work standards have been defined as the com-

plete analysis of man's time. Measurement of achievement is based on relationship between work performed and personnel needed for that performance, related to the particular needs and facilities of specific special libraries.

Two facets in determining this are: (a) quality of library collection, including physical facilities and location; and (b) staff qualifications, job analyses and description.

Quantitative achievement in any library must include qualitative capacity.

62 Brutcher, Constance, Gessford, Glen, and Rixford, Emmet. Cost accounting for the library. LIBRARY RESOURCES AND TECHNICAL SERVICES. 8:413-431, 1964.

Cost accounting techniques may be used to increase accuracy of determining basic unit costs in library budgeting and planning. They are most applicable to such functions as ordering, preparations, circulation; least applicable to functions subject to variation. Two types of techniques are described.

1. Process cost accounting. (a) Cost accumulated according to function. Library functions divided into cost centers: ordering, cataloging preparation (technical services); circulation, book selection, literature search, reference questions (public services). (b) Unit cost figures for each function based on direct costs (materials and labor) and indirect costs (depreciation, rentals, maintenance, etc.). Administrative salaries not allocated because would distort costs, salaries being 2/3 to 3/4 total library budget. (c) Useful figures derived from unit costs include cost per book processed = unit costs of ordering, cataloging, preparation; cost per book on shelf = average net purchase price plus average cost per book processed. (d) Drawback - does not take into account variation in cost for processing different types of material.

2. Job cost accounting. (a) Used in situations where units of output diverse in nature and cost, requiring differing amounts of direct material, labor and indirect cost. (b) Model used to classify functions according to type of material and degree of difficulty. (c) Complexity of model varies according to individual library needs. Hypothetical model provided.

63 Budington, William S. Cost of information service. In THE LIBRARY AS A COMMUNITY INFORMATION CENTER. Champaign: Univ. of Illinois, 1959. p. 51-66.

Discusses merits of performance budgeting in library cost accounting. Method concentrates attention on character of work performed rather than materials and services purchased; requires calculation of unit costs so that true output of each functional division is known.

D. C. Public Library formerly kept conventional accounts, listing costs under: personnel, travel, rent and utilities, printing and reproduction, supplies and material, equipment, capital expense. Performance budgeting was instituted, with primary divisions of: administration, processing, public service, buildings and grounds, capital expenses. Former headings became subdivisions under each of these.

In determining whether reference service is worth what it costs, one should consider cost of answering a question if the librarian or the library was not there.

64 Buffa, Elwood S. MODELS FOR PRODUCTION AND OPERATIONS MANAGEMENT. New York: John Wiley & Sons, 1963.

An introduction to the analytical methods developed by people in operations research, management science, and industrial engineering.

Written using basic mathematics and statistics without resorting to formula derivation. The text covers areas such as:

1. Statistical methods.
2. Waiting line models.
3. Programming models.
4. Inventory models.

65 Bumgardner, Harvey. Labor-saving methods applied to magazine circulation. SPECIAL LIBRARIES. 43:92-93, 1952.

Description of changes in journal circulation procedure in the Detroit Edison Company library made during 1940-1948. These included: (a) copies continuously routed; (b) circulation only changed upon request by users; (c) punch card system used to make circulation lists.

66 Burness, Jack and Vitek, Clement. Proposed standards for newspaper libraries. SPECIAL LIBRARIES. 51:501-504, 1960.

Description of seven-point outline to be followed in establishing standards set up by SLA Newspaper Division Committee for Study of Daily Newspaper's Library Standards.

1. Administration. Librarian directly responsible to highest ranking individual in news and editorial departments. Necessary to have support of management.

2. Reference material. Standard collection of reference works. Clipping collection and other material determined by individual needs.

3. Personnel. Library positions clearly labeled so that categories of positions and standards of personnel can be set up. Chief librarian's responsibility in administration - hiring, firing, planning, liaison.

4. Organization and control of materials. Copious use of cross references.

5. Physical facilities. Close as possible to news and editorial departments.

6. Hours of operation. Determined by hours of publishing. If library works more than regular shift, responsible library personnel should always be in control.

7. Service. If additional projects are assigned to library, management must provide enough staff for flexibility.

It was advised to look for standards and not a means of standardization in the libraries.

67 Burnette, Paul J. Research libraries of the Army. PROCEEDINGS OF THE FIFTH ANNUAL MILITARY LIBRARIANS WORKSHOP. Colorado Springs: U.S. Air Force Academy, 1961. p. 32-38

Discussion of problems involved in the operation of research libraries of the Army. Major difficulties are:

1. Obtaining professional librarians to fill vacancies and authorization for additional library personnel positions.

2. Lack of storage and floor space.

3. Distance between research laboratories and offices and the libraries that support them.

Principal areas in need of improvement are Army procurement practices and administrative organization as they affect research and development libraries. Another problem cited was insufficient planning of locations, expansion and staffing. The procurement system was in some cases not adapted for rapid acquisition and distribution of library materials. An additional complication is the constant movement of the Army, activation and inactivation of installations, transfer of units and establishment of new libraries, which keeps all records in a state of flux.

68 Bush, G. C., Galliher, H. P., and Morse, P. M. Attendance and use of the science library at M.I.T. AMERICAN DOCUMENTATION. 7:87-109, 1956.

A questionnaire survey on use was conducted at M.I.T. The measure of effectiveness selected was ratio of material used to material demanded, where material used is material borrowed plus material used in the reading room, and material demanded is material used plus material unavailable. The library was about 85% effective in supplying books and about 93% effective in periodicals. Overall effectiveness was 89%.

Data were gathered on three classes of failure by the library to meet demands for material:

1. Material temporarily out. Measures the adequacy of the supply of duplicates and the suitability of the period for which borrowed material may be retained.

2. Material unavailable for various reasons. Provides an indication of the effectiveness of the combined purchasing, cataloging, and shelving functions.

3. Material in another M.I.T. library. Indicates the extent to which the division of library material among the various Institute libraries causes inconvenience to users.

69 Butler, Evelyn. The rule of thumb. SPECIAL LIBRARIES. 51:232-234, 1960.

A general consideration of the responsibilities of a library administrator. Responsibilities include setting work standards and establishing morale of library.

Administrative suggestions include:

1. Job classification. Professionals must not be wasted on clerical duties, which subprofessionals can do.
2. Balance between supervisors and assistants must be carefully maintained. With too many assistants, supervisor loses control and has little time for duties other than direction and supervision.

70 Campbell, Angus. Administrating research organizations. AMERICAN PSYCHOLOGIST. 8:225-230s, 1953.

A discussion of objectives in achieving group responsibility in organization administration. These include:

1. Organization head has sufficient freedom to adequately handle functions implicit in his role.

2. Senior organization members work closely with head, share responsibility for major policy decisions, help perform various administrative functions.

3. Individual researchers and research teams have large measure of responsibility for conduct of individual projects. Person directing research aspects of project makes decisions on expenditures, report deadlines and other major administrative project phases; makes day-to-day decisions once scope and character of project have been determined; acts as project executive.

4. Middle and junior personnel have realistic means of influencing organizational policy but are not involved in major time commitments to broad administrative considerations.

5. Organization staff has feeling of common purpose and fate.

71 Campbell, Wayne R. Feedback from the user - sine qua non. In Paul W. Howerton, Ed., INFORMATION HANDLING: FIRST PRINCIPLES. Washington: Spartan Books, 1963. p. 107-136.

Discusses the importance of users' reactions in evaluating library service. Scientists at the International Conference on Scientific Information, in 1958, pointed out a number of things libraries should do, including: issue list of services, provide notification of current reports in users' fields, improve photocopy and translating services, compile technical and design-data manuals from set

of reports, circulate bibliographies, compile more up-to-date bibliographies, produce literature surveys, record work done by individuals for reference by others, instruct users in how to phrase inquiries, publish cumulative index, include in announcement list books of interest not published, provide abstracts or short reviews of new books, use more specialized arrangement of library collection, improve coverage of certain subject fields and foreign periodicals, identify articles of interest to recipient when sending weekly bulletin of periodical titles, list contents of periodicals issues by issue.

Provides sample cost analysis for conventional industrial library. Analysis distinguishes between cost of being ready and cost of services, estimating that 25% of total is for actual services and the rest is obligated before any service begins.

72 Canning, Richard C. INSTALLING ELECTRONIC DATA PROCESSING SYSTEMS. New York: John Wiley & Sons, 1957.

This book is directed towards the interests of the higher levels of management which are responsible for the success of an electronic data processing system. The text includes getting the system into operation according to the time and money schedules, as well as the more basic question of what the installation does in terms of company goals and problems.

73 Carnovsky, L. Evaluation of library services. UNESCO BULLETIN FOR LIBRARIES. 13:221, 1959.

Discusses data on circulation, personnel, finance and collections of libraries that have been used to evaluate public libraries. These statistics do not relate to research or university libraries. Each librarian must decide proper goals for his library, based on potential readers, their needs and desires. Any evaluation must be done on the basis of goals. The more clearly they are perceived, the better are the tools and measuring instruments used to gauge the extent of library service.

74 Carnovsky, Leon. Standards for special libraries. Possibilities and limitations. LIBRARY QUARTERLY. 29:168-173, 1959.

Gives five broad principles as a basis for the establishment of standards for special libraries.

1. Each library should have materials necessary to supply information required by personnel of its parent institution.
2. Each library should have personnel necessary to collect and assimilate the information needed.
3. Each library should observe sound principles of personnel administration.
4. Each library should make use of materials available in other libraries.
5. Each library should be so organized as to permit systematic location of desired information.

Considers such things as salaries, education and library materials, and asks whether standards are possible for them.

75 Carroll, Kenneth D., and Summit, Roger K. MACHINE APPLICATIONS TO TECHNICAL INFORMATION CENTER OPERATIONS. Sunnyvale: Lockheed Missiles and Space Company, 1962. (AD-401 227)

A modular development of a system for application of electronic equipment to various operations of the Lockheed Technical Information Center is discussed. Card catalog preparation, reproduction and alphabetizing are rote functions which a machine performs more efficiently than the clerical staff. Besides more rapid card delivery to the catalog, the improved services through wider and more selective dissemination of information of new acquisitions, automated searching, allows the staff more time to examine processing and reader services.

Other factors to be considered in viewing costs and savings are the added services afforded the TIC with this basic cataloging input. These are:

1. KWIC indexes as required.
2. SDI regarding new acquisitions.
3. Information retrieval tapes.
4. Book catalogs in specialized areas of the collection.

76 Carroll, Phil. HOW TO CHART DATA. 2d ed. New York: McGraw-Hill, 1960.

This text describes charting as a simple method to obtain answers to complex problems that contain multi-variable factors. This method is in opposition to operations research which uses mathematical equations to solve this type of multi-variable problems.

Charting is a step by step process that requires only simple mathematics to get answers to many complex problems such as profit control forecasting, budgets and product costs. Finding ways to economically set standards for non-repetitive types of work is the chief reason why these charts were developed.

Many types of charts are discussed, including alignment charts, multi-variable charts, curve layouts, straight-line equations, and constant percent charts.

77 Carroll, Phil. PROFIT CONTROL. New York: McGraw-Hill, 1962.

This book deals with the methodology of planning profits, analysis of budgets and systems, waste detection and correction, performance measurement, and corrective actions. Provides a thorough analysis of the whole profit picture, including overhead and direct labor cost, improving engineering specifications, shortening the process cycle, and determination of product cost.

78 Carroll, Phil. We need work measures. SPECIAL LIBRARIES. 50:384-387, 1959.

Discussion of the need for work measures to eliminate management errors, sort out wasted work and determine costs of an operation. Some of the byproducts of work measures are: (a) ease in training and promotion; (b) progress of new employees can be followed; (c) an early evaluation of a new employee is possible, and (d) permits a librarian to evaluate costs of services and types of information to management.

79 Carson, Gordon B., Ed. PRODUCTION HANDBOOK. New York: Ronald Press, 1959.

The text provides descriptions of the various tools used in work measurement and simplification as applied to a manufacturing situation. The same tools may be applied to any work situation which involves physical movement of a product or product components.

In a discussion of some operations research techniques, an explanation is given of regression analysis as it is used in the analysis of a production line drilling operation.

80 Carter, Launor F. Evaluating the performance of individuals as members of small groups. PERSONNEL PSYCHOLOGY. 7:477-484, 1954.

Discusses factors which can be evaluated by observing people interact. Three factors were singled out as representative of a number of behavioral traits:

1. Individual prominence--traits of aggressiveness, leadership, confidence, and striving for individual recognition.
2. Group goal facilitation--efficiency, adaptability, cooperativeness.
3. Group sociability--sociability, striving for group acceptance, adaptability.

The interaction of individuals in small group situations can be adequately described by these three factors, simplifying the conceptual problem of describing individual behavior. This may also clarify thinking regarding such concepts as leadership by indicating the prominence of an individual as he stands out from the group, his effectiveness in the achievement of the group goal and positive social interaction within the group.

81 Cason, Cleo S. Standardization in military library organization. THIRD MILITARY LIBRARIANS' WORKSHOP. Montery: U. S. Navy Postgraduate School, 1959. (AD-479 447)

Of 13 military libraries examined by Panel on Standardization in Military Library Organization, organization charts revealed that:

1. One has direct access to Commander, five are one block from Commander, five are two blocks removed, two are three blocks removed.

2. Five are included in Administrative groups, four in Service groups, three in research groups. One reporting directly to Commander stands alone.

82 Churchman, C. W., Ackoff, Russell L., and Arnoff, E. L. INTRODUCTION TO OPERATIONS RESEARCH. New York: John Wiley & Sons, 1957.

This text is an outgrowth of a series of lectures at the Case Institute. It provides an introduction to operations research, explains what operations research is and how it approaches solutions to various types of problems. Sample problems are solved, demonstrating the use of models in operations research.

83 Clapp, Verner W., and Jordan, Robert T. Quantitative criteria for adequacy of academic library collections. COLLEGE AND RESEARCH LIBRARIES. 26:371-380, 1965.

Develops new formulas for estimating the number of volumes required for minimum adequacy by academic libraries of widely differing characteristics. Argues that adequacy of an academic library can be measured by its number of books.

Variables involved include: (a) student body size, composition, scholastic aptitude, socio-economic and intellectual background; (b) faculty size, involvement in research, "library-mindedness"; (c) curriculum and methods of instruction; (d) availability of suitable places for study on campus; (e) geography of campus, proximity to metropolitan areas and other large libraries; (f) intellectual climate, inducements and distractions to study.

Presumes that minimum adequacy can be achieved only if all material is carefully chosen with a view to the purpose to be served and the weeding program is as active and realistic in relation to needs as is the acquisitions program. In applying formula to four college libraries, it is noted that standards are easier on the stronger institutions and harder on the weaker than is minimum adequacy.

84 Clark, Andrew J. A PROGRAM LIBRARY APPROACH FOR IMPLEMENTING RESULTS OF LOGISTICS RESEARCH. Santa Monica: RAND Corp., 1965.

Presents a method for narrowing the gap between research in inventory theory and its use in operational systems. Proposes establishment of a library consisting of self-contained computer routines that can be used in desired combinations by system designers who are not specialists in applied inventory theory.

1. Admissions or acquisitions criteria: the proposed subroutine should represent a model, algorithm, or technique of actual or potential value for practical application in computerized logistics management systems in military establishments; be nontrivial with respect to scope or problem application; be submitted in an established format; be problem-oriented rather than specific to a particular operational environment; and include as many "safety devices" as warranted.

2. Indexing information: descriptive data such as title, status, and Problem-Oriented Language (P)L) used; definitions and technical instructions; and a Statement Listing of the subroutine written in the selected POL.

An admission committee responsible for controlling the development of the library will develop criteria for admission and standards for documentation, evaluate condidate subroutines accomplishing the same general functions and assign codes indicating relative value. Reduction of implementation setup costs and encouragement of application of research results in operational management systems are the chief benefits of the plan.

85 Cleverdon, Cyril W. The evaluation of systems used in information retrieval. INTERNATIONAL CONFERENCE ON SCIENTIFIC INFORMATION, 1958. Washington: National Academy of Science, 1959. p. 687-698.

Description of variables to be examined in an NSF-sponsored study by Aslib of the merits and demerits of four information retrieval systems. Three main considerations were (a) cost indexing, (b) cost of equipment, and (c) cost of retrieval.

Variables in indexing were: (a) the indexer, (b) the system, (c) indexing time, (d) experience of the indexer, and (e) collection size.

Variables in testing were (a) type of question put to index-degree of specificity, and (b) type of person physically attempting to retrieve information, including question originator who may have no knowledge of indexing system, technical indexer, librarian indexer, technical person not originating inquiry, librarian not engaged in indexing, or any combination of these.

Main difficulties in evolving test program are uncertainty that all variables have been identified and need for repeated testing to determine reliably the nature and relative effects of all relevant variables. Even when all possible testing has been done, catalogs and indexes will remain of value for comparison in testing of other systems and subject fields.

86 Cleverdon, Cyril W. An investigation into the comparative efficiency of information retrieval systems. UNESCO BULLETIN FOR LIBRARIES. 12:267-270, 1958.

Discussion of the factors to be considered in an NSF-sponsored study by Aslib of information retrieval systems.

Economic efficiency was felt to be the only satisfactory basis in comparing systems. This involves (a) time cost of preparing index, (b) time cost of locating required information and obtaining required documents, (c) equipment cost, (d) probability of producing required answer, (e) absence of irrelevant answers, (f) frequency of searches, (g) potential value of information or potential cost of failure to find information.

(Other aspects of program covered in NSF abstract)

87 Cleverdon, Cyril W. REPORT ON THE TESTING AND ANALYSIS OF AN INVESTIGATION INTO THE COMPARATIVE EFFICIENCY OF INDEXING SYSTEMS. (Aslib-Cranfield Research Project) Cranfield, 1962.

Failure to retrieve source document using U.D.C., Alpha, Facet and Uniterm systems were assigned to the following causes:

1. Questions. (a) too detailed, (b) too general, (c) not easily understood, (d) misleading, (e) incorrect.

2. Indexing failures. (a) insufficient indexing caused by indexer's lack of judgement or shortage of time allowance, (b) overdetailed indexing, (c) incorrect indexing, (d) insufficient number of entries, (e) careless indexing, (f) lack of entry in index to the schedules, (g) lack of cross reference.

3. Searching failures. (a) lack of understanding, (b) failure to use all concepts given in question, (c) chain index, (d) failure to search systematically, (e) incorrect searching, (f) insufficient searching.

4. System. (a) number of places in schedules for same aspect, (b) lack of place in schedules, (c) lack of subdivision, causing placing to be too general, (d) bad choice of heading, (e) synonyms; (f) inability to combine particular concepts.

88 Cleverdon, C. W., and Harper, L. J. Information services: assessing their value. ASLIB PROCEEDINGS. 8:239-251, 1956.

A discussion of some of the problems in determining how much should be spent on what library services. These include:

1. Improving ability of technologist or scientist to find required information; time economically devoted to educate him to be information conscious.

2. Expanding numbers of information specialists. What is best ratio of information specialists to scientists?

3. Developing techniques to perform information tasks, determining means of comparing machine and manual performance and costs, taking into consideration such indirect costs as scientist time in preparing and using reader when using microfilm.

Suggested techniques in determining value of information officer:

1. Defining purpose. Investigate not only his work but work of researcher - information he wants, how he gets it, time spent, amount and effect of failure.
2. Definition of individual. What is his potential in research fields as researcher or subject specialist?
3. Effect of information officer's activity on research team
4. How can value of information officer's work be measured in money?

89 Cleverdon, C. W., Lancaster, F. W., and Mills, J. Uncovering some facts of life in information retrieval. SPECIAL LIBRARIES. 55: 86-91, 1964.

Discusses aspects of indexing analyzed in the Cranfield study. Two parameters used in evaluating

indexing systems were recall and relevance. Ratios for each were determined as:

$$\text{Recall ratio} = \frac{\text{relevant documents retrieved}}{\text{known relevant documents in collection}} \times 100$$

$$\text{Relevance ratio} = \frac{\text{relevant documents retrieved}}{\text{total documents retrieved in searching}} \times 100$$

An inverse relationship between recall and relevance was discerned. The key factors governing these parameters were concluded to be specificity and exhaustivity. Specificity is a property of index vocabulary. The more specifically a concept can be described, the higher the relevance ratio of searches involving with concept. Exhaustivity is based on a decision by the indexer. Exhaustive indexing implies recognition and description of every indexable item of information in a document. Low exhaustivity implies recognizing only most important concept. High exhaustivity produces high recall and low relevance; low exhaustivity produces low recall and high relevance.

90 Cohan, Leonard, and Craven, Kenneth. SCIENCE INFORMATION PERSONNEL. New York: Modern Language Association, 1961.

Discusses the role and training of the science information specialist. Makes the following recommendations.

1. Management. (a) Salaries of information specialists should be equal to laboratory scientists with equivalent qualifications, (b) Appropriate job classifications should be developed. (c) All junior-level scientists should perform some information functions. (d) Senior executive officer, generally of R&D, should oversee information department. (e) Industry and government should cooperate with library schools.

2. Scientists should (a) show proper concern for information facilities relative to their disciplines, (b) recognize contributions of information personnel, (c) acquaint

information personnel with their special requirements.

3. Information personnel should (a) produce more reports on information problems, solutions and projects; (b) improve liaison with users, variety and quality of service; (c) improve recruiting by emphasizing scope and concern with intellectual content of material.

91 Cohen, Jerome B. and Robins, Sidney M. Profit measurement and use. In THE FINANCIAL MANAGER - BASIC ASPECTS OF FINANCIAL ADMINISTRATION. New York: Harper & Row, 1966. p. 154-157.

Manpower data like turnover rates, absenteeism and promotions provide insight into success of personnel policies. Top management may rely on personal evaluation, through trips to plants and personal discussions with employees. Nature of firm's operation influences measures taken by management in evaluating performance.

Development of methods to gauge performance of engineering organizations where much work involves research is becoming more important. One tool used to measure performance is the number of scientific publications written for professional journals. Other suggested methods are:

1. Requisitions filled by laboratory supply room.
2. Costs per man-hour of supplies.
3. Costs per man-hour of total research expenses.
4. Tests per month.
5. Formulas developed per man-week.
6. Pages of patent applications written per man-day.
7. Cost per patent application.
8. Cost per operating hour.

These measuring devices do not evaluate quality. In one organization, the means of research evaluation consisted of counting the number of patents developed by staff.

Profit guide is being introduced more frequently into research. Engineering divisions are becoming increasingly cost conscious. More work is necessary before suitable methods are developed to incorporate research and engineering into a company's overall surveillance procedures.

92 Cole, P. F. Analysis of reference question records as a guide to the information requirements of scientists. JOURNAL OF DOCUMENTATION. 14:197-207, 1958.

Statistical analysis of records of reference questions submitted to an organization's specialist information department is suggested as a guide to organization's literature needs. Use of this method by British Petroleum Co.'s information service is described.

Advantages: (a) Records used show actual usage within organization. (b) Record is routinely kept; expensive surveys unnecessary. (c) Records of this type already exist in many fields; method could be widely applied. (d) Scientists only define and amplify requirements; information specialists perform subsequent operations, are more qualified to select most useful literature. (e) Reference questions already widely accepted as qualitative guides.

Method: Reference questions evaluated by (a) distribution among inquirers; (b) object of inquiry; (c) type of answer supplied, (d) source of information.

British Petroleum Co. analysis found: (a) Object of inquiry-48% operating information, 26% other direct uses; 22% indirect uses such as education and briefing. (b) Type of answer-69% medium coverage of well-defined subject, 18% single fact or figure, 9% intensive coverage, 2% light coverage of wide field, 2% other. (c) Sources of information - 58% journals, 21% textbooks, yearbooks, handbooks, etc.; 14% pamphlets, 12% internal reports; 6% external reports; 5% trade catalogues; 4% external information sources. 8% other. (d) distribution of journal references by age - 31% less than 1 yr.; 22% 1-2, 13% 2-3; 13% 3-4; 8% 4-5; 9% 5-10, 5% over 10.

93 Collbohm, F.R. SCIENTIFIC AIDS TO DECISIONMAKING--
A PERSPECTIVE. Address before the General Management Conference, American Management Association. Los Angeles, Jan. 31, 1957. (AD-606 298)

Discusses scientific approach to decision making.

1. Complete analysis of the problem and definition of the objective.

2. Careful examination of simplifying assumptions. In designing most analyses, not all aspects that may have impact on problem can be included. Enough of real environment must be retained to adequately represent context. Assumptions can control the results.

3. Problems can sometimes be broken into components with various scientific techniques used for each part. Mathematical model appropriate to some parts.

4. Determination of criteria to be used in evaluating various solutions to see how well they satisfy the objective. Criteria are treacherous and must be used critically.

94 Collins, William R. Concepts underlying proposed revised occupational standards for professional librarian positions and technical information service positions. NINTH MILITARY LIBRARIANS' WORKSHOP. West Point: U. S. Military Academy, 1965. p. 23-36.

Discusses background for developing Multi-Series Standards and Technical Information Service Series covering librarians, and other professional, scientific and technical positions concerned with document and information processing.

Classification of positions was intended to assist in recruiting qualified personnel and provide equitable salary treatment. The Multi-Series Standards were designed to (a) recognize commonality of functions performed in information facilities, (b) accommodate interdisciplinary positions, and (c) establish equitable grade

level structure for combinations of subject, language, library and documentation knowledges.

Variables in manner of handling information were distinguished as (a) work environment, (b) mission of facility, (c) users' requirements, and (d) academic background and experience needed to perform the work.

Three factors were considered in determining grade level: (a) knowledge requirements, (b) scope of assignment, and (c) level of responsibility.

95 Computer Command and Control Company, Philadelphia.
AN AUTOMATIC CLASSIFICATION SYSTEM TO AID R&D MANAGEMENT. Washington: Office of Naval Research. Naval Analysis Group, 1965. (AD-477 919)

Discusses development of an automatic classification system to aid R&D management. Included are analyses of approximately 30 classification systems; development of design criteria; development of classification generating technique to meet specifications set forth and development of experiments to test proposed system.

Requirements of a classification system are:

1. Must be useful.
2. Must be easy to update, maintain and use.
3. Elements within a class must be content related.
4. Elements must cover entire spectrum of available information.
5. Must permit integration of various classification approaches.
6. Should lend itself to mechanical accumulation of data.
7. Should be flexible.
8. Must provide all-directional information flow.

Ideal classification system must be content structured, designed to fulfill needs of user, adaptable to computerization and anticipatory of future developments.

96 Comrey, A. L., Pfiffner, J. M., and Beem, H. P.
Factors influencing organizational effectiveness.
PERSONNEL PSYCHOLOGY. 5:307-328, 1950.

Describes an investigation to determine factors related to effective functioning of organizations by locating a group of relatively homogeneous organizations which could be graded with respect to operational effectiveness, and determining whether other measurable characteristics of the organizations and their personnel correlated with effectiveness scores. Organizations selected were 18 U.S. forests in California.

The forests were ranked for overall effectiveness and effectiveness in special areas by eight specialists. A composite ranking was derived from these.

Questionnaires relating to methods of supervision, administrative practices and interpersonal relations were sent to personnel at eight levels, ranging from top supervisory to clerical. Items in each questionnaire fitted into various classification categories or dimensions such as (for forest supervisors) critical attitude toward management, critical attitude toward subordinates.

Dimension scores were compared with effectiveness ranking for each forest. Significant conclusions concerned mostly top line staff group, indicating that forest supervisors of more highly rated forests exercise democratic methods in dealing with subordinates, show personal interest in them, are younger and newer at business of forest administration. Other findings were largely inconclusive.

97 Conway, B., Gibbons, J., and Watts, D. D.
A research study and report prepared for
Controllers Institute Research Foundation.
BUSINESS EXPERIENCE WITH ELECTRONIC COMPUTERS.
New York: Controllers Institute Research Foundation,
Inc., 1959.

This report is a synthesis of what has been learned from electronic data processing installations. It is concerned primarily with the ideas, approaches and techniques which will help organizations about to start an EDP program. However, it is not directed at individuals

whose interest is largely technical or solely that of general education, but those who have been assigned decision making responsibility concerning planning, supervision, control and ultimate program success.

98 Costello, Timothy W., and Zalkind, Sheldon S. PSYCHOLOGY IN ADMINISTRATION. Englewood Cliffs, N.J.: Prentice-Hall, 1963.

This text is a research-oriented document which consists primarily of integrated readings dealing with the role and use of a behavioral science (psychology) in business. In addition it covers the use of behavioral sciences in the field of industrial management and related areas in management communication.

99 Cox, Thomas M., Jr. Improving business information systems through planning and centralization. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT NO. 41) American Management Association, 1960.

To solve problems concerning use of information, management must undertake fundamental planning involving company's goals and operations. The data processing and information operation should be set up as a separate centralized function. With this approach the following advantages are evident:

1. Ready determination of data-processing costs.

2. Data processing would be handled by specialists and thereby free other managers for their primary functions.

3. In a centralized operation people could be moved around to meet peaks in workload - difficult where data processing is departmentalized.

4. Installation of new and better methods would be simplified.

5. Duplication between departments would be eliminated.

Advantages indicate possibility of reduced costs. Equally important is ready access to information for decisions leading to improved earnings. A data processing department which gathers all data available from system, knows how to develop new information from raw data and gathers additional raw data, all at least possible cost seems most advantageous to company to supply decision makers at all levels with needed information.

100 Crawford, James R. SYSTEM SIMULATION FOR EVALUATING PRODUCT QUALITY. Presented at Midwest Quality Control Conference, Denver, Colorado, October, 26-27, 1962. (AD-288 840)

The conceptual framework for simulating any large system is described in terms of a queue task network through which transactions flow. The concept of simulating motion in such a system is discussed. The portions of a whole system associated with product quality are considered as an operating subsystem, including generating functions for incoming product quality and the defectives produced by production. Sampling plans operate in this system. How the simulated system provides records for evaluating the product quality presented the stockroom or to the customer is explained.

101 Crenshaw, Craig M. The military scientist views technical libraries. In Special Libraries Association, TRANSACTIONS OF THE 41st ANNUAL CONVENTION. New York, 1950. p. 103.

Discusses need for awareness of technical personnel that the library exists as a tool to help them in their work, as instruments help them in the construction of equipment. Proposes the following ways of improving the effectiveness of a technical library:

1. Create a need in the mind of the technical worker for the library.

2. Maintain as complete a collection of current periodicals in the fields of investigation as feasible.

3. Establish maximum circulation of standard books with many on permanent loan to individual workers.

4. Institute a complete and efficient abstracting service.

5. Make available translation and duplication services.

6. Obtain progress reports, classified and unclassified, of work at other laboratories or on contract.

7. Promote an effective inter-library loan system for publications not normally needed.

8. Employ a cheerful, efficient librarian who is willing to tolerate the idiosyncrasies of absentminded scientists.

102 Croxton, F. E. AUTOMATION PROGRESS AT RSIC-THE STATUS OF ALPHA I. Redstone Arsenal, Alabama: U.S. Army Missile Command, Redstone Scientific Information Center, 1963. RSIC-92 (AD-615 813)

The paper discusses automated literature processing in a scientific library.

A systems analysis of what was actually done in the library led to development of a system composed of four basic parts:

1. Master file of information on user.

2. Master file of information on three primary kinds of items available to user.

   a. periodicals
   b. books
   c. documents

Changeover from manual to machine processing of library functions was accomplished without increase in manpower and in spite of heavy demands on library services.

103 Cuadra, Carlos A. ON THE UTILITY OF THE RELEVANCE CONCEPT. Santa Monica: System Development Corporation 1964. (AD-443 746)

A key concept in evaluating the information retrieval function has been relevance, in the dictionary sense of having a relation to the matter at hand. The effectiveness of the information retrieval function is determined by the number of relevant items retrieved in relation to other considerations, such as total number of items retrieved, number of non-relevant items retrieved and number of relevant items not retrieved. The paper argues that it is necessary to separate relevance as a construct from the particular means used to measure it.

104 Cutlip, Scott M., and Center, Allen H. Evaluation: the fourth step. In EFFECTIVE PUBLIC RELATIONS. 3d ed. Englewood Cliffs, N. J.: Prentice-Hall, 1964.

Evaluation of a public relations measure should have two phases: pre-testing and post-testing. A careful pre-check of material to be used in a project will pay off by:

1. Predicting possible backlash effects.

2. Sharpening the understandability of the information for its intended audience. Make the pre-test as immediately as possible before the presentation so as to maintain the same conditions.

Post-testing is valuable for:

1. Determining after effects of a specific program.
2. Advancing professional knowledge.
3. To measure results of specific appeals, media, and methods.

105 Daniels, Arthur C. As management sees the special library. SPECIAL LIBRARIES. 51:185-188, 1960.

A discussion of qualifications of the special librarian from the management point of view. In addition to library skills, the librarian should:

1. Learn about organization, its business, users' areas of interest.
2. Know not only the literature but persons within organization who are experts in certain fields and are sources of information.
3. See that all new information on a topic reaches persons working on that topic.
4. Build and maintain interest and enthusiasm which keeps library a creative part of organization.

106 Davies, J. G. W. What is occupational success. OCCUPATIONAL PSYCHOLOGY. 24:7-17, 1950.

Review of criteria for evaluating occupational adjustment.

1. Principle categories of criteria: (a) objective records of individual performance; (b) differences between groups of known characteristics, (c) results of examination or tests of knowledge and skill, (d) gradings and assessment.

2. Objective records of group performance: (a) direct records or figures of output; (b) indirect figures - earnings, breakages or accident rate, overhead savings, sickness and absence rates, turnover, etc.

3. Productivity in relation to cost of work in physiological and psychological effort, indicated by bad relations with supervisors, intra-group friction, insecurity, unacceptable systems of payment.

107 Davis, Charles J. DOCUMENTATION AND INFORMATION RETRIEVAL ASPECTS OF ARMY STUDIES. ANNEX C TO THE ARMY STUDY SYSTEM, STUDY DOCUMENTATION AND INFORMATION RETRIEVAL, Washington: Department of the Army, 1963. (AD-602 527)

An examination of the documentation and information retrieval aspects of Army Study effort. Essential operating features defined as: (a) collection and control of past information on Army Studies; (b) monitor and control of current information; (d) review and consultation services; (e) training or training advice on preparation and use of Army Studies; (f) central liaison with other study agencies; (g) research on management conduct and review of Army Studies, including human factors, use of studies, format, classification and indexing, storage and retrieval, automation and methodology.

Deficiencies noted included lack of standard abstract, established indexing and cross-indexing system, and such finer points associated with information flow as review and monitoring of total study program, training in study management and methods, central liaison and free exchange of information with other Services study efforts. Recommendations included preparation of standard abstracts by author (study agency), where possible, with alternative of abstracting by professional personnel at central information center.

Considers use of library research staff to prepare summary data from library of completed studies. Staff must employ same judgement requester would use if doing own literature search, must have first responsibility to the study.

108 Davis, Keith. HUMAN RELATIONS IN BUSINESS. New York: McGraw-Hill, 1957.

This book concerns employees working together as manager and employee, and how they may be motivated to greater teamwork. It discusses the fundamentals of employee human relations in business and uses charts and drawings, examples and illustrations from business and case studies.

Some of the areas discussed are people in their work environment, staff relationships, leadership and supervision, wage administration, organization structure, procedures and work systems and the appraisal of morale.

109 Davis, Ruth M. Classification and evaluation of information system design techniques. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 77-83 (AD-632 587).

Defines the criterion of a profession as the existence of a systematic body of knowledge of substantial intellectual content and the development of personal skill in the conscious application of this knowledge to specific cases. Three criteria are:

1. Is there a prescribed way of entering the profession through enforcement of minimum standards of training and competence?
2. Is there a clearly agreed upon and generally accepted standard of professional conduct for information system design as a whole?
3. Is there a governing body similar to those for the legal and medical professions?

Problems of establishing criteria consist of:

1. Lack of well-defined objectives.
2. Lack of meaningful models.
3. Uncertainty concerning measures of effectiveness.
4. Difficulties of determining test problems and system scope.
5. Problems of security or proprietary interest.
6. Disinterest expressed through lack of "punishment procedures" for poor system design.
7. Lack of quantitative system criteria.

Examples of criteria are:

1. Time.
2. Maintenance cost.
3. Number of indexing terms required.
4. Size vocabulary and number of grammatical rules needed.

110 Dickmann, Robert A. PERSONNEL INVENTORY. A REPORT ON AN AUTOMATED INDEX TO MANPOWER. Silver Spring: John Hopkins Univ., Applied Physics Laboratory, 1965. (AD-462 334)

The primary function of the personnel inventory is to be a repository of all information on all employees and be able to present this information to management rapidly and accurately. Failure of most information systems used for personnel data systems stems from the parameters used to store and retrieve the information.

The following criteria were designed to eliminate these problems:

1. The system must be able to store and retrieve sufficient information for manpower utilization purposes.

2. The output must be readable (non-coded) and easily understood.

3. The retrieval of information must be readily accessible and the updating relatively simple.

4. The format must be flexible, allowing the user to add or delete storage and output.

111 District of Columbia Institute of Certified Public Accountants, Committee on Governmental Accounting. COST CONTROL IN THE FEDERAL GOVERNMENT. Washington: Author, 1958.

The Institute advocates an accrual accounting system and a cost-based budget to further the program to modernize the financial operations of government. Some data which can be developed from an accrual system are:

1. Data to determine cost of performance.
2. A basis for safeguarding and controlling resources.
3. Support data for budget estimates.
4. Meaningful financial reports related to specific needs of all management levels.

Necessary characteristics of an accrual system:

1. Must be tailored to each agency's management and accounting requirements.
2. Must provide a measure of costs.
3. Should be compatible with the budget.
4. Should not be too detailed.

112 Documentation, Inc., Bethesda, Maryland. COST AS A MEASURE OF EFFICIENCY OF STORAGE AND RETRIEVAL SYSTEMS. (Technical Report No. 13) By Mortimer Tabue. Washington: Office of Naval Research, 1965. NONR-1305(00) (AD-137 399)

Describes use of cost factors in measuring the reference adequacy of diverse systems. Retrieval systems have been considered superior when they have exhibited the same retrieval power at a lower cost. R. G. Thorne (J. Doc., 5:130-148, 1955) measures efficiency (n) of system in percentage as number of successful searches (A) per 100 over 100: $n = \frac{A}{100}$.

But there is no agreement about what constitutes a successful search. The measurement of the efficiency of a system in terms of cost requires the assumption that all systems can be made equal in reference adequacy by varying input and output costs. A formula for the cost of searching a system is SQC, where C is the total number of documents in the collection, Q the number of searches made in a year, S the average cost per document of hand sorting. The three elements which make up the costs of storage and retrieval systems are input costs which are equipment and the time spent doing various duties that can be divided by the number of items processed to get the individual costs, output costs that can be determined by the amount of time it takes to get the information out of the system, and the hypothetical costs which are the costs of answering a hypothetical question.

The objective and public criteria which distinguishes one system from another are input costs and output costs measured in labor time and equipment.

113 Dougherty, Richard M. The scope and operating efficiency of information centers as illustrated by the Chemical-Biological Coordination Center of the National Research Council. COLLEGE AND RESEARCH LIBRARIES. 25:7-14, 1964. (AD-451 188)

Discusses the operation and use of a center which was later dropped by the NAS-NRC since it could not define or limit the scope of its operations. It was, however, an example of information centers now in existence. The investigation showed that the operation of information centers requires four categories of skills: (a) subject specialization; (b) control of literature and ability to convert information into suitable form for storage, retrieval and dissemination; (c) knowledge in depth of devices and mechanisms available for achievement of bibliographic operations; and (d) administrative ability.

114 D'Ouville, E. L. and Mohlman, J. W. Dynamic information needs reshape the library function. Special Libraries Association, TRANSACTIONS OF THE 49th ANNUAL CONVENTION. Chicago, 1958.

The Standard Oil Company research library's function is to provide the prompt and automatic flow of specific and interpreted technical information. The company found its information service lagging because of:

1. The huge volume and complexity of the technical literature in the post-war period.

2. A high proportion of the inexperienced personnel due to explosive growth, and

3. Cloudy individual responsibility in team research for searching the literature.

The library function was expanded to provide rapid communication of select and appraised information to specific research projects.

1. Selecting experienced researchers with higher degrees.

2. Notifying the library staff in detail about new research, changes in programs, and hot new findings.

3. Participating in group conferences, informal discussions, and planning sessions.

4. Meeting with the patent liaison group for briefing on research developments.

Deficiencies in the library or failure on the part of the research staff to use it effectively leads to noticeable inefficiency.

115 Doyle, James J. Making office cost reduction everybody's business. In Albert Newgarden, Ed., TECHNIQUES OF OFFICE COST CONTROL. (AMA MANAGEMENT REPORT No. 26) New York: American Management Association, 1959. p. 22-26.

Illustrations of the possible approaches to work simplification and cost reduction are:

1. Examine all unfilled or subsequently vacated positions to determine whether workloads could be spread among remaining staff and replacements avoided.

2. Re-evaluate proposed work programs to ascertain whether peaks could be leveled off by better scheduling and whether utilization of outside service organizations for emergencies would permit lower permanent staffing.

3. Compare costs of certain services with those of competent service organizations.

4. Expedite methods and procedure studies in areas which appear to offer immediate substantial savings.

5. Institute an active suggestion system.

116 Doyle, Lauren B. Is relevance an adequate criterion in retrieval system evaluation? In H. P. Luhn, Ed., AUTOMATION AND SCIENTIFIC COMMUNICATION. (Short Papers of the 26th Annual Meeting, American Documentation Institute) 1963.

It is argued that the use of relevance to a search request as a criterion of what a system retrieves is, in effect, a sub-optimization of the man-machine interface, and that the searcher needs an efficient exploratory system rather than a request-implementing system.

117 Durkin, R. E., and White, H. J. Simultaneous preparation of library catalogs for manual and machine application. SPECIAL LIBRARIES. 52:231-273, 1961.

Description of mechanical processing system at the IBM Command Control Center Library, using IBM 407 electric accounting machine, punched card equipment and simple machine operations, meeting these requirements:

1. Cards produced could be interfiled with standard card catalog; all file approaches in effect were retained.

2. Weekly library bulletin produced from same input as catalog cards.

3. Workload and processing costs per document were reduced.

Advantages of system included:

1. Speed-up of cataloging, announcement and distribution.

2. All library information available in machineable punched card form, providing circulation records, overdue notices, etc.

3. Card data easily transferrable to magnetic tape for automatic information retrieval program.

4. Compared with the former processing system, a saving of 17 manhours was achieved in the overall processing operation of 100 items cataloged. The savings in work for the entire library staff since the jobs were being done by machines or their operators was 300 manhours/100 items.

118 Duyvis, Frits D. Standardization as a tool of scientific management. LIBRARY TRENDS. 2:410-427, 1954.

The major and direct aims of standardization are: (a) interchangeability; (b) facilitation of inspection and control, making comparisons easier; and (c) facilitation of training.

The final purpose of standardization is raising of quality and production. Experience shows that standardization starting from the top and proceeding downward is seldom successful. A government, for instance, should not impose standardization. It should begin at the level of individual enterprise.

119 Eckman, Donald P., Ed. SYSTEMS: RESEARCH AND DESIGN. New York: John Wiley & Sons, 1961.

This collection of articles from the proceedings of the First Systems Symposium at Case Institute of Technology is an excellent primer on systems design, organization philosophy, engineering, etc. Each chapter is a presentation by an expert in a given field of systems research and design.

120 Edwards, Nathan D. Performance analysis. ADVANCED MANAGEMENT. 23:24-25, 1958.

Outlines a method of continuous appraisal of organization effectiveness. Method has two primary phases:

1. Integrated reporting system. Functional definition determined for all work. Tasks classified into unmeasured area or measured area resulting in definite end product. Work units assigned to provide management with periodic appraisal of performance.

2. Performance analysis system. Report form filled in for amount of work done and time spent. These data used as basis for establishing statistical performance standards for each measured operation. Standard operation time and performance effectiveness of each operation computed. Monthly report presented showing effectiveness attained by each activity, noting excellencies, deficiencies, corrective actions recommended, taken and planned.

121 Elicano, Rene V. Needed: performance yardstick for manufacturing engineering. THE TOOL AND MANUFACTURING ENGINEER. 57(4): 28-31, 1966.

The effectiveness of manufacturing engineering operations is rated by several standards of performance. These are:

1. Appraisal of expenses. Determines relationship of total expenses, individual expenses, and number of personnel to direct labor, sales or other levels of expense for a specific activity.
2. Appraisal of projects. Measures the total savings earned directly by the department's own work projects.
3. Appraisal of processes, systems and techniques. Measures performance of manufacturing engineering department through a review of improvements brought about by new manufacturing processes, systems and techniques.
4. Appraisal of personnel capabilities. Gauged by examining each employee's capabilities so that the strength of a department can be judged by the qualifications of its personnel.

All the foregoing methods of appraisal should be used in conjunction with the following three-point frame of reference:

1. Past performance.
2. Competitor's performance.
3. Performance by objective. Using management planned objectives, establishing short and long range objectives and comparing accomplishments against previously set goals.

122 Ellis, Howard. Planning and organizing for totally integrated data processing. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT NO. 41) American Management Association, 1960. p. 43-47.

Responsibility for systems planning should be placed at fairly high level in organization. Certain principles and precautions should be observed from the outset in planning system. Among these are (a) no restricted areas; (b) no restrictions in initial scheme development stage; (c) coding is of paramount importance. Lack of effective codes makes programing difficult.

At data-originating stage, the following precepts should be considered:

1. Plan to document and code as much first-hand information as possible to reduce redundant look-up, posting and posting and punching operations.
2. Plan to use master tapes and cards of standard information to reduce errors.
3. Combine as many business forms as possible for related documentation.
4. Design forms which can be synchronized with tape and card conversions and machine processing.

Critical information needs of business to be integrated should be identified in such a way that rational planning can take place before an expensive system is engineered and installed. Concrete plans of attack on total data-processing problem should be formulated. Companies whose data-processing function has matured and whose plans include total systems approach to information handling should consider giving these functions separate organizational

identity. Person responsible for coordinating these activities should report at Corporate Staff level.

123 Elvers, Douglas A., and Armour, Gordon C. AN ANALYSIS OF AND RECOMMENDATIONS FOR THE MAIN LIBRARY CIRCULATION DEPARTMENT OF INDIANA UNIVERSITY. Bloomington: Indiana University Libraries, 1962

Goals and objectives to be used by the circulation system are as follows:

1. High standards of service.
2. Speed and efficiency.
3. Simplicity of operation.
4. Accurate record keeping.
5. Knowledge of book location.
6. Return of materials.
7. Statistical information.

Some problem areas are:

1. Difficulty in understanding how to use card catalog.
2. Time required to satisfy requests.
3. Time lag for book returns.

124 Emerson, W. L. Adequacy of engineering resources for doctoral research in a university library. COLLEGE AND RESEARCH LIBRARIES. 18:455-460, 1957.

A study of the literature used in dissertations of doctoral candidates in engineering at Columbia University to determine whether the university libraries could supply these sources. Twenty-three dissertations completed between 1950-54 were used. Bibliographies contained 761 citations. 70.9% of the material was from serials, 29.1% from monographs.

Other characteristics studied included publications sources (70% commercial vs. society, governmental, university or industrial), language distribution (80% English) and time span (46% were less than 5 years old).

125 Ernst, Martin L. Evaluation of performance of large information retrieval systems. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 239-249. (AD-632 587)

Effectiveness is defined as the ability of a system or component thereof to perform the function for which it was designed. Two methods are available for evaluation of information retrieval:

1. Marketplace. Considers the influence of user costs on consumer habits developed from analyses of relations between circulation rates and consumer costs. This cannot be done successfully, however, because of lack of operating statistics, experimentation, and consumer choice.

2. Analysis in terms of arbitrary measure of effectiveness:
   a. Measures effectiveness. Measures adopted for studying retrieval systems are (a) recall ratio, documents relevant which are retrieved, and (b) precision ratio, those documents retrieved which are relevant. These measures have four deficiencies:
      1. Relevance
      2. Recall
      3. Awkwardness
      4. Costs
   b. Patterns of operations.
   c. Search strategies - number of concepts searched on and near-synonym index terms used per concept and the number of index terms which must be matched for acceptance and retrieval of a document.
   d. User costs - cannot be clearly defined.

126 Etzioni, Amitai. MODERN ORGANIZATIONS. Englewood Cliffs, N. J.: Prentice-Hall, 1964.

Describes goals and systems approaches to organization evaluation. Goal approach defines success as complete or substantial realization of organization

goal. Drawbacks are (a) social criticism rather than scientific approach, (b) goals often idealistic rather than realistic. Systems model provides statement about organization relationships, is concerned with both under- and over-allocations, examines activities such as morale which contribute to efficiency but are not directly involved in goal achievement. Draw-back is need for considerable knowledge of organization functioning and determination of highly effective allocation of means. Two types of models are described:

1. Survival model: Provides statement about essential organization relationships, gives yes or no score in determining necessity of each specific relationship. Does not record significant changes in operations.

2. Effectiveness model: Gives relative effectiveness of several alternatives; evaluates changes and how they affect ability to serve organization goals; compares to original or earlier state, or other similar organizations.

Work management considerations discussed include: (a) Incentives and quotas. Level of production set by social norms, non-economic rewards and sanctions. Workers often act and react as group members rather than individuals. Informal leadership more influential than formal in setting and enforcing group norms. (b) Communication. Lines of communication between producers and clients may not represent clients' actual feelings and needs. Lower-level workers often organization-oriented rather than customer-oriented.

127 Evans, M. K. Impact of information technology on organization. Academy of Management, PROCEEDINGS OF THE 24TH ANNUAL MEETING. Chicago, 1965.

This article discusses the changes which will occur in the organizational structure in cases where routine information handling activities are taken away from the functional department manager and transferred to centralized information centers built around a computer.

128 Ewing, David W., Ed. LONG-RANGE PLANNING FOR MANAGEMENT. New York: Harper, 1958.

This collection of papers, articles and excerpts on long-range planning has been selected on a qualitative basis from writings of various leaders in the industrial, academic, and consulting fields. The book is organized for specific reference by sub-topic. Within this collection there is sampling of both theory and current practice in the area of long-range management planning.

129 Farmer, James. MANAGEMENT CONTROL SYSTEMS. Santa Monica: Rand Corporation, 1963. (AD-409 862)

This text contains a description of management systems in terms of the management functions of control and decision making. The problem areas of performance measurement, the language barrier between manager and system, and the costs of such systems are described in order to indicate the difficulties involved in establishing a good management control system.

130 Farr, Leonard, and Nanus, Burt. FACTORS THAT AFFECT THE COST OF COMPUTER PROGRAMMING. Santa Monica: System Development Corporation, 1964. AF 19(628)-3418 (AD-447 329)

Discusses estimating costs for the production of large-scale command and control computer programs. Cost factors can be divided into three broad categories: (a) research and analysis, (b) data gathering and cost collection, and (c) experimentation and hypothesis testing.

Difficulties in cost factor grouping exist because of ambiguities and extensive overlap. Factors can be grouped into categories by work phase, such as program design or test; by management activity, such as planning or evaluation; by units of cost measurement, such as man months or dollars, or by classic accounting method of direct and indirect costs.

131 Fazar, Willard. Advanced management systems for advanced weapon systems. PRESENTATION ABSTRACTS. Washington, D. C.: U. S. Navy Special Projects Office, 1961.

This text deals specifically with a planning and control concept (PERT) designed to: (a) focus managerial attention on key program development parts; (b) point up potential problem areas which could disrupt program goals; (c) evaluate progress toward the attainment of program objectives; (d) give management a prompt mechanical reporting device; and (e) aid and facilitate decision-making. In the accomplishment of these objectives time is used as a common denominator to reflect three categories of factors that influence success--time, resource applications, and required performance specifications.

132 Ferguson, Leonard W. A brief description of a reliable criterion of job performance. JOURNAL OF PSYCHOLOGY. 25:389-399, 1948.

Description of job evaluation technique which can be used for large or small groups. Three work sheets are used:

1. Acquaintance rating form. Judge indicates that he is (a) extremely well acquainted, (b) moderately well acquainted, (c) slightly acquainted, or (d) not acquainted with employee.

2. Numerical rating form. Job performances are rated on scale from 9-distinctly superior to 1-distinctly inferior with instructions giving standard distribution of 100 employees.

3. Paired comparisons form, generally in groups of 15. Relative proficiency of each employee in group is compared with every other. Form used only by judges extremely well acquainted with employees.

Paired comparison ratings are translated into percentages of maximum possible ratings. These percentages are translated into units on a linear measuring scale and averaged with numerical ratings assigned on work sheet no. 2.

133 Ferrell, Robert W. Criteria for evaluating customer orientation. In CUSTOMER-ORIENTED PLANNING. New York: American Management Association, 1964. p. 229-234.

Suggested criteria for evaluating company attitudes and conditions include:

1. Is concept of customer orientation understood, accepted and communicated by management?
2. Is scope of company and operating components based on particular needs?
3. Is research and engineering function responsible for development of better products?
4. Do all functions of company have adequate communication systems and procedures?
5. Does management quantify its decisions by specifying expected results?
6. Does company provide information, recommendations, decisions, implementation and measurements for the future on current and continuous basis?

134 Ferrell, Robert W. General management evaluation and control of R&E. In CUSTOMER-ORIENTED PLANNING. New York: American Management Association, 1964. p. 201-227.

Discusses evaluation techniques and checkpoints for fundamental research and engineering projects, R&E involved in products and processes.

Company objectives define the scope, degree, timing of company's technological needs. In order to establish objectives, decisions must be made regarding nature of company business, scope, direction of intended growth and method of growth.

Research must be responsive to technological knowledge from scientific community, competitors, present and prospective customers. Mission of research must be carefully defined by management.

135 Fisher, Eva Lou. CHECKLIST FOR ORGANIZATION, OPERATION, AND EVALUATION OF A COMPANY LIBRARY. New York: Special Library Association, 1966.

A cost figure for a company library can be arrived at by obtaining a one-year estimate for:

1. Space needed.
2. Equipment.
3. Salaries.
4. Budget for additional materials.
5. Number of personnel to be served.

The total of the estimate should be approximately 2% of company's total sales or at least $250 per technical man served. This cost can be justified by the savings in time for scientists and research workers. The evaluating operation will yield the following data: output, workload (if workload is unevenly distributed), backlog, individual performance, cost data, overlapping performance, future budget planning, future personnel needs. Preliminary steps for the study: determine a time period, a work unit, what to measure, when to count an item, time-keeping procedure, standard forms for measurement, and a guide to the determined procedure; then distribute the forms and guide to all employees concerned and make certain that they understand it and will cooperate.

136 Fisher, G. H. THE WORLD OF PROGRAM BUDGETING. Santa Monica: RAND Corporation, 1966. (AD-633 069)

Primary considerations involved in program budgeting are:

1. Structural or format.
2. Analytical process.
3. Data or information systems.

In analysis of program budgeting, cost effectiveness is of major importance. Systematic examination of all relevant alternatives that can initially be identified is emphasized and the design of additional ones if

those examined are incomplete. Two main considerations in this respect are assessment of cost and utility pertaining to each of the alternatives being compared.

Some guidelines in carrying out a cost-utility analysis are:

1. Proper structuring of the problem and analysis design.
2. The conceptual framework--(a) fixed utility approach, (b) fixed budget approach.
3. Building an analytical model.
4. Treatment of uncertainty--(a) uncertainty about world's future, (b) statistical uncertainty.
5. Validity checking.

Examples are given of the types of problem areas where cost-utility analysis either has been applied or is planned in the future. The main role of analysis is seen to sharpen the intuition and judgment of the decision makers.

137 Fleischman, Edwin A. Differences between military and industrial organizations. In Ralph M. Stogdill and Carroll Shartle, Eds., PATTERNS OF ADMINISTRATIVE PERFORMANCE. (BUREAU OF BUSINESS RESEARCH MONOGRAPH No. 81). Columbus: Ohio State Univ., 1956.

Results of a study comparing performance of high-level business and military personnel. Data were obtained by means of rating forms and checklists filled out by the subjects, and included estimates of level in the organization structure, responsibility, authority, and time spent in various kinds of work. The conclusion was that differences in performance between industrial and naval organizations are generally greater than differences among either naval organizations or industrial groups. The analysis yields these results:

1. Naval groups rated themselves higher on responsibility and delegation; the degree of authority reported was the same for both groups.

2. Naval groups spent more time consulting assist-

ants, industrial groups in consulting outsiders. There was no difference in consulting superiors and peers.

138 Flood, Merrill M. The systems approach to library planning. THE LIBRARY QUARTERLY. 34:326-337, 1964.

A general discussion of the need for systems engineering to meet future information needs, with a tentative description of social, political and technical steps in modernizing the entire research library operation in the U.S.A., and the nature of future curriculums for library school graduates, providing a systems approach to library planning.

A systems approach must start with workable concept defining fundamental purpose, clear enough to allow choosing between alternative system proposals. It must consider (a) selection and preservation of appropriate records, (b) development of adequate retrieval procedures, (c) selection and development of personnel, (d) physical plant and other system resources. Major problem is difficulty of assessing social and economic benefits to users in comparing advantages of proposal alternatives.

Curriculum falls into four areas: (a) general conceptual background; (b) specific techniques such as linear programing and computer simulation, (c) special tools such as stored program digital computer and rapid-access microfilm files, (d) case studies of successful library systems engineering projects (not yet available).

139 Forester, Jay W. INDUSTRIAL DYNAMICS. Cambridge: M.I.T. Press, 1961.

This volume is the definitive statement of the organizational theory of industrial dynamics which seeks to explain organizational phenomena in terms of feedback control. The philosophy of industrial dynamics asserts that organizations are most effectively viewed and managed from the perspective of control systems.

140 Forster, Richard L. Space administration and planning. MANAGEMENT BULLETIN. 49:31, 1964.

Space administration = people + principles + prerogatives + physical barriers. There are gross sq. feet, net (rentable) sq. feet, and usable sq. feet. Space requirements in office planning are normally the function of the equipment which is used rather than the employees themselves. This is confused because space requirements are determined by the number of people on the payroll; but what really happens is that space requirements are a product of the equipment required by the people on the payroll.

141 Fox, Peter D., and Haney, Dan G. SOME TOPICS RELATING TO MILITARY COST-EFFECTIVENESS ANALYSIS. Presented to Operations Research Society of America, 29th National Meeting, Santa Monica, Calif., May 18-20, 1966. Menlo Park, Calif.: Stanford Research Institute.

Two criteria in evaluating appropriateness of effectiveness measures are (a) degree to which measure represents overall effectiveness of system, and (b) whether measure can be estimated quantitatively. The schedule is an essential concept. A series of effectiveness levels may be available at different costs.

Effectiveness may be defined as a probabilistic variable and computed as a product of three probabilities:

$$P_{SE} = P_{OR} \times P_R \times P_{DA}$$

where P_{SE} = system effectiveness, P_{OR} = operational readiness, P_R = mission reliability, and P_{DA} = design adequacy.

The most appropriate measures of effectiveness are those that best represent system objectives. These objectives may be measured by strategic analysis or cost-effectiveness analysis. Effectiveness of the various components of a system should be considered individually as well as in their contribution to the overall system.

Several techniques are given for analysis with apparently unquantifiable measures of effectiveness: (a) formulating list of independent problems and assessing likelihood of

their occurrence; (b) evaluating ability to handle problems described in one or more scenarios; (c) developing a simulation involving participants who make decisions in simulated environment.

142 Fry, George, Associates. STUDY OF CIRCULATION CONTROL SYSTEMS. (Library Technology Project, No.1) Chicago: American Library Assoc., 1961.

The direct costs of administering a circulation control system can be divided into three major groups:

1. Cost of staff time (operating time).
2. Cost of purchasing or renting and maintaining equipment.
3. Cost of materials such as book cards, charge slips, and transaction cards.

The study of circulation control systems can demonstrate how accepted management techniques can be effective in improving and simplifying operating methods in libraries. If applied to the entire book processing operation, systems and procedures should result that permit librarians to devote more time to the purely professional requirements of their jobs.

143 Fussler, Herman A. The problems of physical accessibility. In Jesse H. Shera and Margaret E. Egan, Eds., BIBLIOGRAPHIC ORGANIZATION. Chicago: Univ. of Chicago Press, 1951. p. 163-186.

Discussion of the importance of physical accessibility to library service. Libraries are useful only insofar as they meet actual or potential needs. Accessibility is essential.

Five means of improving accessibility are suggested:

1. Improved understanding of readers' needs and working methods.
2. Improved understanding of libraries' internal procedures and economics of operation.
3. Extension of cooperative action between libraries, scholars, institution and organization.

4. Greater application of scientific and technical knowledge to library operations.

5. Some shifting in library expenditures.

Frequency of use is the major factor in establishing levels of accessibility, supplemented by (a) qualitative evaluation of use and materials, and (b) evaluation of potential need or use as distinguished from actual. Selection of material and establishment of accessibility levels on this basis would provide increased efficiency through savings in the non-productive purchase, organization and housing of materials.

144 Gallagher, James D. Improving the organization and management of the data-processing function. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT No. 41) American Management Association, 1960. p. 52-58.

Centralized or decentralized data processing is discussed. In designing a management information system for a decentralized operation in a company pursuing policy of vertical integration, consideration must be given to relative advantages or disadvantages of:

1. A singly large data-processing facility established on a centralized basis to serve needs of various operating units of the company.

2. A number of smaller de-centralized data processing facilities each designed and located to serve needs of one or more operating units.

In comparing these two alternatives several factors must be considered.

1. Physical size of corporation and each unit or division.

2. Degree of uniformity presently existing in accounting and reporting practices throughout company.

3. Present nature of information flow. Proposed system must allow free exchange of operating data between departments.

4. Required investment for establishment of system capable of meeting combined administrative and data-processing requirements of company if centralized system is contemplated. If de-centralized system is planned, the problem lies in consolidation of each facility for corporate offices use.

5. Ability of proposed facility to meet schedule demands made by operating management.

No single set of criteria exists which can be relied upon by management in deciding whether to centralize or de-centralize. Of importance is that stated factors be evaluated and careful planning instituted before decisions are made.

145 Garrett, Leonard J., and Silver, Milton. PRODUCTION MANAGEMENT ANALYSIS. New York: Harcourt,Brace and World, 1966.

This text is concerned with the rapid and radical change in the field of production management due to the advent of automation and computer systems, and the changes in the conceptual approach to business, as reflected in the growth of operations research.

The modern tools of management science, such as linear programming, queuing theory, information systems, and simulation are introduced within the context of specific production problems. These techniques are discussed objectively and are not presented either as panaceas or with unnecessary frills.

Some of the areas covered are the design of work methods, the development of labor standards, the PERT concept, plant location and plant layout analysis, and cost systems.

146 Gelfand, Morris A. Techniques of library evaluators in Middle States Association. COLLEGE AND RESEARCH LIBRARIES. 19:305-320, 1958.

Description of techniques used by library evaluators in the Middle States Association of

Colleges and Secondary Schools in evaluating (a) program of library, (b) adequacy of collection, (c) quality of readers' services, (d) student use of library, (e) faculty use of library, (f) adequacy of space (building), (g) adequacy of staff, (h) attitude of institution toward library, and (i) overall effectiveness of library.

Some basic considerations are:

1. Extent to which library supports institution's objectives. Evaluator must have exact description of institution's mission and means by which it proposes to fulfill mission.

2. Resources required by institution's educational program, extent available and accessible in library; way availability and accessibility may be improved and use encouraged.

3. Characteristics of good librarian.

4. Faculty attitudes and teaching methods, voice of faculty in determining objectives and general policies of library.

5. Ultimate test of library effectiveness is student use of library.

147 George Washington University, Human Resources Research Office. PROJECTED MANPOWER NEEDS AND PROJECTED TRAINING REQUIREMENTS FOR OPERATORS AND USERS OF FUTURE STINFO SYSTEMS. By C. Dennis Fink, Herbert B. Leedy and John F. Hayes. Alexandria, Virginia: Dept. of the Army, Chief of Research and Development, 1966. DA 44-188-ARO-2 (AD-635 132)

Report involves manning and training requirements for future U.S. Army Scientific and Technical Information (STINFO) systems. Conflicting answers exist as to skills and knowledges needed to operate technical libraries. Senior ADP operators are most apt to be in

short supply for some time to come. Written material plus in-house training workshops are suggested for any ADP procedures to be adopted under ATLIS program.

Personnel with extensive educational and research or engineering background in technical subjects and technical librarians specializing in document processing are needed at information and analysis centers. Preparation and maintenance of a staff manual is a valuable aid in training job replacements and recording experience gained in solving specific problems.

User training is considered critical. Brochures and training sessions should be used to show users how to obtain the products and services of the center. Systems directors and supervisors should be the first ones to be taught how and why information centers and systems may be used.

148 Georgopoulos, Basil S., and Tannenbaum, Arnold S. A study of organizational effectiveness. AMERICAN SOCIOLOGICAL REVIEW. 22:534-540, 1957.

Effectiveness of industrial organizations has traditionally been viewed in terms of productivity. The "ultimace criteria" have been organizational productivity, net profit, extent to which the organization accomplishes its various missions, and success of the organization in maintaining or expanding itself. Other variables used: morale, commitment to the organization, personnel turnover and absenteeism, and member satisfaction.

Organizational effectiveness is extent to which an organization as a social system, given certain resources and means, fulfills its objectives without incapacitating its means and resources and without placing undue strain upon its members. This conception of effectiveness assumes the following general criteria:

1. Organizational productivity.

2. Organizational flexibility in the form of successful adjustment to internal organizational changes and successful adaptation to externally induced change.

3. Absence of intraorganizational strain, or tension, and of conflict between organizational subgroups.

149 Gibbings, J. C. Principles of planning accommodation for technical libraries. ASLIB PROCEEDINGS. 9:4-11, 1957.

The library should be centrally located, near plant entrance or eating facilities, on the ground floor for convenience of users and mail delivery as well as floor load considerations. It should have good natural lighting, no large-scale vibration sources nearby, and should not be below a potential source of flooding, such as a laboratory.

There should be only one entrance, preferably opening into a supervised information room, to prevent removal of unchecked stock and afford a point for recording loans.

The staff room housing typewriters and telephones should be separated from the reading room by a glass partition, permitting supervision of the reading room. A high ceiling is preferred (but without distracting galleries); a low ceiling should be sound-proofed.

150 Gibson, Robert W. Selling yourself to management. INSTITUTE ON CHANNELS OF COMMUNICATION FOR SPECIAL LIBRARIES. Bloomington: Indiana Univ., 1960 p. 37-41.

Discussion of ways to sell management on the importance of library service. Basically, this is done by making library services, assignments and functions indispensible to company operations. Sales strategy involves three points:

1. Better communication with management.

2. Broader library functions, new ways of disseminating information and new information programs to meet definite needs.

3. Clear conception of goals and objectives - emphasizing function and benefit to organization rather than budget and personnel in reports to management.

151 Gibson, Robert W., Darby, Ralph L., and Koch, Melvin C. Prepare your own catalog cards. SPECIAL LIBRARIES. 46:428-433, 1955.

The library of Battelle Memorial Institute decided to prepare their own catalog cards to eliminate: (a) time spent searching Library of Congress galley proofs, ordering card sets, and waiting for delivery of LC catalog cards; (b) the additional delay caused when LC cards were not available; (c) unnecessary duplication of effort; and (d) excessive time lag before new material was released to users.

Their process included: (a) a catalog check sheet to aid typists in producing accurate cards; (b) typing cards on and eight-card master, reducing them, preparing an offset-duplicating master, and printing them in several copies; and (c) cutting the cards, drilling them, adding final entries, and filing them.

Results included: (a) processing time reduced to a 5-day maximum; (b) expenses reduced; (c) two catalogers could do the work previously done by three; and (d) catalogers could make full use of their training and experience.

152 Gill, William A. Developing a survey program. In SURVEY PRINCIPLES AND TECHNIQUES. New York: Society for Advancement of Management, 1949. p. 6-10.

Checklist of factual data required for a preliminary management survey contains the following headings:

1. Planning of objectives.
2. Well-balanced organization.
3. Sound procedures or methods.
4. Effective utilization of personnel.
5. Adequate facilities.
6. Comprehensive performance standards.
7. Effective appraisal of results.

Provides significant questions under each heading.

153 Gill, William A. The operations audit. In SURVEY PRINCIPLES AND TECHNIQUES. New York: Society for Advancement of Management, 1949. p. 25-31.

The operations audit is a means of appraising the effectiveness of existing procedures and the people who operate them.

Items of coverage in an operations audit are:

1. Identification of the area audited.
2. Items of historical significance.
3. Production data.
4. Status of the organization.
5. Status of the procedures.
6. Problems encountered.
7. Proposed solutions to problems.

154 Goffman, William. On relevance as a measure. INFORMATION STORAGE AND RETRIEVAL. 2:201-203, 1964. (AD-615 046)

The retrieval process of an information retrieval system is considered as a matching process between a query and a set of documents. The property which associates certain documents with a given query is called relevance.

The author proves mathematically, by set theory, that if relevance is defined as a measure of information conveyed by a document relative to a query, the relationship between document and query is not sufficient to determine relevance. That is, the measure must be defined with respect to the set of documents containing a given document rather than only to the document itself.

155 Goffman, W., and Newill, V. A. Methodology for test and evaluation of information retrieval systems. COMPARATIVE SYSTEMS LABORATORY TECHNICAL REPORT NO. 2. Cleveland:Western Reserve Univ., Center for Documentation and Communication Research, 1964.

Presents evaluative and experimental methods for evaluating mechanized information systems which provide answers in the form of sets of documents. There are two methods of evaluating various machine-task systems. One is to examine each machine to see how it performs various tasks. The other is to examine how various machines perform a particular task. A means for evaluating these machine-task systems is:

$$P = F_{(u,v)}$$

where P = performance of a system measured in terms of a function of two variables (u = effectiveness, v = efficiency).

Effectiveness can be measured by

$$v = C_{(t)}$$

where v = efficiency, C = a cost function, t = time. Thus performance can be measured in terms of effectiveness/dollars.

The effectiveness measure must be an evaluation function that behaves in accordance with requirements imposed on the system's performance.

156 Goldberg, Stanley A. RECOMMENDED APPROACHES TO DESIGN OF THE U.S. ARMY ENGINEERING DATA INFORMATION SYSTEM (Technical Report No. 5) Edgewood Arsenal, Md.: U.S. Army, 1964. (AD-453 737L)

Reasons for engineers' lack of interest in information retrieval include: (a) self leveling; (b) specialized personnel not readily available to supply answers; (c) queries should be directed only to on-site holdings--bypassing local sources imposes premature load on system designed for maximum effectiveness.

Present-day library training may have to be upgraded to meet added technical requirements to satisfy com-

prehensive system of exchange. Retrieval can be considered effective if request is satisfied in the time required by minimum use of available resources.

Requirements of a switching center include:

1. Contents and contracts indexed in conformity with common language and sufficient to complete searches locally or investigate successful searches at other locations.
2. Procedures leading to most effective retrieval based on nature of query.
3. Means for evaluating participant conformity with rules of usage.
4. Personnel capable of maintaining participant training program.
5. Capabilities to evaluate internal operations and recommend changes leading to increased effectiveness.

Center must have well ordered and indexed holdings and knowledgeable information specialists with respect for operating rules. Level of information specialists depends on size of collection. With consistent indexing system and suitable microthesaurus, confusion and duplication would be at a minimum.

157 Goode, Harry H., and Machol, Robert E. SYSTEM ENGINEERING. New York: McGraw-Hill, 1957.

This text discusses the following techniques in operations analysis: (a) probability, (b) mathematical models, (c) mathematical statistics, (d) system logic, (e) queuing theory, (f) game theory, (g) linear programming, (h) cybernetics, (i) simulation, (j) information theory.

158 Graham, Earl C. Administrative policies for the special library; an inventory. SPECIAL LIBRARIES. 45:367-370, 1954.

Factors that determine the administrative policies of any library are:

1. The parent organization and its characteristics.
2. The place of the library in the organization.
3. Management's concept of the library function.
4. Personnel using the library.
5. Library facilities, staff, and budget.

The librarian, in preparing a library policy statement, should consider:

1. Physical plant and equipment.
2. Collection.
3. Services to be rendered.
4. Staff.
5. Reporting and record keeping.
6. Extra-library activities.

Seventy-five percent of the budget of the typical special library is usually earmarked for staff salaries.

159 Green, Bert F. A test of the equality of standard errors of measurement. PSYCHOMETRIKA. 15:251-259, 1950.

A criterion is needed to determine whether the observed differences of the standard errors are significant, or whether they could reasonably be ascribed to the chance fluctuations of a single parameter.

A procedure is proposed for testing the significance of group differences in the standard error of measurement of a psychological test. Wilks' criterion is used to assure that the tests used in ascertaining reliability and hence variance of errors of measurement may be assumed parallel for each group. Votaw's criterion may be used to check whether the test scores of all groups have the same mean, variance, and co-variance. It is possible, however, for the variance and reliability of the test to differ widely from group to group, so that Votaw's criterion is not satisfied even though the variance of errors of measurement stays relatively constant. For this case a modification of Nayman and Pearson's criterion is developed to test agreement among standard errors of measurement despite group differences in mean, variance, and reliability of the test.

160 Gregory, Robert H., and Van Horn, Richard L. AUTOMATIC DATA PROCESSING SYSTEMS. Belmont, California: Wadsworth Publishing Co., 1963.

This is an introduction to business data processing and does not require previous knowledge of electronic computing systems. Processor programming and systems analysis are covered in detail. New developments in these areas and new tools and techniques for management information are discussed. The book attempts to blend a theoretical with practical approach in order to explain the why, the what and the how of data processing.

161 Hackman, John. Specification for an integrated management information system. SYSTEMS AND PROCEDURES JOURNAL. 14:40-46, 1963.

Management's requirements for an integrated management information system are discussed. The system should be based on the essential minimal data that the people on the firing line need to get their jobs done effectively and provide a method for assessing the effects of possible alternative courses of action using operation research or other advance techniques such as continuous marginal-profit costing, based on standard costs and variance analysis; inventory flow and control formulas; optimization of work load and facility distribution, using simulation where appropriate; PERT; and other long-term planning and forecasting techniques which relate to day-to-day activities. The system should also include adequate controls over the accuracy of input and processing with provision for correcting the effects of errors in the data introduced into it.

162 Hagerty, Philip E. Evaluation of personnel. In Wayne S. Yenawine, LIBRARY EVALUATION. (FRONTIERS OF LIBRARIANSHIP, No. 2) Syracuse: Syracuse Univ., 1959. p. 21-29.

Discusses the problems of using performance rating to differentiate employees, make decisions about promotions, etc. Difficulties include (a) tendency to place almost everyone near top of scale, (b) over-emphasis of recent

performance incidents, (c) over-rating of senior employees and under-rating of juniors, (d) close subordinates given benefit of doubt.

Proposes instead a personal conference between supervisor and subordinate with sole objective of helping employee to improve performance. Review to cover (a) amount of employee's contribution, (b) quality of work, (c) amount of supervision needed, (d) relationship with others. Two copies of written record made, for employee and for supervisor's personal files. Major value of such a conference is better understanding between employee and supervisor.

163 Hansen, B. J. PRACTICAL PERT. Washington: America House, 1965.

This text was designed to introduce PERT in simple, non-technical language and to provide the kind of information needed to make it work. Included in the text are the following topics:

1. Introduction to PERT.
2. PERT and time.
3. How PERT plans and controls.
4. Building PERT.
5. What is networking.
6. Measuring management risk.
7. PERT and cost.
8. PERT costs and computers.
9. Profit PERT and incentives.
10. PERT data display.

164 Hanson, C. W. Reference and information work. In Wilfred Ashworth, Ed., HANDBOOK OF SPECIAL LIBRARIANSHIP AND INFORMATION WORK. 2d ed. London: Aslib, 1962. p. 313-341.

Discussion of library work involved in reference and information.

Elucidating inquiry: Determining (a) inquirer's identity and standard of knowledge, (b) exhaustive or representative information wanted, (c) general information or particular application wanted, (d) inquirer's knowledge of foreign

languages, (e) time span to be covered, (f) how soon information needed.

Giving answer: (a) Indicating completeness and authoritativeness of answer, extent of search, period covered, sources consulted. (b) When obtaining literature for client, weighing advantages and disadvantages of reproducing material, arranging loan, or having inquirer visit library.

Relationships with users: (a) Informal relationships arising in handling inquiries. (b) Formal arrangements to keep information staff aware of main operations and interests of organization; head of service sent all reports dealing with policy and planning, included in all meetings where such matters are discussed. (c) Special programs and services such as conducted tours of library for organization with external membership, library bulletins, information circulars, abstracting bulletin or other library publications.

165 Hartshorne, Edward. Research cost analysis and project evaluation. In David B. Hertz and Albert H. Rubenstein, Eds., COSTS, BUDGETING, AND ECONOMICS OF INDUSTRIAL RESEARCH. (Proceeding, Annual Conference on Industrial Research, June 1950) New York: Columbia Univ. Press, 1951. p. 153-170.

Outlines two types of criteria established by Olin Industries for use by R&D division of industrial organizations in considering possible projects.

1. Fields-of-work objectives: (a) assure supremacy of quality of all organization products; (b) develop new and improved products; (c) develop new or improved processes; (d) develop useful raw material or raw material sources; (e) improve safety of operation; (f) develop new uses for existing materials products, techniques and facilities; (g) make the best possible return on the investments.

2. Considerations in evaluating execution of specific project: it must: (a) utilize technical experience and abilities of presently employed staff; or (b) enable organization to exercise better control of its manufacturing practices or of raw materials; or (c) make possible the recovery of processing materials-scrap and useful by-products; or (c) utilize existing facilities not earning satisfactory profit.

166 Hattery, Lowell H. Organization for a science information service. In Paul W. Howerton, Ed., INFORMATION HANDLING: FIRST PRINCIPLES. Washington: Spartan Books, 1963. p. 171-181.

Discusses functions of the information center. Presents alternative organizational relations of the information center with the library, R&D and engineering.

Successful organization requires careful definition of total library information need and specific and detailed allocation of responsibility and authority.

Qualities to look for in science information personnel include: (a) professional competence in subject matter, (b) managerial ability, (c) knowledge of literature sources, (d) understanding of information handling equipment and its applications, (e) ability to handle unconventional forms of information, (f) understanding of classification and indexing principles, (g) skill in human relations, (h) understanding of principles of operations research, (i) understanding of the concept of systems.

The ultimate criterion in planning is an analysis of the user and his needs. Planning should be based on continuous feedback which includes kinds of information needed, most useful forms of information, and timeliness. More systematic research about user habits is needed.

167 Hermann, Cyril C., and Magee, John F. Operations Research for management. In B. C. Lemke and James D. Edwards, Eds., ADMINISTRATIVE CONTROL AND EXECUTIVE ACTION. Columbus: Merrill, 1961.

This article describes several applications of operations research and discusses the factors affecting their use in business, since operations research will provide a basis for arriving at an integrated and objective analysis of operating problems as well as helping in improving inventory and reordering policies and estimating amount of clerical help needed.

168 Herner, Saul. Improving the internal information services in scientific research organization. SPECIAL LIBRARIES. 44:15-19.

A description of ways in which the library of the John Hopkins University Applied Physics Laboratory meets the problem of communication in scientific activity, caused by the growing volume of published information; slowness in publication of new findings, standard indexings and abstracting services; and lack of familiarity of research staff with available bibliographic aids.

The library is the focal point of internal information apparatus because (a) through training and organizational setup, library staff maintains contact with research staff and can best understand and meet their current information needs; and (b) research workers look to library for aid as traditional stronghold of knowledge.

Library prepared internal information directory, listing all APL departments able to distribute technical information, including those which publish material and those which are sources of information due to highly specialized nature of their work. Directory outlines information dissemination facilities and potentialities of departments and ways of using these facilities. Section about library describes major indexing and abstracting services, establishing familiarity with available bibliographic tools. Additional directory planned to list special technical knowledge and skills of APL personnel.

169 Herner, Saul. Operations research and the technical information group. In Tibor E. R. Singer, Ed., INFORMATION AND COMMUNICATION PRACTICE IN INDUSTRY. Reinhold: New York, 1958. p. 79-81.

Discussion of need for operations research studies of library operations, to optimize effectiveness of library operations through scientific study and analysis of management problems. Operation research uses quantitative methods of analysis based on carefully derived statistics to define existing problems, find solutions and develop rules to apply to similar future problems.

Attempts have been made to apply operations research methods to information problems, but generally without the necessary understanding of purposes and application of these methods. Studies have included: effectiveness of library catalogs; use of information as measured by references in scholarly periodicals; how people seek and obtain information; problems of space allocation, shelving arrangement, etc; personnel requirements, recruiting and allocation.

170 Herner, Saul. The physical planning of special libraries. SPECIAL LIBRARIES. 42:5-12, 1951.

A floor plan demonstrates area potential. Usual live floor load is 75 lb./sq. ft. Standard shelf size is 91 inches high by 36 inches wide by 10 inches deep with seven tiers at 1 foot intervals. Each section holds 21 linear feet of books, 7 volumes per foot; should have minimum of 6 inches per 3 foot shelf for expansion; separate oversize books to conserve space; allow 1 foot shelf space per periodical subscription. Closed shelves require 3 foot aisle space, open shelves need 5 foot aisles.

A deposit library is recommended to save space since shelves are more accessible and economical than boxes.

Various types of furniture are discussed, and the best type of each is recommended.

171 Herner, Saul, and Heatwole, M. K. The planning of libraries for military research establishments. SCIENCE. 114:57-59, July 20, 1951.

Describes model unified library serving staff of 300-400, containing classified and unclassified material, as alternate to having separate classified and unclassified libraries for same facility, each completely staffed and indexed. Presupposes proximity of larger technical reference libraries, fairly heavy interlibrary loans, culling to keep size constant, and deposit library for culled material.

Collection: 3100 books, 2400 bound periodicals, 250 current subscriptions, 2160 pamphlets, 57,000 classified documents.

Physical facilities: Library divided into four areas - main reading room, limited access classified reading room, classified work areas for assembling organization-produced classified material, and librarian office.

Staff: Chief librarian, assistant chief, two cataloger-abstractors, two clerk typists, two clerks.

Estimated cost: Initial outlay $78,000, annual cost $31,000. Cost for two separate libraries serving staff of 400 - initial outlay $97,000 to $107,500; annual cost $53,500.

172 Herner, Saul, and Myatt, D. O. Building a functional library. CHEMICAL AND ENGINEERING NEWS. 32:4980-4982, 1954.

Report of Atlantic Research use study of the items in the library. In order of most use they were: handbooks, unpublished research reports, manuscript literature, advanced textbooks and monographs, etc., textbooks, technical news or house or trade publications, dictionaries, indexing and abstracting publications, etc.

173 Herner, Saul, Lancaster, F. W., and Johanningsmeier, Walter F. A CASE STUDY IN THE APPLICATION OF CRANFIELD SYSTEM EVALUATION TECHNIQUES. Paper delivered at American Chemical Society, 148th meeting, 1964. (AD-608 743)

This paper is an account of a project performed in behalf of the U.S. Navy Bureau of Ships Technical Library to evaluate and maximize the effectiveness of a computerized information-retrieval system based on the EJC system of role indicators and links. Retrieval effectiveness was expressed in terms of relevance and recall ratios.

174 Relevance ratio is defined as the proportion of documents in a search product directly responsive to a search topic. Recall ratio is defined as the proportion of known relevant documents in a collection that are actually retrieved in a search.

Herrmann, Irvin A. OFFICE METHODS, SYSTEMS AND PROCEDURES. New York: Ronald Press, 1950.

Describes industrial engineering techniques applied to office work, from fundamentals to a complete working program and is based upon the principles of work simplification, standardization and motion economy. The analytical techniques described provide for the systematic scrutiny of all elements of office work and consideration of all aspects of reports, activities of personnel, filing, space utilization and office layout.

175 Heuval, I. M. van den. Stimulating the visiting and use of a documentation service and library. BIBLIOTHEKLEVEN. 37:105-118, 1952.

Discusses importance of a direct, friendly and helpful relationship between the library staff and clientele. Even the library's location in the firm's quarters is important to its full use. Prompt service is essential. The value of the library is determined by the aggregate of the individual needs it meets.

176 Heyel, Carl, Ed. HANDBOOK OF INDUSTRIAL RESEARCH MANAGEMENT. London: Chapman & Hall Ltd., 1960.

In the scientific periodicals of the world there appear reports of new knowledge within a very short time after it has been acquired. For the specific purpose of avoiding work to obtain knowledge after it has already been acquired, it is most important that a basic scientist make library research an important part of his operations. He also receives many direct benefits from this. It broadens his

horizons, triggers off new areas of thought, and frequently contributes to the design of the experiment. For these reasons a library with adequate professional staff is an essential component of facilities for basic research. Where libraries sufficiently large to be comprehensive are economically impossible, arrangements can be made with large libraries for supplementary service.

177 Hill, L. S. MANAGEMENT PLANNING AND CONTROL OF RESEARCH AND TECHNOLOGY PROJECTS, Santa Monica: Rand Corporation, 1966. AF49(638)-1700 (AD-637 462)

Management control techniques in exploratory and advanced development programs were analyzed with a view to providing increased visibility for achieving research objectives. The requisites for management control as applied to research and technology are defined as:

1. Standards for establishing benchmark from which to measure deviations from a plan. Research operations have tended, thus far, to reject use of standards as in production operations.
2. Reporting. Researcher should report only minimum of essential data relating to status of work.
3. Capacity for evaluation. In this report it is considered possible to evaluate productivity of research activities.
4. Means for instituting control action when needed.
5. Follow-up. Feedback on results of corrective actions.

Potential areas of improvement were found to be: (a) more thorough orientation of effort towards objectives and sub-objectives; (b) explicit recognition of uncertainty in the management control procedures; and (c) integration of time, cost, and performance aspects of the project.

New techniques are presented for preparing estimates of uncertainty, success and failure, and for checking against these during the program.

178 Hill, Lawrence S. TOWARDS AN IMPROVED BASIS OF ESTIMATING AND CONTROLLING R AND D TASKS. Santa Monica, Calif.: RAND Corporation, 1966. (AD-633 939)

Outlines techniques for improving operational cost estimating and control techniques for technological development programs by increasing visibility for the establishment, pursuit and accomplishment of research objectives. Steps are establishing a statement of project purpose, breakdown of objectives, and use of this list as a guideline for the project until changes occur.

Technological development problems are frequently ill-defined. Considerable effort is sometime devoted to problems to which formal problem-solving methods do not apply. A checklist should be used including such questions as:

1. What new principles have been evolved?
2. What hypotheses have been tested?
3. How do possible advances relate to future applications?
4. What further research might be required to achieve results?

Basic aim of research should be to produce high quality work within resources, schedule and technical constraints. Most programs, including production and system development phases, can benefit from attempts to integrate time, cost and technical performance considerations.

179 Hillier, James. Management's evaluation of information services. In Lowell H. Hattery and Edward M. McCormick, Eds., INFORMATION RETRIEVAL MANAGEMENT. Detroit: American Data Processing, 1962. p. 54-60.

Considers the two aims of an information service as (a) dealing with the information explosion facing the technical staff, (b) providing management with technical information necessary for decision making.

Discusses five types of information needs: (a) stimulate creativity, (b) search literature for retrospective

information, (c) maintain current awareness, (d) provide specific information, and (e) prevent duplication. Considers most important the system's ability to contribute to creativity of research and channel the researcher's capabilities.

180 Hillier, James. Measuring the value of information services. JOURNAL OF CHEMICAL DOCUMENTATION. 2:31-34, 1962.

Discusses the ways an information service takes positive action in meeting information needs for exploratory research. The information flow must:

1. Prevent excessive duplication of research.

2. Provide specific information needed by technical staff.

3. Provide appropriate information for individual who needs to become familiar with new field.

4. Provide efficient means for technical staff members to keep current in specific projects and field; management must balance cost of service with value, since volume of published material, level of training, specialization, time required, and other limitations restrict this function.

5. Stimulate creative thought in way that will maximize occurrence of valuable creative ideas. The function of the information service here is to select from the great volume of scientific literature the material valuable to the creative individual without interfering with the creative process.

More must be learned about the relationship between information flow and creativity.

181 Hirayama, Kenzo. Time required, cost, and personnel for documentation. AMERICAN DOCUMENTATION. 13:313-319, 1962.

Within the scope of documentation of chemical literature, the methods using visual cards (non-punched cards, NPC), edge-punched cards (hand-sorted punched cards, HSPC), and Hollerith cards (machine-sorted punched cards, MSPC) are compared for processing documents from collection to retrieval.

182 Hirsch, Felix E. Facing the future: on the way to new college library standards. COLLEGE AND RESEARCH LIBRARIES. 19:197-200, 1958.

The ACRL Committee on Standards decided that their standards would center around the formulation of principles, and include clear expectations for staff size, financial support, seating capacity, etc. Percentages rather than dollar values would be given.

The following suggestions were tentatively reached:

1. The librarian should be directly responsible to the president of the college or a dean; every college library should have a minimum of three professional librarians; enrollment, rate of acquisitions, and instructional program should determine size of staff; all professional librarians should receive academic status and the same salary schedule and benefits (tenure, sabbatical leave, retirement provisions) as the teaching faculty.

2. A centrally located and functionally designed library building, seating 25 to 33-1/3% of the student body; shelf space allowance for growth for at least a decade.

3. Frequent evaluation of the library; per capita circulation.

Standards must be high enough and flexible enough to protect and improve libraries.

183 Hirsch, Rudolph. Evaluation of book collections. In Wayne S. Yenawine, LIBRARY EVALUATION. (FRONTIERS OF LIBRARIANSHIP, No. 2) Syracuse: Syracuse Univ., 1959. p. 7-20.

Four methods of evaluating a library collection are described.

1. Impressionistic. Evaluation by librarians, scholars or laymen in terms of library's policies and purposes, based on individual or collective knowledge and reasoning.

2. Checklists. (a) By standard checklists. These assume core of necessary or important books for every group of libraries. (b) By specially compiled lists. More time consuming but more useful.

3. On basis of use. By data on circulation and use of material. Provides objective measurement but requires qualitative interpretation, considering (a) library objectives, (b) value of circulation of titles in view of objectives. Data may be used to check validity of other methods and examine special fields of certain kinds of materials.

4. Measurement of expenditures by classes or _in toto_ over given period, using data from other institutions for comparison. May relate expenditures to size of collection, annual additions, etc. Purely quantitative. Useful as secondary method to find under-and over-allocations.

184 Hitch, Charles J., and McKean, Roland N. THE ECONOMICS OF DEFENSE IN THE NUCLEAR AGE. Boston: Harvard University Press, 1960.

This text advances the concept of economic choice which, in essence, requires the efficient allocation of resources: all relevant alternatives are compared from the point of view of the objectives each can attain and the costs involved and then the selection of the best alternative is made using the appropriate economic criteria.

185 Hodgson, James G. The literature of library standards. THIRD MILITARY LIBRARIANS' WORKSHOP. Monterey: U.S. Navy Postgraduate School, 1959. (AD-479 447)

Discusses the development of library standards. A basic criterion is whether the library is adequate for its purpose. The bookstock is adequate only when it fills user needs in the most economical manner, considering costs to user and to library.

A formula is provided which indicates when too large a proportion of material is borrowed from other libraries, which it would have been cheaper to have owned:

$$\Sigma i \left(\frac{C_o}{N_u} + N_e \; C_p < N_r \; C_b + N_f \; C_s \right)$$

where C_o = cost of acquisition, cataloging and services; C_b = interlibrary loans; C_p = cost to user of using own library; C_s = cost to user of using other library, and N = number of times used.

186 Holland, M. MANAGEMENT'S STAKE IN RESEARCH. New York: Harper, 1958.

This is an attempt to draw management and research into a closer and more productive working relationship. It presents a synthesis of the problems common to top managers. For example, what management should expect of research and development, how much should be spent on it, systems of reporting to management and measurement of research performance.

187 Holmes, Emory H. THE INFORMATION CENTER: SOME SELECTED EXAMPLES. Santa Monica: System Development Corporation, 1964. SP-1702 (AD-606 174)

Development of an information center is discussed as opposed to a traditional library. It is pointed out that the special needs of scientists and technicians can no longer be met by the traditional library.

Functions of an information center are described as they relate to user's needs. A set of criteria of concern to the information user is presented, including (a) time required to obtain information, (b) assurance of coverage in search, (c) form of output, (d) irrelevant material and rapport between user and center. Administrative criteria are considered as they deal with costs, flexibility and expandability, and changes in the system. System design criteria include (a) hardware, (b) capacity (c) location, (d) positive interaction between system and requester.

Four case studies describe and evaluate in detail systems in operation at Douglas Aircraft Company, Defense Documentation Center, The Title Insurance and Trust Company, Los Angeles, and Smith, Kline and French Laboratories.

Smith, Kline and French Laboratories is an example of a system employing top scientists as information scientists to provide specialized, technical information to research teams. A number of techniques are employed at this center, ranging from 3 x 5 index cards to machine data processing. This system has proved satisfactory and has the full support of management.

Conclusions are that, in designing an information system, full attention must be paid to functions and needs through a systems study.

188 Holt, Raymond M., and others. The planning team. NEWS NOTES OF CALIFORNIA LIBRARIES. 59:347-360, 1964.

A panel discussion by library and management experts concluded that the chief contributions made by a librarian on a library planning team are:

1. Inform other team members about the library collections and operations.
2. Interpret library objectives and standards for other members.
3. Save duplicating effort where possible.
4. Be a liaison member and/or coordinator of the project.
5. Evaluate the collection and analyze service qualitatively, particularly reference and information services.

A marketing approach to library service is to rate a good collection as salable merchandise, resulting in satisfied customers. To reduce the payroll and increase inventory, (a) reduce library hours (probably unsatisfactory); (b) allocate duties properly among different classifications of personnel; and (c) increase self-service by library users.

189 Hopeman, Richard J. PRODUCTION. 2d. ed. Columbus: Merrill, 1965.

This book represents a unique blend of the descriptive and analytical approaches to the study of production management.

The concept of the function of production in the organization is developed in this book. Production concepts, analytical techniques and controls are related to other functional fields of business such as marketing finance and management. This text was designed to provide an integrated perspective since an understanding of business administration rests, in part, on an understanding of the relationships of the functional areas.

190 Horowitz, Ira. AN INTRODUCTION TO QUANTITATIVE BUSINESS ANALYSIS. New York: McGraw-Hill, 1965.

In an attempt to develop a quantitative solution to business problems, the following techniques are discussed:

1. Utility in decision making.
2. Selection of the best sampling procedure.
3. The value of additional information.
4. Inventory models.
5. Linear programming.
6. Queuing theory.

191 Howard, George W. COMMON SENSE IN RESEARCH AND DEVELOPMENT MANAGEMENT. New York: Vantage Press, 1955.

A report on a survey of government, industrial and university research establishments in the United States and Europe with observations on the different ways these activities are organized. Percentage ratios used in preparing budgets are brought out.

192 Howard, P. Consequences of management surveys. LIBRARY TRENDS. 2:428-436, 1954.

Work study has a two-fold purpose: improvement of product and increase in production. Improvements in quality and quantity of library service are true applications; any programs reducing productivity and quality of service are misapplications. An important step is to establish a favorable climate of opinion, explain the objectives, portray the rewards, encourage openmindedness and objectivity. A timetable for measuring progress is a useful public relations device.

Misapplication of managerial recommendations may stem from: improper analysis, failure to integrate operations, addition of new operations to old, overuse, underuse, or abuse.

193 Hower, Ralph M., and Orth, Charles D. MANAGERS AND SCIENTISTS. Cambridge: Harvard University, 1963.

Focus of this text is upon those human problems involving the relationship between scientists and company managers. It analyzes certain human factors which give rise to stresses in daily work, using a clinical approach with exploratory and qualitative rather than quantitative or statistical reasoning. Problems examined are: status, communication, motivation, morale, manager development and other important aspects of the scientist-manager relationship.

194 Howerton, Paul W. Criteria for total information system evaluation. In INFORMATION HANDLING: FIRST PRINCIPLES. Washington: Spartan Books, 1963. p. 195-207.

Discusses factors in planning the automation of documentation work. Two main areas which may be automated are (a) storage and retrieval of literature, and (b) data processing. Criteria to determine justification of automation are (a) to save time, (b) to achieve greater efficiency, (c) to save space, or (d) to show financial economy after amortization of capital investment over a reasonable time.

Steps in comparing present and proposed systems are: (a) determination of points of similarity and identity; (b) identification of first point in processing cycle which would be affected by change; (c) summary of all changes necessitated by new system; (d) determination of advantages of each system; (e) comparative tables of cost factors showing requirements for manpower, space, time and equipment.

Detailed criteria for evaluating proposed system are given in the areas of: (a) physical handling of documents; (b) intellectual problems; (c) creation, maintenance and servicing of system; (d) establishment, maintenance and servicing of document holdings; (e) space requirements, (f) conversion problems, (g) human factors, and (h) flexibility.

195 HRB-Singer, Inc., Science Park, Pa. THE SIMULATION AND EVALUATION OF INFORMATION RETRIEVAL SYSTEMS. By C. Richard Conger. Washington: Office of Naval Research, 1965. NONR 3818(00) (AD-464 619)

Report describes the assumptions, logic and operations of an Information Retrieval System Simulation Model. The model has been programmed in FORTRAN II for the IBM 1620. Two model variations, input and output examples and some possibilities for improvement and development are given.

Primary event sequences for both a manual and a computer-based information retrieval system are schematically described. The following sequence of events occurs in a manual system:

1. Analyst - (a) forms question; (b) asks question.
2. Operator - (a) interprets question; (b) forms query; (c) searches file; (d) compares record; (e) transfers data; (f) prepares answer; (g) delivers answer.
3. Analyst interprets answer.

In a computer retrieval system the following events take place:

1. Analyst - (a) forms question; (b) asks question.
2. Operator - (a) interprets question; (b) forms query; (c) prepares query; (d) enters query.
3. Computer - (a) searches file; (b) compares record; (c) transfers data; (d) puts out data.
4. Operator - (a) prepares answer; (b) delivers answer.
5. Analyst interprets answer.

196 Hufford, J. H. Principles to be considered in planning and operating a functional technical reference library. SPECIAL LIBRARIES. 41:9-13, 1950.

Discusses general principles of a functional reference library, emphasizing qualifications and duties of the librarian.

The librarian should be a trained professional, able to interpret library materials to patrons. This requires a plan, adequate organization of materials and preparation of books and files, and communication of information through intelligent aid to patrons. Basic responsibilities are:

1. Preparation of files, books and complete card catalog with cross references.
2. Perusal of new material to inform organization staff of relevant information.

3. Communication with staff members to anticipate research needs.
4. Continued schooling and active membership in professional organizations to stay abreast of new developments in librarianship.
5. If collection has over 200 volumes and extensive periodicals and vertical files, librarian should not have additional outside duties.

197 Hughes Dynamics, Los Angeles. METHODOLOGIES FOR SYSTEM DESIGN. (Final Report) Rome, N.Y.: U.S. Air Force, Rome Air Development Center, Research and Technological Division, 1964. RADC TDR-63-436 (AD-434 749)

This report presents the results of work on development, programming, and testing of methodologies for aiding information system design and evaluation. They include, in particular, (a) a first step in formalization of a calculus of operations developed for aiding definition of processes for file organization and searching, (b) the complete programs for an evaluation and assignment model which provides for mechanized determination of the optimum assignment of components and functions to points in a hierachial reporting structure, and (c) test results on the relative effectiveness of the measure of system efficiency, in terms of quality of results and time and cost for the design process.

Efficiency is given by:

$$a = \frac{CT}{N}$$

where C is unit of dollars per time, T is in time, N is in bits.

198 Human Sciences Research, Inc. METHODOLOGY FOR TEST AND EVALUATION OF DOCUMENT RETRIEVAL SYSTEMS: A CRITICAL REVIEW AND RECOMMENDATIONS. By

Monroe B. Snyder and others. Washington: National Science Foundation, Office of Science Information Service, 1966. NSF C-418.

A critical review of the literature on document retrieval systems testing and evaluation, to develop recommendations designed to improve future research in this area.

Forty-nine studies were examined, with three related aspects of evaluative standards distinguished:

1. Criterion concept. The concept of the variable or factor which should be measured in order to evaluate results, e.g. relevance, precision, speed, cost.

2. Criterion measures. Operational definition of way criterion concept is measured; results of procedure used to collect data. Measures must be evaluated for appropriateness to system objectives and output, freedom from bias or contamination by variables other than independent variable, and reliability.

3. Criterion value. Specific value of the criterion measure which separates acceptable from unacceptable, good from bad, high from low.

Discusses two procedures for determining relevance.

199 Huss, Henry O. VALUE ANALYSIS--VALUE ENGINEERING. Edgewood Arsenal, Md.: U.S. Army CBR Engineering Group, 1962.

This publication was prepared as a primer on the principles and practices of value analysis. It states that value analysis is an organized approach or philosophy implemented by the use of a specific set of techniques, a background of knowledge, and the assembly of learned skills. Value analysis as a creative approach has, for its objective, the efficient identification of unnecessary costs, (i.e., costs which provide neither quality, use, life nor appearance to satisfy the stated requirements).

Also discussed are the fundamentals of value analysis, such as, the criteria for analysis, identifying and evaluating the function of the item being analyzed, the key techniques used in the analysis, and the basic approach to the problem.

200 Information Dynamics Corporation. SELECTIVE DISSEMINATION OF INFORMATION: REVIEW OF SELECTED SYSTEMS AND A DESIGN FOR ARMY TECHNICAL LIBRARIES. By W. A. Livona and E. J. Goldblum. Natick, Mass.: U.S. Army Natick Laboratories, 1966. DA 19-129-AMC-957(N) (AD-636 916)

An analysis of systems for the selective dissemination of information (SDI), comparing systems with respect to design criteria and the following system parameters: (a) information input, (b) methods of indexing and abstracting, (c) user interest profile construction, (d) user group, (e) profile/document match strategy, (f) profile maintenance and updating, (g) products disseminated, (h) operating statistics accumulated, (i) ADF equipment utilized, and (j) results reported.

Criteria are drawn for design of an SDI system that is generally applicable to a broad range of Army technical libraries. The design criteria are used as basis for designing an SDI system with the following characteristics: (a) broad applicability, (b) acceptance of information in many different formats, (c) ability to yield high relevancy for specific information requirements, and (d) high recall for general information requirements.

201 International Business Machines Corporation. THE IBM 870 LIBRARY ADMINISTRATIVE PROCESSING SYSTEM FOR FEDERAL GOVERNMENT LIBRARIES AND SPECIAL INFORMATION REPOSITORIES. White Plains, N.Y.: Author, 1963. Report No. E50-0029-0

Describes an automatic data processing system for the library, using punched cards, an IBM 870 Document Writing System an IBM 82 Sorter, and the IBM 85 Collator. The system

creates an integrated, self-perpetuating chain reation of automated processing, beginning with the borrower's request and including order writing, order status reporting, claim notice processing, receipt and check-in, cataloging, book pocket and label production, shelf list preparation, announcement and notification, circulation control and statistical collection.

Advantages of the system include: (a) speed up of process, (b) reduction of number of files to be monitored, (c) reduction in clerical time, (d) more timely material availability, (e) fewer errors, and (f) system simplification.

202 Jahoda, Marie, and Barnitz, E. The nature of evaluation. UNESCO SOCIAL SCIENCE BULLETIN. 7:353-364, 1955.

Outlines steps in evaluation.

1. Establish criteria, or standards for determining whether a program accomplishes its aims.

2. Devise criterion measures to examine accomplishments in terms of the criteria. Considerations are (a) validity of the instrument in measuring what it is supposed to measure, and (b) reliability or dependability in giving the same result each time the same thing is measured.

3. Determine method, or means of studying the effects of the program isolated from all extraneous factors. (a) Use of experimental and matched control group, ideally with before and after data for both. (b) Use of sampling, selecting group of subjects from whole population, either by random sampling for population about which little is known or by proportional sampling to match data known about population. Methods of collecting data include (a) observation and (b) interrogation by questionnaire or interview.

4. Analyze data.

203 Janaske, Paul C. Ed., INFORMATION HANDLING AND SCIENCE INFORMATION: A SELECTED BIBLIOGRAPHY 1957-1961. Washington: American Inst., of Biological Sciences, 1962.

Self-recorded work sampling sheets at the Johns Hopkins University library showed the following average distribution of librarians' activities:

Shelving and re-arranging material	9.0%
Routine clerical work	36.5
Assisting patrons	18.3
Communication	10.5
Work with card catalog	7.6
Miscellaneous	18.1

A student questionnaire showed the need for both author and subject files, information on unavailable material, and open shelves for selection by browsing.

Circulation control by EDP equipment using charge-a-plate type cards and a union shelf list on magnetic tape were recommended. The latter could:

1. Prepare a "map" of the library to facilitate necessary movement of collection.
2. Record rates of acquisition for various areas of scholarship and incorporate this information into the "map".
3. Signal reshelving or thinning needs.
4. Print out usage records to facilitate choice of material for less accessible storage.
5. Provide means for information retrieval as a byproduct of the above possibilities.

204 Jerome, William Travers. Evaluation--the inside look. In EXECUTIVE CONTROL - THE CATALYST. New York: John Wiley & Sons, 1961. p. 54-65.

Discusses process of developing internal criteria for measurement of organization success. Five steps involved are: (a) self-analysis of what company is trying to do; (b) setting definite objectives of products and services to be offered; (c) restating objectives in operational or measurable terms by identifying specific

contributing activities and accomplishments; (d) considering the inconsistencies between different objectives; (e) periodically reviewing actual against projected results.

Long and short term objectives must be distinguished. General Electric consideres results that can be attained within 12 months as goals; desired continuing results as objectives. Short-range and long-range objectives are described in eight key results areas: profitability, market position, productivity, product leadership, personnel development, employee attitudes, public responsibility, and balance between short-range and long-range objectives.

205 Jerome, William Travers. Evaluation--the outside look. In EXECUTIVE CONTROL - THE CATALYST. New York: John Wiley & Sons, 1961. p. 37-53.

Discusses three approaches to organization evaluation.

Profit performance. Based on (a) earning power, (b) growth power, (c) payout vs. plowback, (d) plowback performance. Limitations are (a) problem of distinguishing sporadic from continuing profits, (b) failure to explain what constitutes successful management, (c) inapplicability to non-profit institutions and activities.

Key area approach. Used by American Institute of Management. Questionnaire covers 10 key areas, each assigned mathematical weights according to importance of activity. Answers highlight areas needing management attention. Underlying principles are (a) excellent management consists in steady control--company officers' actions not varied by unforeseen circumstances; (b) evaluation of corporate management is evaluation of corporation itself. Limitations are (a) company-by-company observation of control instead of determination of basic characteristics of control; (b) failure to distinguish principles of good management and control apart from corporate factors.

Checklist evaluation. Premises are (a) company success and good management are assured if policies and procedures of check list are followed, by all types of companies; (b) benefit of evaluation is primarily therapeutic, obliging executives to think in terms of whole company rather than individual activities and creating climate of

continuing appraisal. Differs from other approaches in that criteria against which performance is evaluated are selected by organization executives instead of outside evaluators. Limitation is tendency to deal with techniques of control rather than its substance.

206 Johns Hopkins University. PROGRESS REPORT ON AN OPERATIONS RESEARCH AND SYSTEMS ENGINEERING STUDY OF A UNIVERSITY LIBRARY. Baltimore: Author, 1963. NSF-GN-31 (AD-163 087)

A study of the Johns Hopkins University research library. Library objectives are defined as:

1. Supply and maintain as much of needed material as feasible, to meet current needs and anticipated future needs on continuing basis.
2. Supply as much retrieval information as feasible.
3. Minimize time required to obtain and absorb needed information.
4. Minimize cost of library operations.

Describes and summarizes results of work sampling and library usage studies.

207 Jorgensen, William E. Role of libraries in military research laboratories. Special Libraries Association. TRANSACTIONS OF THE 41st ANNUAL CONVENTION. New York, 1951. p. 96-99.

The role of the library is determined largely by the requirements for library services of the laboratory served. These may be to:

1. Provide a means for scientific and technical personnel to keep up-to-date with new developments in their fields.
2. Assist the educational program for in-service and advancement of personnel.
3. Provide adequate library facilities for scientists and technicians to study broad problems or build a background in preparation for research.

4. Provide technical information as a background for specific, individual projects.
5. Provide factual information such as reference data, handbooks, and tables.
6. Provide special services such as translation or photostat facilities.

Some criteria by which to judge how well libraries are meeting needs are the manner in which they are organized for service, the way use of the library is promoted, and the extent to which cooperation with other libraries is encouraged.

The success of a library program depends on the type and amount of support provided by the organization itself, the caliber of the library staff, and the effectiveness of their training in technical library procedures, as well as adequate library facilities and adequacy and effectiveness of the collection.

Cost must always be kept in mine--purchase price, cataloging expenses, and cost of the space occupied. To promote effective use of the library, the library must turn out a good performance in its day-to-day work, so that its patrons will come to rely on the library for efficient and speedy service. Another measure of the effectiveness is the extent to which the library cooperates with other libraries via interlibrary loan and exchange of bibliographic information.

208 Kast, Fremont E., and Rosenzweig, James E. MANAGEMENT IN THE SPACE AGE. New York: Exposition Press, 1962.

This text provides an analysis of the concept of weapon-system management and related nonmilitary applications. The authors have investigated and evaluated the management processes involved in complex weapon and space systems research and development. In addition, it provides brief sketches of PERT, PAR, Configuration Management and Quality Assurance techniques employed by government and industry.

209 Kast, Fremont E., and Rosenzweig, James E., Eds. SCIENCE, TECHNOLOGY, AND MANAGEMENT. New York: McGraw-Hill, 1963.

A collection from the proceedings of a conference on the problems of managing a very large and complex program, from its inception to production of the end product. Discussions include: (a) required coordination of various factors, such as enormous numbers of people, (b) long-range planning on the basis of incomplete information, and (c) modifying plans and design in the face of unexpected technical difficulties or innovations.

210 Kee, S. Janice. The library's responsibility in meeting student needs. INSTITUTE ON CHANNELS OF COMMUNICATION FOR SPECIAL LIBRARIES. Bloomington: Indiana Univ., 1960.

Discusses the following problem in meeting student needs:

1. Over-all deficiencies of libraries.

2. Jurisdictional boundary lines limiting extent of use of libraries, resources.

3. Shortage and measure of professional library personnel.

4. Lack of communication among those in responsible positions of providing for students' educational needs.

211 Kee, Walter A. Must library surveys be classics in statistics? SPECIAL LIBRARIES. 52:433-436, 1960.

Discusses need for libraries to survey clientele's reactions to library materials and services. Survey need not be highly scientific.

Describes survey undertaken by Library and Documents Section, Martin Company, Baltimore. Replies

indicated need for expansion of collection in certain areas, more detailed catalog breakdown, index to ASTIA reports, literature-research people to help with technical problems. Users showed interest in having reading room separate from circulation area, and having classified reading room with access controlled by circulation desk where classified material could be read without being checked out.

212 Kendall, Maurice G. RANK CORRELATION METHODS. London: Charles Griffin and Company, 1948.

Rank correlation has been a neglected branch of the theory of statistical relationship. In the practical field, it was generally regarded as a makeshift for the correlation of measurable variables and in the theoretical field it seemed to present no intersecting or important problems. This book was written to show practical applications in psychology and education, industrial experimentation, and economics. Thus, the theoretical properties of order-statistics are throwing light on some difficult questions of statistical inference.

213 Kenrick, John W. Measuring the productivity of organizations. In U.S. Bureau of the Budget, PROGRESS IN MEASURING WORK. (MANAGEMENT BULLETIN) Washington: Government Printing Office, 1962. p. 8-19.

Asks the following questions in relation to government agencies:

1. What are the basic functions and final products?
2. Do agency activities represent the best system for implementing these functions?
3. Which services may be defined in measurable units?
4. How may the workload data be collected most inexpensively?
5. What changes are needed in quality of workload units to preserve the comparability of output measures?

6. Do time records reveal man-days of actual measured work?
7. Should volume of non-labor inputs be measured in relation to output?
8. Are measured changes in output in relation to input reasonable?
9. What organization, equipment or other changes caused changes in efficiency?
10. Were dollar savings of productivity advances commensurate with costs of changes?
11. In planning next budget year or longer range periods, what will be the effects of new management improvements?
12. What measures not now planned could increase productivity?

214 Kent, Allen. MINIMUM CRITERIA FOR A COORDINATED INFORMATION SERVICE (Technical Note No. 10) Arlington, Va.: U.S. Air Force, Information Complexes Division, Office of Scientific Research, 1959.

A listing of criteria is presented. Factors taken into account are scope of subject covered by system, variety of services provided by system, ability to extend to other subject areas, timeliness and cost of operating system.

The more important criteria include:

1. File size factor. Quantity of articles in file, acquisition rate, obsolescence rate and complexity of subject matter.
2. Activity factor. Question input rate, number of questions per day, per user and total use.
3. Penetration factor. Depth of indexing, subject matter relationships, vocabulary and capable machines.
4. Control factors. Cost, size, and terminology.
5. Quality factor.
6. Expandibility factor.
7. Cost factors.
8. Physical factors.

A set of minimum standards should be established for each criterion in order to evaluate the total system.

215 Kent, Allen and Perry, James W. The library and the research team. SPECIAL LIBRARIES. 47:156-161, 1956.

Outlines contributions of the library at various stages of a research program.

1. Initiation of program. Information trends, market research, availability of materials, patent situation.

2. Planning program. Review of ideas, information related to suggested lines of research, background for evaluating experiments.

3. Accomplishment of program. Information for evaluating results and continuing planning of experimental work, for day-to-day work.

4. Development of results. Availability of materials, equipment, etc.; engineering information, evaluation of competition and product specification.

5. Evaluation (during stages 2, 3, 4). Background information as to technical practicality, market research, availability of materials, patents.

6. Application of new product or process. Information on possible application and markets, reasons for customer complaints, plant difficulties, etc.

Two ways are discussed of coordinating library and laboratory:

1. For permanent or long-term research project. Research and management teams include literature specialists who do library work, investigate patents, etc.

2. For short-term projects. Information division employs literature specialists to maintain close surveillance of certain specialized fields, work with research team during project, with management during planning.

216 Kepner, Charles H. and Tregoe, Benjamin B. THE RATIONAL MANAGER. New York: McGraw-Hill, 1965. p. 44-50.

Basic concepts of problem analysis:

1. Compare performance standard against actual performance.
2. A problem is a deviation from standard performance.
3. A deviation from standard must be precisely identified, located and described.
4. Distinguish the causes for deviation.
5. Problem cause is a change in some distinctive feature, mechanism or condition, and produces a new unwanted effect.
6. Possible causes for deviation are deduced from relevant changes found by problem analysis.

Sequence of procedures based on above concepts:

1. Decision objectives must be established first.
2. Objectives must be classified as to importance.
3. Alternative actions are developed.
4. Alternatives are evaluated against established objectives.
5. Alternatives best able to achieve all the objectives represent the tentative decision.
6. Tentative decisions explored for future possible adverse consequences.

217 Kertesz, Francois. THE ROLE OF INFORMATION CENTERS; EVALUATION OF THEIR EFFECTIVENESS. Oak Ridge, Tenn.: U.S. Atomic Energy Commission, 1965. ORNL-TM-1339.

During initial stage of establishing an information center, overall production cost figures should be determined, including number of documents put into system and number of individuals involved in operation.

Potential evaluation methods considered are unit cost of the input and saving of money that would be possible if previous work were known.

Evaluation of effectiveness is done on three levels:

1. Whether the information center is worthwhile in context of the entire technical community it serves.
2. Whether total product of information center is useful to each individual user.
3. Whether retrieval system provides proper amount of exhaustivity and selectivity per dollar and per request.

218 Kilpatrick, R. E. Management engineering look at cataloging. COLLEGE AND RESEARCH LIBRARIES. 14:52-56, 1953.

Description of management engineering survey of preparations procedures in the Reference Department of New York Public Library. (See also Morris.)

Objectives: (a) Expedite handling of acquisitions and related cards. (b) Lower processing costs. (c) Assure highest possible accuracy and consistency.

Scope of study: (a) Organization--assignment of duties and authority. (b) Staffing--numbers and qualifications of personnel needed at each step. (c) Controls--statistics and reporting systems needed for measures of time, cost, and quality of work. (d) Methods--work flow, routines, forms, mechanical devices. (e) Physical factors--location, layout, furnishing, convenience of facilities.

Recommendations: (a) Assistants to division chief to oversee precataloging work, cataloging policies and training, administration, editing of catalogs. (b) Division into cataloging and preparation departments. (c) Organizing catalog branch around subjects rather than forms of material. (d) Catalog planners to determine subject entries; entry investigation section to prepare authority cards and determine final forms of names. (e) All process work under process section of catalog branch. (f) Creation of adding and card correction

section separate from catalog branch. Corrections made photographically to provide correct cards for other catalogs. (g) Use of L.C. printed card discontinued because of time and cost of revision for consistency.

219 King, D. W., and Terragno, P. J. Some techniques for measuring system performance. In PROCEEDINGS OF THE AMERICAN DOCUMENTATION INSTITUTE, V. 1. PARAMETERS OF INFORMATION SCIENCE, ANNUAL MEETING. Philadelphia, 1964.

This paper deals with attempts to find meaningful criteria to evaluate information systems. One method for evaluating system performance has been in terms of a retrieval profile determined by relevant and nonrelevant documents retrieved and not retrieved. Given one or more assessments of relevance, it is possible to estimate these values using statistical sampling techniques. Examples are presented for both operating systems and systems in the development stage.

220 Klein, M. L., Williams, F. K., and Morgan, H. C. DIGITAL AUTOMATION. Pittsburgh: Instruments Publishing Co., 1957.

Shows how linear programming can be used to solve a typical scheduling problem. Linear programming is used to find the optimum solution to problems having many interrelated factors, although mathematically there is a problem of minimizing a given linear performance equation, subject to given linear restrictions among the variables. By linear programming via computer a problem can readily be analyzed for the lowest cost method. A linear program also yields positive qualitative measure for optimal use in order to meet any criteria desired and actual performance can be compared with the best that can be obtained.

221 Klempner, Irving M. Methodology for the comparative analysis of information storage and retrieval systems: a critical review. AMERICAN DOCUMENTATION. 15:210-216, 1964.

Reviews several studies which utilized the historical, normative survey or experimental method for the comparative analysis of information storage and retrieval systems.

The ASLIB Cranfield Research Project conducted by Cyril W. Cleverdon, an experimental methodology project, represents the most sophisticated approach (studied here) for the comparative analysis of information storage and retrieval systems.

Conclusions were:

1. The overall results support the Jonker theory (historical methodology) that multiple approach or combinatory indexing systems should be considered the most effective for the retrieval of technical information. However, the data are statistically quite close and additional corroboration is necessary.

2. The Cleverdon study represents significant strides in experimental evaluation of IR systems which examined (a) cost of indexing, (b) cost of preparing the physical index, (c) cost of searching.

The review shows that only a combination of these research methods can yield an overall generalization of the comparative superiority or efficiency of one retrieval system over another.

222 Klineberg, Otto. The problem of evaluation. UNESCO SOCIAL SCIENCE BULLETIN. 7:346-352, 1955.

Introduction to a series of articles concerning evaluation techniques in the social sciences. (See Jahoda and Barnitz)

Evaluation is a process which enables the administrator to describe the effects of his program and thereby make

progressive adjustments in order to reach his goals more effectively. The problem of values is involved in examining the goals of action projects. In some cases the effects of a fundamental program can be studied without much concern for goals, but generally the techniques of evaluation must be adapted to the goals and practitioners must supply a statement of the general principles and specific purposes of a project.

Unesco activities relating to evaluation have concentrated on widely applicable methods and techniques, which can be used by a great many practitioners in carrying out necessary evaluation themselves.

223 Knapp, D. Gordon. The executive and the librarian: administrative relationships. SPECIAL LIBRARIES. 50:196, 1959.

The budgeting process provides the librarian the opportunity to sell the library and its program to management. In budgeting, it is good to consider the business climate. The prestige of the library may be affected by the day to day contact with the library patrons as well as with supervisory personnel of equal or higher rank in the division of the organization.

224 Knox, W. T. Administration of technical information groups. INDUSTRIAL AND ENGINEERING CHEMISTRY. 51:48a-61a, 1959.

Summary of survey of information groups in 300 chemical and related organizations.

1. Functions: 100% performed document control tasks, 53% management communications, 42% graphic arts services, 26% public relations, 41% patenting procedures and acquisitions.

2. Placement in organization structure: Reflected differences in parent institutions; correct placement largely dependent upon clear statement of objectives, which should always be at level of management which will ensure communication of information rapidly, effectively, accurately, efficiently.

3. Staff vs. line placement: 25% had head reporting to top management of his component; 70% of information groups aligned with various types of service; 40% reported to executive in charge of research. Data indicated that, in general, group should be no more than two levels below top management.

4. Economics: Information groups got average of 1.5-2.5% of research budget. Budgets averaged $500 per year per research staff member, varying from $90 to $1365. Relating budget to space, groups spent an average of $30 per sq. ft., ranging from $5 to $100. Spent an average of $[illegible] per year on literature per professional person served.

225 Knox, W. T. Guidelines for a technical information service. RESEARCH MANAGEMENT. 7:287-296, 1964.

Discusses aspects of integrating a modern technical information service into operations of a large research and engineering firm.

1. User orientation. Promotion of active use of information is more important than acquisition and storage.

2. System design. Ability to handle information without distortion requires limits in quantity of information handled. Best service is not one that produces most or fastest information but one which produced exact information needed, when it is needed.

3. Staffing. Should include persons trained in users' fields and familiar with their information retrieval problems. User must feel that information staff are understanding and sympathetic.

4. Operations. Success of information service is based on soundness of planning related to organization it serves.

5. Retrieval. Faster and more pertinent searches are made if information researcher knows why specific information is needed. Most economical balance must be found between requester's time, interest and talent and the ability of the information service to act on his behalf.

226 Kohler, Eric L., and Wright, Howard W. Accounting for costs. In ACCOUNTING IN THE FEDERAL GOVERNMENT. Englewood Cliffs, N. J.: Prentice-Hall, 1956. p. 178-203

A general discussion of theories, methods and definitions of cost accounting, accrual accounting and activity accounting.

Activity accounting methods are:

1. Determination of the organizational units into which the whole agency is divided.

2. Budget estimates of forward costs by activity supervisors.

3. A separate account for each activity, with only direct costs under control of the supervisor charged against it.

4. Overhead regarded as a collection of identifiable activities, each under special management and control. Every employee and expense charged to only one activity.

5. General divisions such as administrative services divided into separate activities, such as housekeeping, motor pool and switchboard.

6. Current costs classified both by activity and by object.

7. A report at the end of each period for all levels of management

227 Koontz, Harold, and O'Donnell, Cyril. PRINCIPLES OF MANAGEMENT. 3d ed. New York: McGraw-Hill, 1964.

This text attempts to provide a framework to systematically join the principles and techniques of management, which have been isolated and unrelated.

It also discusses the following topics: functions of a manager, span of management, line and staff authority relationships, decentralization of authority, managerial appraisal and selection, the nature and purpose of planning, the operation of planning, and the control of overall performance.

228 Kopkin, T. J. Circulating the table of contents of magazines. SPECIAL LIBRARIES. 46:211-212, 1955.

Description of system of circulating tables of contents of periodicals in advance of periodicals themselves, having readers indicate those they wish to receive, instead of regular routing system. Library subscribes to 92 magazines, receives about 30 each week. Multilith plates of tables of contents are copied and 45 copies are sent to organization branches.

Advantages found were: (a) Magazine requests increased. (b) Library learned more about patrons' interests. (c) Daily circulation increased. (d) News of magazine contents available without delay. (e) Technical personnel more informed of magazine resources.

229 Kyle, Barbara R. Administration. In Wilfred Ashworth, Ed., HANDBOOK OF SPECIAL LIBRARIANSHIP AND INFORMATION WORK. London: Aslib, 1962. pp.11-31.

Distinctions between library and information service: (a) Unit for material for library is an item, while in information service, it is a particular piece of information. (b) Library gives what is asked for, while an information service draws attention to relevant information. (c) Special libraries are intended to serve section of community interested in particular subjects.

For a small collection of material, the scholar with subject-knowledge is better; for large libraries, a trained librarian is essential. A staff manual is essential. Work should be organized to ensure maximum value obtained for energy expended; staff should be flexible, with one supervisor per six staff members.

Qualifications of library staff include: (a) technical or professional duties--good knowledge of cataloging, literature searching, writing ability; (b) administration--good knowledge of bibliographic tools, policy and goals of parent organization, ability to organize and to write.

230 Lampkin, Burton E. Decision-making tools for improved library operations. SPECIAL LIBRARIES. 56:642-646, 1965.

The IBM Development Laboratory examined the operational efficiency of its library, and found that computers could be used effectively in the following technical services of a library:

1. Ordering, receiving, and inventory control.

2. Preparing book catalog, circulation cards, and labels.

3. Summary reports of reference activity.

4. Circulation reports.

The statistic data from items 3 and 4 provide information to help the library become oriented to user needs and inform management of the library's needs and activities.

231 Lang, Theodore, McFarland, Walter B., and Schiff, Michael. Cost reports and statements. In COST ACCOUNTING. New York: Ronald Press, 1963. p. 481-482.

Defines cost control as involving inventory control, control over efficiency of men and machines, and control of material usage.

Defines labor cost as a function of both wage rates and time.

Reports on wage rates should include:

1. Trend in labor rates: percent of employees in each pay bracket, shifts in pay brackets.
2. Wage rates compared with rates in industry generally.
3. Straight time hourly earnings as an aid in job classification and formulation of wage rate policy.

Reports on time should include:

1. Daily comparison of standard to actual direct labor.
2. Summary of workers operating at less than standard efficiency.
3. Departmental labor efficiency.
4. Analysis of productive labor hours charged to nonproductive activities.

232 Langenbeck, E. H. A PLAN TO REDUCE COSTS OF TECHNICAL LIBRARY OPERATIONS IN THE DEPARTMENT OF DEFENSE. White Oak, Maryland: U.S. Naval Ordnance Laboratory, 1961. NOLTR 61-102.

Proposes the establishment of a cooperative system of cataloging DOD, NASA, AEC, and their contractors' reports (includes about 90% of the reports received by DOD libraries) at the point of origin. Thus the cost of cataloging, 60% of the total cost of handling a report, might be considerably reduced:

Cataloging cost under present practices....	$954,000.
Cost of cataloging own reports, as proposed in this plan.....	31,000.
Savings per year by elimination of duplication of effort of cataloging.....	$923,000.

The originating activities know best what is important in a report and should be in a position to do the best job. One suggestion is a standard library information page to be a part of each report originated. These costly operations will then be eliminated for the receiving libraries.

233 Lazar, P. Library and documentation standardization. MUSZAKI KONYVTAROSOK TAJECOZTATOJA. 7:23-24, 1960.

On the 10th anniversary of the reorganization of the Hungarian Office of Standardization, the achievement of its Committee for Library and Documentation Standardization are reviewed. The following principles were observed in the preparation of the standards: (a) priorities were determined according to the relative importance of the standards; (b) the degree of concentration of complex activities or themes into a common standard and the extent of standardization according to the frequency of occurrence of the tasks in the library; (c) interconnections between standards were observed; (d) the standards were intended to assist in the training of librarians and documentalists; (e) account was taken of the international aspects of standardization. Nineteen national standards have been prepared and future projects include the revision of cataloging rules, preparation of material for the International Conference on Cataloging Principles in 1961, and the revision and extrusion of standard terminology for libraries and documentation activities.

234 LeBreton, Preston P., and Henning, Dale A. PLANNING THEORY. Englewood Cliffs, N.J.: Prentice-Hall, 1961.

This text covers planning at all levels in business, but much is applicable to other kinds of organizations. Discussion is within a three-part framework consisting of the planning process, the dimensions or characteristics of a plan, and the influence a given set of dimensions will have on the planning process.

Within these three parts are: a recommended planning procedure, parts of a plan, the theory of need determination, the theory of choice, the theory of data collection and processing, and the theory of testing.

235 Lefebvre, Louise. The special library: what it is and what it can do for business and industry. SPECIAL LIBRARIES. 49:53-57, 1958.

A general discussion of the value of technical libraries in present period of expansion of scientific knowledge. Services rendered by library:

1. Collection of information relevant to organization.

2. Classification and cataloging of materials.

3. Keeping abreast of new literature by cooperative cataloging with other libraries, subscription to abstracting services and indexing journals, maintenance of subject files, etc.

4. Providing successful reference service, varying from answering miscellaneous questions to providing literature surveys and comprehensive bibliographic reports.

5. Dissemination of information by means of abstracts, bulletins, etc.

6. Liaison with other libraries.

Two measures are provided in determining adequacy of library budget: (a) 2% of total sales, (b) $250 per technical person.

236 Lehigh University, Center for the Information Sciences. STUDIES IN THE MAN-SYSTEM INTERFACE IN LIBRARIES. (Report No. 2) THE APPLICATION OF PSYCHOMETRIC TECHNIQUES TO DETERMINE THE ATTITUDES OF INDIVIDUALS TOWARD INFORMATION SEEKING. By Victor Rosenberg. Bethlehem, Pa.: Lehigh Univ., 1966. (AD-637 713)

Results of this study show that ease of use of an information-gathering method is preferred to amount of information expected for information-gathering methods in industrial and governmental environments, regardless of research information of the users.

Information-gathering methods used were:

1. Search of personal library.
2. Search material in the building where one works.
3. Visit knowledgeable person - 20 or more miles away.
4. Use library outside own organization.
5. Consult a reference librarian.
6. Visit knowledgeable person nearby.
7. Write letter requesting information from a knowledgeable person - 20 or more miles away.
8. Telephone knowledgeable person.

Subjects were asked to rate methods according to (a) ease of use, and (b) amount of information expected. No statistically significant differences in rankings or ratings between research and non-research personnel were found. A high significant correlation was found between preference ranking and the ease of use rating within both groups. No significant correlation existed between preference ranking and amount of information ratings. Further examination of the factors involved in the concept "ease of use" should prove useful in providing more detailed description of information gathering process and system environments. An appendix includes samples of questionnaires used in the study.

237 Leimkuhler, Ferdinand F. System analysis in university libraries. COLLEGE & RESEARCH LIBRARIES. 27:13-18, 1966.

Outlines an engineering approach to functional design of a university library system. The goal of such a study is not just automation but to find reliable methods of measurement and analysis compatible with established objectives of library administration. Present dels to explain long-term interaction of acquisition, circulation, storage, loan period, and duplication policies and patterns. Circulation is the one factor related to all others. Models serve to indicate effects of various policy decisions.

Presents elementary growth model:

$$N_t = (1 + \alpha)N_{t-1} = (1 + \alpha)^t N_0$$

where N_t defines size of collection at end of year $\underline{t}$ as a function of annual growth rate, α, and size $\underline{t}$ years ago, N_0.

A method of selecting items for storage suggests relocating all items acquired more than $\underline{d}$ years ago. Proportion of total circulation due to the stored items c_d, is defined as:

$$c_d = \frac{C_t\ (N_t - d)}{C_t\ (N_t)} = \frac{(1 - \beta d)}{(1 + \alpha)}$$

where C is circulation, α is growth rate and β is obsolesence rate.

Mean circulation rate, C_1, of a volume can be written:

$$C_1 = \frac{1}{T_R + T_L} = \frac{R}{1 + \frac{T_L}{T_R}}$$

Where T_R is mean interval between check-in and check-out, T_L is mean loan interval, and R is rate at which volume is requested.

238 Leonard, William P. Evaluating executive effectiveness. In THE MANAGEMENT AUDIT. Englewood Cliffs, N.J.: Prentice-Hall, 1962. p. 149-159.

Three steps are outlined in evaluating executive performance:

1. How well should the work be done - based on performance standards, goals, forecasts and operating plans and programs.

2. How well is the work done - based on comparison of operations and performance standards and close observation of managerial techniques used.

3. How effective is the individual executive's work - based on determination of his contribution to overall success of enterprise.

A list of 30 necessary characteristics for an executive is given, including leadership, judgement, creative ability, drive, planning and foresight.

239 Leonard, William P. Gathering and recording information. In THE MANAGEMENT AUDIT, Englewood Cliffs, N.J.: Prentice-Hall, 1962. p. 113-126.

Some techniques used in management are:

1. Organization charts (structural, functional, block, line and position).
2. Process charts (product, man, flow, operation, form, procedure).
3. Man-machine time charts.
4. Layout charts (machine, equipment, building, floor, workplace, facilities).
5. Comparison charts (Gantt, relationship, line and staff).
6. Combination charts (man process with form process, etc.).
7. Graphic charts (progress, line, surface, bar, map, pie).
8. Forms distribution charts.
9. Time studies (worker, product, equipment).
10. Data sheets (interviews, observation studies, statistics).
11. Work sampling and work measurement.
12. Work simplification.

240 Lesourne, Jacques. The compilation of quantitative data. In ECONOMIC ANALYSIS AND INDUSTRIAL MANAGEMENT. Englewood Cliffs, N.J.: Prentice-Hall, 1963. p. 65-74.

Methods of compiling quantitative data include:

1. Research (surveys, samples, questionnaires).

2. Statistics.
3. Experiments.

Five types of research are identified as follows: (a) behavior of consumers; (b) consumers' intentions; (c) attitudes; (d) areas of knowledge and consumers' thought processes and (e) motives and reasons for action.

Careful definition of terms, sources of statistical data and expert supervision are required in all areas of data gathering and collation.

Experiments are another source for information pertinent to market research. Method differs from surveys in that studies are made of basic reactions of consumers in situations where certain variations are controlled. Examples are given citing advantages and disadvantages of experiments in market research.

241 Lewis, Chester M. What's your information rating? SPECIAL LIBRARIES. 42:249-254, 1951.

The chief librarian for the New York Times discusses organization and equipment for an information service, and suggests:

1. A definite division in work assignments.
2. Restricting material to use by the information staff.
3. At least 50 sq. ft. working space per staff member; centralized location of important data.
4. Staff manual delineating objectives of information service, types of information to be searched for or withheld, extent of research. This should be formulated before service begins, and adhered to strictly.

242 Library standards. In Wyllis E. Wright, Ed., AMERICAN LIBRARY AND BOOK TRADE ANNUAL, 1961. New York: Bowker, 1960. p.109-143.

Reports of standards established by library associations.

1. Budget. Normal program of college library service requires minimum of 5% total educational and general budget; at least twice as much spent on salaries as on books.

   Evaluation methods for college libraries. (a) Circulation records provide partial picture if library has open shelves. (b) Trends in per capita figures of books on loan. (c) Surveys of what students are reading, books not supplied, reference questions not answered, character of interlibrary loans. (d) Evaluation of library resources and services undertaken jointly by teaching faculty and library staff.

3. Library and teaching faculty. Library should advise faculty members of new acquisitions and involve them in selection of materials. Faculty should consult library with regard to actual and potential significance of library resources for new courses and curricula.

4. Indexing. ASA basic criteria for indexing books, periodicals and other documentary materials includes definition of index, standards covering nature, organization and style of index, general observations about indexing procedures and values.

243 Likert, Rensis. Measuring organizational performance. HARVARD BUSINESS REVIEW. 36:41-50, 1958.

Measures are proposed to provide a means of gauging results of production and human assets for managers. A system of common, simple measurement would provide:

1. Means to measure and plan performance.

2. Means of detecting deviations from established standards.

3. Means of appraisal, selection and compensation of personnel on the basis of objective performance.

4. Important motivation for better performance.

5. Simplified communications.

Variables currently being measured include:

1. Loyalty and identification with the institution.

2. Extent to which members at all levels feel that the organization goals are consistent with their own.

3. Level of motivation among members for top performance cost reduction, and improvement.

4. Degree of confidence and trust among levels.

5. Amount and quality of teamwork.

6. Extent to which people feel delegation is being achieved.

7. Extent to which members feel that their ideas, information, knowledge of processes and experience are being used in the decision-making processes of the organization.

8. Competence and skill.

244 Lilley, Oliver L. Evaluation of the subject catalog: criticisms and a proposal. AMERICAN DOCUMENTATION. 5:41-60, 1954.

Critical review of studies of the subject catalog and proposal for future study.

1. Quantitative, user-centered. Approach of most studies. Useful in diagnosing problem but not in prescribing solution. Findings cannot be differentiated by relative importance or value to user, as users' motivations, interpretations and uses of information found in catalog are intangibles.

2. Qualitative, catalog-centered. Approach of study by M. Taube listing 15 criteria for evaluation; cost; physical size; time to construct, maintain, search; scope by topic; ease in determining relevance; number of access points as main or reference entry; universality of information; rate of growth per new entry; obsolescence rate; simplicity of apparatus;

adaptability to reproduction and dissemination; adequacy in supplementing similar tools; security, where necessary. Useful as general and subjective guides but lack specificity and objectivity in determining degree to which subject catalog approaches ideal or in establishing rules of procedure in improving catalog.

3. Description of ideal subject catalog. Suggested as solution to weaknesses of other approaches. Actual catalog could be compared to model in detail, modification suggested and checked in experimental operations. Would give insight into which user motivations fall within scope of subject catalog, give precision to Taube method. Five steps needed () determination of subject catalog function; (b) statement of specific goals, (c) tentative proposal of methodology; (d) tests of alternate proposals for methodology; (e) construction of rules for the subject catalog.

245 Limberg, Herman. The management reporting system of the City of New York. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT No. 41) New York: American Management Association, 1960. p. 103-118.

A management reporting system to provide the Mayor and City Administrator of New York City with guidelines for effective application of business and industry techniques. Pattern of reporting was developed based on the following elements of administrative sequence in planning, coordination and control:

1. Clarification of mission of each department and its components.
2. Review and analysis of each budgeted program.
3. Development and adoption of program objectives.
4. Development and adoption of yardsticks for measuring, reporting and evaluating accomplishment of objectives.
5. Establishment and clarification of policies to govern program administration.
6. Review and evaluation of organization plan to determine its adequacy.

7. Review and evaluation of systems and procedures.
8. Follow-up to effect improvements, revise objectives, etc.
9. Criteria for reports based on (a) simplicity in compilation, presentation and reporting of data; (b) comprehensiveness and adequacy; (c) timeliness; (d) reliability; and (e) significance in light of predetermined objectives.

Program budget should serve as basis for reporting system. Structure of system should consist of two parts:

1. Annual planning statement.
2. Quarterly reports of accomplishments.

246 Linder, L. H. Comparative costs of document indexing and book cataloging. SPECIAL LIBRARIES. 56:724-726, 1965.

Compares costs and functions of document indexing and book cataloging. The average cost per item of conventional book cataloging was found to be $3.67, of indexing reports into a machine document address storage system, $2.99. Factors contributing to the greater cost of cataloging are (a) different size units of knowledge contained in collection, (b) different mental activities required, and (c) task of creating and maintaining subject authority control file.

Although the ultimate costs of cataloging and indexing are both the retrieval of items of information, the systems are not precisely comparable. A book catalog leads a user to more broad treatments of a subject, a report index to more specialized items. Cataloging and indexing are only inputs of information storage and retrieval systems. Final evaluation of two such systems must include measures of comparative retrieval effectiveness and dollar costs for retrieval.

247 Lindveit, Earl W. SCIENTISTS IN GOVERNMENT. Washington, D. C.: Public Affairs Press, 1960.

This study represents one of the earliest and most constructive examinations of the role of science in government. It discusses the government as a major employer of scientists in the United States, and the ramifications of recruitment, retention, training and motivation of government scientists.

248 Lipetz, B. A., and others. INFORMATION PROCESSING OPERATIONS AND PROBLEMS AT THE AFCRL RESEARCH LIBRARY. Bedford, Mass.: Itek Corporation, 1961. (AD-636 978)

Discusses applicability of automatic data processing techniques in an Air Force scientific library. Four basic library functions are (a) decision to acquire, (b) action to procure, (c) incorporation into collection, and (d) dissemination. The main information processing activities which implement these functions are selection, acquisition, cataloging and announcement, circulation, and distribution.

Procurement is closely associated with selection, falls under jurisdiction of Acquisitions Section, consists of verification, purchasing, receiving, and accepting gifts. Routines performed by processing section involve pre-cataloging, cataloging, announcements, and binding.

The library's mission is to provide scientific information. Two mutually restrictive objectives are the desire to expand the depth and kind of service, and the desire to provide a particular service more economically.

249 Little, Arthur D., Inc. CENTRALIZATION AND DOCUMENTATION. Boston: Author, 1964.

This report discusses the feasibility of centralizing facilities for storage and retrieval of scientific documents.

Recommendations were that: (a) at the reporting time (1964), support of large-scale centralization of mechanized document retrieval facilities should be avoided and instead (b) a comprehensive program to determine the real informational needs for scientists and engineers should be supported.

250 Littlefield, C. L., and Rachel, Frank. OFFICE AND ADMINISTRATION MANAGEMENT. 2d ed. Englewood Cliffs, N.J.: Prentice-Hall, 1964.

The areas covered in the text are as follows:

1. The administrative organization - organizational arrangements of administrative management, office job design, and techniques of organizational analysis.
2. Systems design - management information and reporting needs, systems design and integration, procedures and methods improvement, work simplification, and mechanization in administrative processes.
3. Data collection and processing methods - computer functions and applications, specialized computer concepts, and administration of data processing.
4. Communications and records management - communications management, forms design and control, office reproduction services, filing, records retention, and microfilming.
5. Physical facilities - office layout, space management, the working environment, and office location.
6. Performance standards and control - methods standardization, time standards, work measurement, production control, control of volumn fluctuations, quality control, and cost control.
7. Motivation of office personnel - leadership and motivation, selection and placement, training and retraining, personnel administration and control.

251 Lockheed Aircraft Corporation, Missiles and Space Division. GROUP ATTAINMENT PROGRAM "G.A.P." Sunnyvale, California: Author, March 1, 1963.

Using proven work measurement techniques, GAP objectively determines attainment factors for the jobs in a group. These attainment factors represent the time, including allowances, that it should take a reasonably competent employee, using the prescribed methods, and working at a normal pace to successfully and fully perform one unit of production. Having determined the "should take" time, it is applied to the present or planned volume of production to determine the total time requirements for the entire work volume. The result of this application constitutes "attained hours". Attained hours are compared to actual hours to compute the index of productivity with which the job was performed.

GAP reporting helps answer the following questions:

1. What is the true output relationship to cost for this organization? Has it been improving or growing worse?

2. Has this organization been experiencing more or less demand for special jobs? Is non-productive time contributing to the increase in this percentage and therefore to cost?

3. Is production volume increasing or decreasing in terms of true man-hour requirements?

4. Is manning consistent with requirements? Are people being added when volume appears stable, or retained in face of decreasing volume?

252 Lockheed Missiles and Space Company. INFORMATION ANALYSIS USING CHART VERSIONS 3 AND 5, By L. W. Heinle. Sunnyvale: Author, 1966. (AD-481 646)

Two computer programs have been completed that provide different levels of graphic reporting and analysis.

Collecting data for a project requires knowledge of the following characteristics and requirements: (a) functions and responsibilities of personnel; (b) method for controlling interfaces between program personnel, investigators, and organizations; (c) plan of operation; (d) constraints of operation; (e) time scale in reporting system.

Unified requirements can develop a trade-off situation: when management has unknown and/or unstated criteria in decision making, a matrix of data functions which can be implemented can be developed, allowing manager and analyst to accomplish tasks effectively.

The user of the information must have knowledge of the information flow, network or matrix through which it flows, special problems in the data or the difficulty of obtaining data for various non-logical reasons.

Once the objectives of a proposed information analysis have been agreed upon and the reliability, product assurance, technical and management information needs have been determined, it is possible to establish and structure the chart-making programs.

253 Loeber, Anita D. The measurement and evaluation of work. In IDEAS FOR MANAGEMENT. Buffalo: Systems and Procedures Association, 1958.

This booklet discusses work reduction and measurement techniques beginning with a historical background, and then covers the following topics: purposes of measuring work, planning the measurement program, phases of a measurement program, developing standards, determining the effectiveness of the work performed, modification and refinement of measurement data results to be expected.

254 Loftus, Helen E. Why work standards? SPECIAL LIBRARIES. 50:173-174, April 1959.

In order to set standards for special libraries, it is necessary to:

1. List major functions of the library.

2. Define these functions in detail.

3. Formulate standards for each function.

In order to determine functions it is necessary to:

1. Determine what management expects of the library.

2. Determine whether the job special libraries are doing is the job that needs to be done.

3. Study what has been done in the past and set standards for these activities.

Two types of standards exist:

1. Qualitative--principal consideration is level of efficient performance and service by a well-organized and efficiently managed library.

2. Quantitative--chief concern is the number of units produced in a given period of time.

255 Logsdon, Richard H. Time and motion studies in libraries. LIBRARY TRENDS. 2:401-409, 1954.

Summarizes published results of time and motion studies and concludes that librarians generally are failing to fulfill their management responsibilities in applying modern techniques, particularly time and motion study. The following suggestions are given:

1. Read a book on time and motion studies.
2. Identify similarities and differences between library operations and industrial activities.
3. Recognize the significance of small dollar and/or staff convenience gains.
4. Recognize that perfection is rarely if ever reached.
5. Use the results of the study to standardize methods, determine the time required by a qualified worker to do a given task, and train the staff in the new method.

256 Longnecker, Henry C. The role of a science information department in industrial research and development. JOURNAL OF CHEMICAL EDUCATION. 33:633-635, 1956.

Describes the science information department of Smith, Kline and French Laboratories.

Qualifications sought in science information personnel are: (a) broad scientific training and background, (b) interest in wide range of subjects, (c) flair for writing, (d) ability to get along with and work on equal terms with laboratory and clinical associates. They seek well-trained scientists who work with literature by preference.

Activities of science information representative supplement but do not replace the researcher's reading.

257 Lowry, W. Kenneth. Some functions, interactions, and problems of communication. SPECIAL LIBRARIES. 51:479-484, 1960.

Views the library as a communication system whose objective is to bring the reader to the book or information he wants. Its functions are to select, control, store, retrieve, and compile information.

Machines are of almost no value in book selection and learning what has been published. Machines have dubious value for: (a) physical acquisition, except for large sophisticated libraries; (b) subject analysis and organization of information; (c) local announcements; (d) information retrieval; (e) information transmission; and (f) storage of information.

Machines are quite useful for: (a) providing loan or reproduction copies; and (b) correlating data from surveys for planning programs to meet local needs and eliminating nonessential, costly low-return services.

258 Lowry, W. K., and Albrecht, J. C. A proposed information handling system for a large research organization. PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON SCIENTIFIC INFORMATION. v. 2. Washington: National Academy of Science, 1959. p. 1181-1202.

The determination of an organization's information requirements should provide more accurate selection of all forms of information according to needs. Needs of a research group must be established in relation to:

1. Research projects being pursued.

2. Scientific and technical interests of group members.

3. Information produced by group.

Primary consideration in review and control if information is participation by research staff and scientifically trained information staff. Use of standardized techniques in information control process facilitates orderly and consistent development of system of effective control. Techniques are suggested for announcement of new information to staff generally and specific individuals and for combining manual, intellectual and machine operations to best advantage.

259 Luce, Robert D., and Raiffa, Howard. GAMES AND DECISIONS. New York: John Wiley & Sons, 1957.

This book is a discussion of the central ideas and results of game theory and related decision-making models, without technical mathematical details. It explains the game theory as the approach to the problem of reaching decisions when the individual is in conflict with other individuals and when there is risk involved in the outcome of their choices.

260 Macdonald, Angus S. Building design for library management. LIBRARY TRENDS. 2:463-469, 1954.

In preparing a satisfactory library plan, management should decide cost, total area and type of building desired, and prepare a flow chart before the architect begins. Plans should assure a central location with expansion potential and should divide total space in terms of area rather than rooms because walls inhibit flexibility.

It is management's responsibility to provide a clear-cut statement of requirements to guide the architect in his work.

261 Maizell, R. E. Standards for measuring effectiveness of technical library performance. IRE TRANSACTIONS ON ENGINEERING MANAGEMENT. EM-7(2): 69-72, 1960.

Reviews established criteria and presents some new criteria for evaluating performance of the technical library. Proposes a five-point program to provide administrators with basis for administrative and budgetary decisions.

1. Norms: Relate existing norms for library collection, staff budget and size to total organization size and budget. Use SLA norms for library architecture and space. Use data in library directories regarding collection, staff and budget for comparison, basing standards on data from better libraries.

2. Quality of collection: Compare with published lists of key literature or citations in library's most used journals. Note records on library's ability to fill users' requests.

3. Referral service: Record number of questions handled per week, time and cost per question. Most important is percentage of questions solved in reasonable time period.

4. Performance index: Determine ratio of material used to material requested.

5. Impact of library and staff on research program and staff. Some tentative qualitative guides are proposed.

262 Malcolm, Donald G., and Rowe, Alan J.
MANAGEMENT CONTROL SYSTEMS. New York: John Wiley & Sons, 1960.

This book covers the concepts of management control, present practices and the impact of computers on the design of management controls. Examples are given of automated management controls. New approaches and future possibilities in management control and information systems, and the need for research in management control systems design are discussed. A management laboratory where company activities are simulated is described.

263 Mallick, Randolph W., and Gaudreau, Armand T.
PLANT LAYOUT. New York: John Wiley & Sons, 1951.

A discussion of service operations such as receiving, storing, transporting, inspecting, and office work, and the need for a scientific approach to plant layout problems and design.

Text covers the general areas of:

1. Approach to plant layout.
2. Planning the processing departments.
3. Designing the plant service facilities.
4. Justifying the layout project.

Problem areas are discussed in a "before" and "after" style with illustrations to show the improvement.

264 Mandell, Milton M. RECRUITING AND SELECTING OFFICE EMPLOYEES. (RESEARCH REPORT No. 27). New York: American Management Association, 1956.

Compilation of findings of a study made by questionnaire on a select sample of organizations resulted in a discussion of the following office personnel problem areas:

1. Factors in employee turnover.
2. Factors in increased production.
3. Important job characteristics.
4. Supervision and productivity.
5. Use of merit rating.

After discussion of these problems, solutions are discussed under the following general areas:

1. White collar jobs and workers.
2. The recruitment program.
3. Problems and pitfalls in selection.
4. Selection devices.
5. Recruiting and selecting special groups.
6. Selection of supervisors and managers.

265 March, James G., and Simon, Herbert A. ORGANIZATIONS. New York: John Wiley & Sons, 1958.

This text is a restatement of existing hypotheses concerning organizations, in a form to make them amenable to empirical testing, while giving attention to the operational definition of variables. In some instances the author indicates what kinds of tests are relevant and practicable. Also discussed are the areas of: organization behavior, "classical" organization theory, motivational constraints, conflict in organizations, and planning and innovation.

266 Marshall, George C., Space Flight Center, Computation Laboratory. THE ALPHA SYSTEM. A PROGRESS REPORT OF PHASE I OF A PLAN TO AUTOMATE THE OPERATION OF THE REDSTONE SCIENTIFIC INFORMATION CENTER. Huntsville, Alabama: Author, 1964. R-COMP-A-64-1.

Report of design of ALPHA system for integration of all functions of Redstone Scientific Information Center that are amenable to automation. Information processing and system principles used as design criteria were:

1. Computer used when basis for decision can be defined or action can be performed or expressed by computer.
2. Operations and data simplified and minimized.
3. Original input data introducted into system at earliest possible time.
4. Duplication of data, processing and transcription minimized.
5. Computer used to check validity and consistency of data.
6. "Hopper" concept used to determine effect of transactions on records.
7. System open-ended, capable of modification and extension.
8. External lists and catalogs continued and augmented by system.

Analysis of RSIC found that effective system must have unified automation of housekeeping information. Information falls into two categories, (a) bibliographic--all qualifying information about bibliographic entities, including card catalogs, circulation files, shelf and routing lists; and (b) patron information--all qualifying information about present and potential users, including names, addresses, profiles of interest, security data.

267 Martin, E. W. ELECTRONIC DATA PROCESSING, AN INTRODUCTION. Homewood, Illinois: Irwin, 1962.

This book is a guide for the general manager who does not expect to specialize in computer technology. It elucidates the capabilities and limitations of the electronic computer and the management considerations involved in its use. It also serves as an introduction to those who aspire to specialize in the design of data processing systems.

268 Martin, Howard L. The what, when, where, why, and how of a "profession". SPECIAL LIBRARIES. 52:459-461, 1961.

A profession must have certain attributes to be classed as one. These are:

1. It must be based on a body of specialized and complex knowledge not easily attainable.

2. The practice must be of vital importance to the client and society, and command their respect.

3. It must be organized and enforce a formal code of ethics.

4. The organized association and the state must require formal training in the pertinent body of knowledge and be able to test that knowledge and its application.

5. The profession must place the interests of the client and the public above the immediate interests of the practitioner.

6. Its practitioners must be paid directly for their services either by individuals or by a group.

7. Admission to practice and the right to continue is the concern of and in direct control of society itself.

269 Martin, L. A. Establishing standards for libraries. CANADIAN LIBRARY ASSOCIATION BULLETIN. 16:224-7, 1960.

Recently standards for public, college and school libraries have been set up. The common elements in these are that they (a) raise the level which libraries must attain to be rated adequate; (b) stress qualitative and functional standards as distinct from quantitative and static measures; (c) place emphasis on programs of service; (d) specific standards for immediate application but also a guide line for effective library service.

270 Martin, N. H. Executive control through effective information handling. PROCEEDINGS OF THE EXECUTIVE CONFERENCE ON ORGANIZING AND MANAGING INFORMATION. Chicago: 1957. p. 36-41.

Discusses the various roles a library may take on to help executives with decision-making. These are: getting data, knowing what is going on in the company, and passing on the information so that the executive is provided with alternatives before he makes his final decision.

271 Martin, Robert L. The operations of military technical libraries. THIRD MILITARY LIBRARIANS' WORKSHOP. Monterey: U.S. Navy Postgraduate School, 1959. (AD-479 447)

Preliminary report of survey of 9 military school libraries and 46 libraries attached to military R&D organizations. Problems reported included:

1. Space deficiencies for reader, staff and shelf areas. Only 12 reported adequate space.

2. Staff deficiencies. 37 research laboratories needed from 1 to 15 additional personnel; 5 school libraries needed from 1 to 29.

3. Purchasing problems--a major problem for 28 libraries.

4. Accountability problems--mentioned by 8 libraries.

5. Security problems--mentioned by 15 libraries.

272 Martindell, Jackson. THE SCIENTIFIC APPRAISAL OF MANAGEMENT. New York: Harper, 1950.

Describes use and underlying principles of the organization evaluation approach developed for American Institute of Management. Uses questionnaire covering 10 key areas: economic function, corporate growth, health of earnings, growth, fairness to stockholders,

research and development, directorate analysis, fiscal policies, production efficiency, sales vigor, and executive evaluation. Appendix lists questions asked in each area and weighting assigned. Answers highlight areas needing management attention.

273 Mathieu, J., and Barlen, S. GUIDING PRINCIPLES FOR TIME AND COST IN DOCUMENTATION WORK. Germany: Technical Information and Library Services, Ministry of Supply, 1959. TIL/T. 4966

Evaluation of time necessary for running a newly established documentation center and the performance of various operations. Some of these operations were abstracting of periodicals, classifying by UDC, writing abstract cards, correcting, duplicating, sorting and filing cards. These operations were observed by stop watch in short tests and observed in tests of longer duration. To obtain a broader basis for the values found, the experiences of other documentation centers were compared.

274 Mavbury, Catherine. Performance budgeting for the library. ALA BULLETIN. 55:46-55, 1961.

Performance budgeting involves two basic procedures: (a) determination of programs of work, and (b) calculating the cost of these programs. A list of items necessary for carrying out each program and cost of these items should be separated into two groups:

1. Fixed costs, building, maintenance, administrative duties.
2. Variable costs, such as cataloging, reference and circulation.

Performance budget can be presented either as:

1. Requests for items needed to maintain the services performed during the past year at the same level.
2. Requests for new services.

Performance budgeting is accurate statement of library needs but is no guarantee that demands will be supplied. It does, however, offer control to the librarian and offers a planning tool. Library activities are more easily measured than many other functions employing performance budgeting.

Most libraries do not have standards since they are generally hard to accept and require self evaluation. Quality standards would be better than quantity standards but are hard to measure.

275 Mayo-Wells, Wilfrid James. ORGANIZATION OF A NATIONAL SCIENTIFIC AND TECHNICAL INFORMATION CENTER. Alexandria, Virginia: Defense Documentation Center for Scientific and Technical Information, 1964. (AD-455 078)

This study examined four methods of improving the flow of information. These were: (a) improvement of local public and private libraries, (b) a mobile force to gather information and distribute it on a personal basis, (c) a master government agency, and (d) a National Scientific and Technical Information and Analysis Center.

The staff in this information center would use the following criteria in judging the value of any piece of information: (a) currency, (b) distribution by range of interest, (c) authenticity, (d) reliability, (e) assimilability, (f) credibility, (g) regularity (partly), (h) randomness (partly), and (i) completeness.

Responsibilities of the staff were listed as: (a) formulating problems and hypotheses, (b) planning and designing the investigation, (c) conducting the investigation, (d) interpreting research results, (e) preparing reports, (f) administering research projects, (g) accepting organizational responsibility, and (h) accepting personal responsibility.

276 Mayzner, Mark S. FACTORS AFFECTING INFORMATION STORAGE AND RETRIEVAL IN MAN. (FINAL REPORT) Washington: Office of Naval Research, Engineering Psychology Branch, 1966. (AD-486 382). No. NONR. 285 (56)

Discusses in detail the major results of 14 studies that examined the effects of four parameters on information storage and retrieval capacity in man. Parameters are:

1. Coding of information.
2. Organization of information.
3. Amount of information.
4. Display time.

Five studies dealt specifically with coding, three with organization, two with amount of information and four with display time. The results of all 14 studies were related to a variety of display design problems in military command and control systems. A number of specific display design recommendations are offered based on the research findings.

277 McCarn, Davis B. Large-scale system design techniques. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 95-98. (AD-632 587)

This paper is directed primarily at problems in military systems. Very large systems must be attacked on a segmented, subsystem basis. In military information systems segmentation must be complemented, however, by other alternative cuts through the process if distortion is to be avoided. In particular, functions and techniques offer natural alternative bases for analysis of the chain-of-command capabilities. Such alternative, vertical segmentations of the command and control process could assure the appropriateness of functions at specific commands and allow the development of common techniques. In addition, such vertical analysis would improve the definition of requirements at all levels.

278 McCormick, E. M. The management process and science information systems. In Lowell H. Hattery and Edward M. McCormick, Eds., INFORMATION RETRIEVAL MANAGEMENT. Detroit: American Data Processing, 1962. p. 131-135.

Science information center is defined as an agressive information collector, as opposed to the library's passive role of random storing. Goals and objectives of center may best be determined through market survey techniques, because often the scientist-user is unable to determine needs of system. General goal is that the system should be easy to use. Evaluation of system must be based on validity of assumed user needs as well as on feedback from user. At present it is difficult to measure value of services against cost. Comparison of pricing by various competitive and self-sustaining commercial activities would help in evaluation of cost. Also interesting would be a study in which service activities are taken off overhead and charges made to the appropriate department.

279 McCormick, Ernest J. HUMAN FACTORS ENGINEERING, 2d ed. New York: McGraw-Hill, 1964.

This text discusses the following environmental factors:

1. Development and use of human factors information.
2. Information displays.
3. Work space and personnel equipment.
4. Arrangement of elements and components.
5. Illumination, noise, and vibration.
6. Human factors in system development.
7. Work factors.
8. Time standards.

280 McDiarmid, Errett W. Scientific method and library administration. LIBRARY TRENDS. 2:361-367, 1954.

Administration by hunch should be replaced by administration by scientific method. Steps in

decision making are: (a) Define the problem. (b) State the assumptions. (c) List the component facts. (d) Assemble available pertinent facts. (e) Collect and analyze needed facts. (f) Evaluate facts in relation to problem. (g) Construct a hypothesis. (h) Test the hypothesis. (i) Analyze and reach a conclusion.

Advantages of the method are: (a) Helps appraise qualitative and subjective questions carefully and accurately. (b) Refines and clarifies the problem. (c) Gives decisions more widely accepted, and increases likelihood of correct decision. (d) Strengthens administrator's morale.

Method is an aid to administration, not a substitute for it.

281 McDonough, Adrian M. INFORMATION ECONOMICS AND MANAGEMENT SYSTEMS. New York: McGraw-Hill, 1963.

This non-technical discussion provides an integrated framework for the study, development, design and operation of management information systems. It relates the approaches of organization structure and of information structure to the process of management decision making. This new approach to organization theory is based on the common denominator of information analysis which allows a total look at the information needs of all positions in an organization. By concentration on these problems, this book provides a central core of analysis needed to relate the many now separated views of management problems.

To accomplish this, the book covers the problems of information needs and data processing in all types of organizations, encompassing problems of organization planning, work assignments, and channels of communication for all white-collar jobs.

282 McDonough, Adrian M., and Garrett, Leonard J.
MANAGEMENT SYSTEMS: WORKING CONCEPTS AND PRACTICES.
Homewood, Ill.: Irwin, 1965.

This text discusses management systems design in terms of the approaches to management problem definition, and manpower planning and control. Systems design is treated as a means of uniting the best definition of management problems and the best combination of personnel talents and systems techniques for handling problems.

The feedback and evaluation of systems effectiveness is discussed, and a rough framework is provided for the study of management criteria as a prerequisite to systems improvement.

283 Meier, R. L. Efficiency criteria for the operation of large libraries. LIBRARY QUARTERLY. 31:215-234, 1961.

Criteria for technical libraries should include inter-library comparisons, and refer to quality of holdings, adequacy of reference service, a performance index for delivery of titles within a reasonable time, and qualitative features.

Appropriate units for measurement (a) should be sharply and unambiguously defined; (b) should permit comparison between all institutions that claim to provide the same service; (c) should be counted by techniques that are easily learned and readily agreed upon; and (d) should be no larger than the smallest typical transaction.

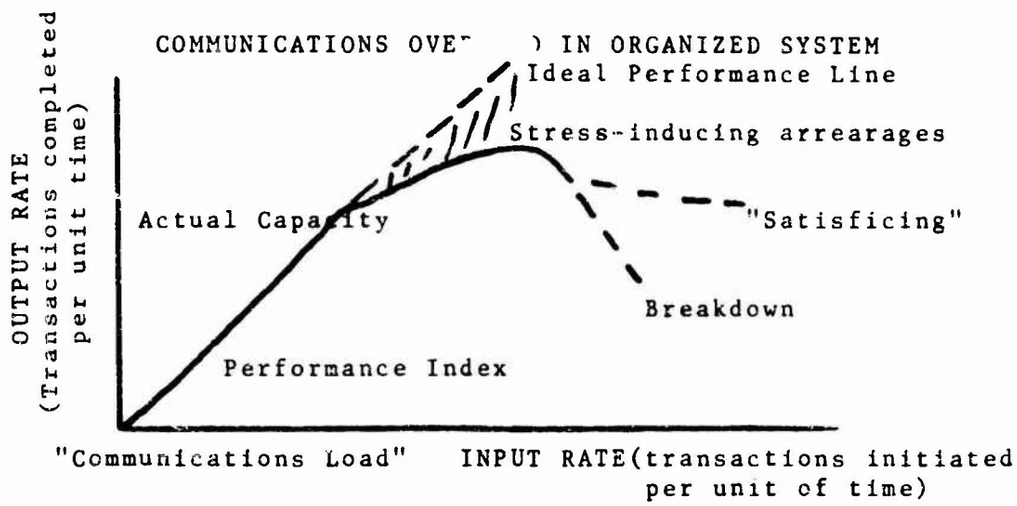
Several routine counts are provided: circulation, acquisitions, holdings, reference questions (less often), and table use of materials (sometimes).

Recommended unit is the <u>item-use-day</u>. Item = a book, map, recording, etc. charged out to the user as an identifiable unit. Use = whatever the user defines it as. Day = the interval between rising and retiring.

Advantages are: (a) fits the criteria; (b) is operational (reproducible results, concrete measure); (c) ambiguities are minimal; (d) circulation and table-use aggregates can be reduced to item-use days; and (e) can be measured with a probable error of less than 10%. Use of the item-use day unit is explained in the article, and results of a survey in a large state university are recorded as examples.

284 Meier, R. L. Information input overload; features of growth in communications-oriented institutions. LIBRI. 13:1-44, 1963.

A unit of circulation represents, by convention, a document that has been charged out of the system for use. Another method of calculating circulation is the item-use day. Problems occur when demands upon service habitually exceed available resources.



285 Meister, David, and Rabideau, Gerald F. HUMAN FACTORS EVALUATION IN SYSTEM DEVELOPMENT. New York: John Wiley & Sons, 1965.

Human factors evaluation objectives can be categorized in terms of performance and products. Steps in functional analysis are: (a) determining system mission requirements, (b) profiling mission, (c) segmenting mission, (d) identifying and describing system functions, (e) establishing functional performance criteria, (f) allocating functions, and (g) performing task analysis. All constraints affecting system design and development must be listed; the most common are dollar cost, schedule time, physical resources and manpower availability.

Objectives of performance evaluation are: (a) to ascertain whether system and/or individual equipment can meet contractural performance criteria; (b) to identify in-

adequacies and deviations from these requirements and find their causes and solutions.

Characteristics of criteria may be classified as: (a) mission accomplishment, ultimate vs. approximate; (b) process/product, performance vs. representational; (c) real time flow, terminal vs. intermediate; (d) part of system, internal vs. external; (e) type of management, mechanistic vs. behavioral.

Steps in evaluation planning include: (a) determination of evaluation purpose; (b) selection of significant test variables, test measures recorded, data analysis methods, system operations evaluated, test subjects and data collection personnel;(c) familiarization with system operations; and (d) development of a detailed test plan.

286 Melin, John S. LIBRARIES AND DATA PROCESSING--WHERE DO WE STAND? Urbana: University of Illinois Graduate School of Library Science, 1964. (Occasional Papers, No. 72)

Discusses the uses presently being made of data processing equipment in library activities which include: (a) ordering and acquisitions, (b) technical processes identifying library material, (c) catalogs and indexes, (d) circulation control, and (e) miscellaneous uses such as payroll, salary surveys, and personnel surveys.

Potential uses for data processing equipment among libraries include: (a) universal identification of books, allowing libraries to share holdings more efficiently; (b) teleprocessing network linking libraries of the world; (c) central cataloging system with the Library of Congress as the clearinghouse; (d) "cataloging in source" by the Library of Congress, government agencies and trade publishers.

Notes that an average of 60% of the public library budget is spent for personnel to prepare and circulate publications. Use of data processing equipment would substantially reduce the nonprofessional activities performed by professional librarians.

287 Melnitsky, Benjamin. PROFITING FROM INDUSTRIAL STANDARDIZATION. New York: Conover-Mast Publications, 1963.

This text discusses the important association of standardization of industrial management to a profitable operation. The text also includes such background material as historical coverage on industrial and governmental standardization programs, creation of standards in the industrial world, organizations, business savings, benefits to the consumer, standards of measurement as applicable to research operations and research in standardization as benefiting production.

288 Menzell, Herbert. The information needs of current scientific research. THE LIBRARY QUARTERLY. 34:4-19 1964.

Attempts at meeting the challenge of the vast increase in demands on the science information system since WW II have centered on three sets of assumptions:

1. Guiding principles - speed, efficiency, comprehensiveness.

2. Prototype activity - exhaustive search.

3. Means - greater systemization, streamlining, mechanization, automation of information processing and dissemination.

New demands have been heard, however, for selectivity, synthesis, state-of-the-art reviews, facilitation of interpersonal communication, and "browsability." These indicate a recognition of three fundamental facts about flow of scientific information:

1. The multiplicity of science-information functions.

2. The importance of informal and personal communication.

3. The need for research on the information needs of scientists.

289 Merrill, Harwood, F. Performance standards: way of life. Remarks by George A. Gowen. MANAGEMENT NEWS. 5 August 1965.

States that the performer sets his own standards and gets his boss's approval. Whirlpool Co.'s performance standards are:

1. To establish company objectives.
2. To define managerial responsibilities.
3. To establish agreed upon performance standards for individual managers.
4. To work out with them plans for reaching the standards.
5. To follow progress and review it.

290 Messmore, Jack W. A PROPOSED MANAGEMENT INFORMATION SYSTEM FOR A TYPICAL UNITED STATES AIR FORCE SYSTEMS COMMAND LABORATORY. Elgin Air Force Base, Florida: Air Proving Ground Center, 1965. (AD-461 259)

The study tests the hypothesis that the present manual reporting system used in the Weapons Laboratory is inadequate in terms of timeliness, accuracy and relevance of information on technical goals, resources, costs, scheduled performance and achievements. The current manual system is compared with a proposed electronic data processing (EDP) system. The findings were that accuracy as presently reported is more precise than desired by the laboratory managers and that human errors distort present management reports. The hypothesis is supported in that relevant and more timely information can be furnished the executives by the proposed EDP system. To insure that in the proposed system errors do not occur in information reports, manual and computer checks would be incorporated to test and validate input information. An information gathering routine including an acceptable "sub-accounting" system is designed to furnish the relevant and accurate information management desires and incorporate the new DoD reports requirements with minor modification.

Approximately 60 percent savings in time could be realized by utilizing the proposed EDP system.

291 Michael, Stephen R. APPRAISING MANAGEMENT PRACTICES AND PERFORMANCE. Englewood Cliffs, N.J.: Prentice-Hall, 1963.

Basic elements of an organization to be surveyed in a management audit are:

1. Purpose and objectives. Should be clearly defined.
2. Functions and operations. Which functions are best performed in-house, which purchased from outside?
3. Organization structure.
4. Resources. Includes manpower, finances, materials and supplies, equipment, plant facilities, products, services and customers.
5. Policies. Should be well defined and documented.
6. Planning operations. Should distinguish what is done from what needs to be done.
7. Execution of operations. How closely do they follow the plans?
8. Evaluation operations. Do reports provide adequate data for management decisions?
9. Management philosophy. Does type of working atmosphere produce the most effective operation?

292 Middle States Association of Colleges and Secondary Schools, Commission on Institutions of Higher Education. What to consider in evaluating the library. LIBRARY JOURNAL. 83:1656-1658, 1958.

A library evaluation prerequisite is an exact description of the institution's mission and the means by which the institution proposes to fulfill it. Use of the library by students is ultimate test of its effectiveness. Questions for evaluating the library include:

1. Is the library (a) convenient, quiet, inviting; (b) developing collections other than books, e.g. maps, etc.; and (c) properly controlled, if departmental.

2. Is the collection (a) broad, varied, authoritative, up-to-date; (b) supplemented by source, monographic, and

periodical material for advanced study/research; (c) sufficient for specialized and technical fields offered by the institution; (d) being expanded so as to fill in gaps; (e) weeded efficiently, to keep it solid and current; (f) supplemented (but not replaced) by interlibrary loans; (g) such as to facilitate advanced study and research by the faculty; and (h) buying enough new books to keep abreast of advances in the fields of instruction and research of the institution?

3. Other questions include the following:

(a) Are the librarians' records well designed for analyzing and improving services; (b) do all those who are legitimately concerned participate in determining the library's objectives, basic acquisition policy, and budget; (c) what is the library's book selection policy on such questions as reference materials, textbooks, books in fields in which no instruction is offered, multiple copies, etc. (d) is the periodical list comprehensive, well balanced, and intellectually stimulating; (e) are communications good between faculty members and librarians; (f) is the librarian closely in touch with curriculum development and faculty planning, so that he may anticipate instructional and research needs; (g) how active is each department in recommending books for purchase?

293 Miles, Jerome A. Work measurement at work. In Bureau of the Budget, PROGRESS IN MEASURING WORK. (MANAGEMENT BULLETIN) Washington: Government Printing Office, 1962. p. 21-28.

Description of work status reports system for office clerical work which is either direct or indirect labor. Indirect labor is top supervisors and their secretaries. Direct labor, 95% of office work, is distributed as follows: (a) program, (b) EDP, (c) administrative, which cannot be measured accurately.

The program aspect is divided into 56 work items, examples are: (a) payment of storage charges, (b) issuance of loading orders, (c) settlement of loading orders and (d) making freight payments. For each work item a unit of measurement has been developed, for storage, the unit is the invoice; number of invoices processed is work load.

Each office maintains record of units, such as: (a) on hand, beginning and end of month and (b) received and completed during month. Man-days used for each item during month also are recorded. At start of each year production rates are set based on highest rate previously achieved for year. Comparison is made each month of actual to standard on index basis.

$$X + Y + Z \times 100 = W$$

where $X = \frac{\text{actual units, standard rate}}{\text{direct labor man-days}}$

Y = EDP man-days, Z = administrative man-days

W = production index for office for month.

System is used primarily for budgeting but may also be used for:

1. Competition among offices.
2. Production incentive and motivation.
3. Esprit de corps within office.
4. Spot development of new methods.
5. Help to determine effects of proposed or instituted changes.

Weaknesses in system are:

1. Difficult to measure some activities.
2. Inability to develop accurate units of measure of some items.

Advantages of system are:

1. Accurate method for determining future manpower requirements.
2. Means of allocating funds.
3. Method for measuring and evaluating performance.

294 Miller, Robert W. SCHEDULE, COST, AND PROFIT CONTROL WITH PERT--A COMPREHENSIVE GUIDE FOR PROGRAM MANAGEMENT. New York: McGraw-Hill, 1963.

This text is concerned with the problems of planning and control in the three dimensions of schedule, cost, and profits. The author explains that the basic approach of PERT is the technique called networking. The frame of reference in which PERT may best apply is the area of program management, as distinguished from functional management.

The text explains the fundamentals of network technique and discusses the relationship between PERT, program definition, systems engineering, and configuration management. Also discussed is the relationship between PERT management systems, organization, and profits.

295 Mitchell, William. Executive functions: evaluation. In THE BUSINESS EXECUTIVE IN A CHANGING WORLD. New York: American Management Association, 1965. p. 75-87.

Correct evaluation of ideas, events, things, operations or persons is defined as:

1. Gathering, analyzing and testing pertinent evidence.
2. Searching for valid criteria or standards by which to judge results.
3. Establishing objectivity in formulating judgements.

Correct evaluation requires:

1. Reliable information.
2. Systematic organization.
3. Avoiding bias by sharing responsibility.
4. Good staff.
5. Good understanding of past performance.
6. Availability of reliable standards.

296 Monroe, M. E. Standards--criteria for service or goals for the future? ALA BULLETIN. 56:818-820, 1962.

Standards should be constructed from an analysis of experience, not merely theory. But this experience may be that of the artists of librarianship. Library standards must look beyond budget, staff, collection, and physical facilities, to the services rendered. Three elements must be considered: the objectives of service, the elements on which service depends, and the process of providing the

service. Standards serve as a tool to facilitate achievement of a consistent level of professional adequacy, and must be revised as new insights into library service are developed.

297 Moore, Franklin G. MANUFACTURING MANAGEMENT. 4d ed. Homewood, Ill.: Irwin, 1965.

This book emphasizes decision making and current management practices. The current trend toward quantitative approaches to problems has been recognized and is reflected in the inclusion of more quantitative material and the reduction of descriptive material. Newer quantitative techniques such as Bayesian analysis, decision trees, and load path matrices in plant layouts are presented and examples of their use are given. The way in which probability and queuing theory can improve managerial decision making is explained. Discussions of Monte Carlo simulation, linear programming, and other established operations research techniques are included.

Also included are discussions of manufacturing economics, break-even analysis, capital equipment replacement and plant capacities.

298 Morelock, Molete, and Leimkuhler, F. F. Library operations research and systems engineering studies. COLLEGE AND RESEARCH LIBRARIES. 25:501-503, 1964.

Techniques and methodology of operations research, organization policies and procedures of Purdue libraries were studied. Participants were committee of professional staff of the university libraries, and graduate students in school of industrial engineering interested in operations research. One of the difficulties this project was designed to meet was the difference in terminology, traditions and techniques existing between library science and systems engineering.

299 Morey, James L. and Yntema, Douwe B. Experiments on systems. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 349-368. (AD-632 587)

Paper proposes that current practices for evaluating man-computer systems can be significantly improved in two ways:

1. By conducting system tests as controlled experiments.
2. By using a technique which incorporates the judgement of experts into the derivation of composite measures appropriate to a broad evaluation of the systems.

Specifically discusses the relative effectiveness of two ways of planning the flight paths assigned to incoming aircraft.

Experimental design is held important in controlled tests. Statistical and operational ways of controlling the major variables which are important in man-computer systems are discussed.

The results show how system performance can be predicted from knowledge of the system inputs.

300 Morgan, LaVera. Round table discussion of problems facing service librarians. NINTH MILITARY LIBRARIANS' WORKSHOP. West Point: U. S. Military Academy, 1965. p. 78-81.

Discussion by Navy librarians of acquisition and procurement problems, inadequate physical facilities and inadequate staff. Proposed solutions included:

1. Automatic invoicing to renew journal subscriptions, direct ordering by milstrip from Navy Supply Depot, acting as procurement officers in dealing with foreign publishers.

2. Finding realistic criteria for estimating space for readers and staff - staff space

average of 150 sq. ft. per person is generally accepted; having realistic weeding policy, records of growth and shelving needs per annum; exploring use of microfiche.

3. Considering career development program similar to the Army's, establishing central register of librarians and vacancies; maintaining and providing management with statistical proof of additional staff needs.

301 Morris, T. D. Techniques of appraising the administrative strength of an organization. COLLEGE AND RESEARCH LIBRARIES. 13:111-116, 1952.

Description of techniques used by management engineers in study of New York Public Library Acquisitions Division. (See also Kilpatrick.) Three areas of administrative competence were studied.

1. Sound organization. (a) Functions defined, relationship of divisions examined. (b) Potential sources of overlap analyzed. (c) Assignment of duties and workload studied by means of personal interviews and individual diaries of duties and time. (d) Duties and responsibilities of each position defined.

2. Simplifying procedures. Examination of problems of high cost, inaccuracy, tardy processing, arrearages of work.

3. Strengthening management controls. (a) Quality controls: user attitudes, time needed to process procurement requests, number of open orders on file and time outstanding, work backlog, supplier performance. (b) Cost control: rough statistics on relative volume of work performed from month to month. (c) Morale control: equity of job evaluation and salary classification, preservation and expansion of opportunities for employee development and participation in management improvement, comfortable working conditions.

302 Morse, Philip M. PROBABILISTIC MODELS FOR LIBRARY OPERATIONS. Presented at annual meeting of Association of Research Libraries, January, 1964.

Discusses data needed in order to plan operational changes in the library and control efficiently new automated systems. Describes methods used to obtain these data by the Operations Research Center, M.I.T.

1. Usage of books and periodicals. Actual use is affected by random factors, but when there are a large number of books in a class, the average use-rate should correspond fairly well with predicted average. Book circulation is a good measurement. Study must determine which material should be quickly accessible, which may be stored.

2. User habits. May be studied by user survey, data on library card-catalog.

3. Determination of measures of effectiveness to indicate a library's success in serving its users.

An important contribution of first stages of automation is increased awareness of how the library is doing.

303 Mueller, Max W. Time, cost and value factors in information retrieval. GENERAL INFORMATION MANUAL. (IBM Information Retrieval Systems conference). Poughkeepsie. 1959.

Operations Research Division, Lockheed Aircraft Corp., conducted a study to identify economic factors in a library information handling system of a typical engineering organization.

Value of retrieval was considered two ways: (a) Compared cost of retrieval to alternate means of obtaining information, principally consultation with other staff members at approximate cost of $20. (b) Survey of random documents used asking last user amount of engineering time saved.

Each retrieval saved 1.2 man-hours or $12. There is need for fast retrieval since efficiency drops 25% waiting for information at a cost of $2.50 per hour. One hour delay consumes 20% of $12. saving.

91% of savings from valuable retrievals dealt directly with specific problems rather than long-range research, supplying much specific data contained in tables and curves, indicating need to tie document indexing with tables and curves, incorporating curve parameters and ranges of variables.

The value per retrieval determines amount to be spent on mechanization: average saving per retrieval ($12), multiplied by average times document used (6 times in 10 years, or $72) minus retrieval delay costs, must cover purchase price of document, indexing, handling, storage, share of other library costs.

Conventional technical library considered passive: storage centered (age = value), non-profit minded (economy = efficiency), inventory conscious (control = merit). Proposed information center considered active: use centered (use = value), profit minded (net return = efficiency), content conscious (information coverage = merit).

304 Muller, Robert H. Compact storage equipment: where to use it and where not. COLLEGE AND RESEARCH LIBRARIES. 15:300-308, 1954.

Compares four brands of compact shelving.

The following factors should guide the librarian in choosing among the available products: (a) cost of shelving per lineal foot; (b) mechanical functioning of the equipment; (c) relative accessibility and visibility of the books; (d) efficiency in shelving, collecting, and shifting of books; (e) ease of shelf labeling; (f) adaptability of the equipment to the floor area dimensions under consideration; (g) adjustability of shelves or drawers; (h) hazards and safety features; (i) relative quietness in operation; (j) appearance; (k) adaptability to non-book uses; and (l) reconvertability to non-compact storage.

305 Mullestein, William E. The practical results of evaluation. In Jerome W. Blood, Ed., OPTIMUM USE OF ENGINEERING TALENT. (AMA MANAGEMENT REPORT No. 58). New York: American Management Association, 1961. p. 383-393.

Technical effectiveness is measured in various ways. In engineering and construction it is estimated by the ease with which operating groups learn to utilize new equipment and by its effective application from the standpoint of improved costs.

Most businesses are engaged in two basic operations:

1. Producing and marketing products as good or better than competition, in an efficient, economic manner.
2. Planning ahead with improved products to be marketed with better service.

Engineering is function that develops plans, designs them into buildings and equipment in coordination with other company functions. These are positive and essential contributions to overall business. Engineering cannot make a profit for the company but is the foundation upon which production can start.

306 Murray, Hubert. METHODS FOR SATISFYING THE NEEDS OF THE SCIENTIST AND THE ENGINEER FOR SCIENTIFIC AND TECHNICAL INFORMATION. Redstone Arsenal, Alabama: U. S. Army Missile Command, Redstone Scientific Information Center, 1966. RSIC-510. (AD-627 845)

Discusses new equipment and techniques being developed to speed or simplify the flow of information. Some types of equipment mentioned were: (a) storage devices--magnetic, photographic, thermoplastic films; (b) output devices--cathode-ray-tubes, photocomposing devices, high speed printers; (c) communication devices--electric transmission, digital code transmission, picture transmission.

Automatic indexing and abstracting will soon be a necessity since library materials are increasing at

a great rate. In the past, librarians were capable of handling information, but now volume and complexity have increased so much that it is impossible for librarians to cope with the problem themselves.

307 Myatt, DeWitt O. Designing an information center to meet a real-system requirement. In Lowell H. Hattery and Edward M. McCormick, Eds., INFORMATION RETRIEVAL MANAGEMENT. Detroit: American Data Processing, 1962. p. 45-53.

A scientific information center is part of a larger functional system consisting of (a) information users (scientists), (b) information sources, and (c) administrative element that determines the users and kind of information and services center is to provide. A technical information center differs from a technical library by maintaining a professional capability in subjects handled as opposed to mere expertise in the management of documents.

According to a survey, a technical center should provide the following services:

1. Data collection.
2. Periodic announcements of new subject knowledge sources.
3. Professional competency in technical subjects and information science.
4. Technical editorial skills.
5. Document collection.

Also, the technical center does not need to provide the following services:

1. Conventional library services such as document loans, book purchases, reprint ordering.
2. Special correlations or mathematical services.
3. Administrative support in organizing meetings.

308 Myatt, D. O. and Entel, J. The profit viewpoint in library management and operation. SPECIAL LIBRARIES. 48:373-377, 1957.

The library at Atlantic Research Corporation found that it is necessary to watch the changing needs of the corporation in order to change the functional character of the library to serve the needs of the time. In order to reach a decision on a specific plan, there are several things a library manager has to know:

1. Will the information obtained be useful and used.

2. What is the most economical way of obtaining the information--loan, purchase.

3. How should acquired documents be handled.

4. How to eliminate obsolete material and services.

The time factor was found to be very important.

Although purchased books constituted only 3% of all items processed, their relative cost was the greatest.

The following is a breakdown of the total documentary resources in the library's possession:

Classified reports	60%
Reference and specialized texts	40%
Bound journals	90%
Patents and misc. documents	25%

The rest of the items are in project offices.

309 Nagle, Bryant F. Criterion development. PERSONNEL PSYCHOLOGY. 6:271-289, 1953.

Three fundamental considerations in the development and construction of criteria are: (a) the relevancy of the criterion, and (b) the reliability of the criterion, and (c) the combination of criterion measures into a composite score.

Relevancy compares the variance in the criterion with that in the ultimate criterion, and thus measures the validity of the criterion. Two sources of low relevance are: (a) omission of systematic variance in the criterion which is present in the ultimate criterion (criterion deficiency); and (b) inclusion of systematic variance in the criterion which is not present in the ultimate criterion (criterion contamination).

There is tendency to over-emphasize reliability as a criterion; although high reliability is desirable, it is not sufficient. Sources of superior reliability and unreliability are discussed, as well as the relationship between reliability and validity.

It is suggested that weighting sub-criterion measures be done by competent judges and that sub-criterion weights be applied to the standard score conversions of the variable. A four step procedure for developing criteria is (a) define the activity, (b) analyze the activity, (c) define elements of success, and (d) develop criteria to measure these elements. The researcher must be cognizant of the limitations and problems of what he is doing throughout the process.

310 Nemmers, Erwin E., and Myers, John H. BUSINESS RESEARCH. New York: McGraw-Hill, 1966.

This text covers operations research and its applicable techniques. Some of the methods discussed were: hypotheses testing - Type I and Type II errors, correlation analysis, regression analysis, simulation, solutions from models, and multiple correlation.

311 Neuner, John W. Nonmanufacturing cost accounting applications. In COST ACCOUNTING. 6d ed. Homewood, Ill.: Irwin, 1962. p. 896-904.

Defines nonmanufacturing cost accounting as (a) analysis and distribution of labor costs and (b) expense costs on the basis of some valid and acceptable unit of measurement and control.

Provides a list of functional cost element and the basis of distribution to the various departments in a department store. Uses percentages to indicate the relation between sales and each class of expense also the relationship between the net profit and sales.

Provides a list of types of office work and the cost analysis units that can be used.

States that cost accounting may be most readily used in those activities where there is some physical output and in those services in which the use of time, materials, and equipment is fairly constant and uniform throughout successive operations in relation to governmental activities.

Provides lists of sample governmental activities or services and the performance units for work measurement.

312 Neuschel, Richard F. Exploring the applicability of electronic data processing. In MANAGEMENT BY SYSTEM. New York: McGraw-Hill, 1960. p. 254-271.

Discusses steps taken in carrying out an electronics feasibility study, criteria to be applied, and pitfalls to be avoided in reaching a decision on (a) whether to install an electronic computer and (b) if so, what type of machine to select. Major steps are:

1. Realistic assessment of objectives and climate.
2. Preliminary size-up of opportunities.
   a. Clerical cost reduction.
   b. Number and location of persons engaged in process.
   c. Simplicity of process.
   d. Frequency of access.
   e. Degree of perfection already achieved in process.
   f. Improvement of management controls or operating results.
3. Detailed feasibility study.
   a. Development of system requirements.
   b. Impact of computer on organization.

c. Availability of competent staff personnel.
d. Alternative uses of talent.
e. Selecting hardware.

313 Neuschel, Richard F. Gathering the facts. In MANAGEMENT BY SYSTEM. New York: McGraw-Hill, 1960, p. 136-176.

Provides a checklist of types of information to be obtained in procedures studies. Shows how essential facts can be recorded to reveal significant relationships and facilitate analysis. Guidelines to be considered in conducting survey include:

1. Objectives and requirements to be met.
2. Organization and personnel. Structure of organization and principal functions of each unit.
3. Policies.
4. Details of existing procedure. Functions and operations, quantitative data, flow of work, and qualitative data.
5. Cost factors.
6. Effectiveness of procedure.
7. External factors.
8. Report, form and record check list.

In recording facts, charts or diagrams have considerable advantage over narrative descriptions. The four types considered are organization charts, procedure flow charts, work distribution charts and layout flow charts.

314 Nicolaus, John J. THE AUTOMATED APPROACH TO TECHNICAL INFORMATION RETREIVAL LIBRARY APPLICATIONS. Washington: U.S. Department of the Navy, Bureau of Ships, 1964. NAVSHIPS 250-210-2 (AD-446 643)

Project SHARP (SHips Analysis and Retrieval Project) was set up as a cooperative information retrieval project between David Taylor Model Basin and the Technical Library. Its prime purpose was to develop an efficient and workable retrieval system but many

beneficial side effects have been realized, such as automated compilation of the library's accessions bulletins, catalog cards, user interest registers and the master control file of technical journals and periodicals.

315 Niebel, Benjamin W. MOTION AND TIME STUDY. 3d ed. Homewood, Ill.: Irwin, 1962.

This text was written to assist the analyst in the determination of indirect labor standards, optimum number of facilities to be assigned an operator or group of operators, allowances to be included in a standard to provide for interference, delays and similar problems.

It includes material on waiting line theory, as applied to establishing indirect labor standards, and determining machine interference allowances. Monte Carlo methods are discussed for use where standard or empirical queuing theory equations are not obtainable. Use of the digital computer in establishing standard data the use of the "t" distribution for determining sample sizes, work sampling, and methods of establishing indirect labor standards are also discussed.

316 Norris, Elizabeth D. Establishing standards. SPECIAL LIBRARIES. 51:229-31, 1960.

The base for a set of standards for a special library is the organization's objectives. There are four methods that may be used to set up standards after the objectives have been determined.

1. Quantitative: Number of books and catalog cards, extent of subject resources, tools of bibliographic control and manpower examined by usual modern management methods. Measurable work estimated within specified time and budget.

2. Survey: Analysis of content and techniques of libraries within particular field, from standpoint of either current needs or current practices.

3. Existing standards: An existing standard of any organization may be submitted to ALA. However, existing standards and practices are usually confused.

4. Qualitative: Determination of library performance quality as the library fulfills its various functions.

317 Novick, David. PROGRAM BUDGETING:LONG RANGE PLANNING IN THE DEPARTMENT OF DEFENSE. The Rand Corp., Nov., 1962. RM-3359-ASDC

Describes the planning and programming process initiated within the DOD in early 1961 by McNamara and Hitch. The structure contains programs in terms of: missions, forces and weapons systems; the analytical comparison of alternatives: a continuously updated five-year plan; progress reporting against the plan, impact on planning in DOD and defense industry.

318 Odell, Margaret K. Information files: a method for automatic disposal of obsolete material. SPECIAL LIBRARIES. 45:199-202, 1954.

Proposes that users of library information files determine the disposal time of the material by grading it "permanent", "temporary" (with indication of period to be retained), "to be destroyed" or "transfer."

319 Odiorne, George S. Measuring organization performance. In MANAGEMENT BY OBJECTIVES. New York: Pitman, 1965. p. 80-97.

Discusses performance measures for managers and organization units. Measure of manager's performance is largely the measure of his organization's performance. Areas of responsibility must be defined and overall objectives determined. Achievement of detailed goals in each area is performance measure for subordinates.

For profit-making organization units, three accounting measures may be used: (a) profit - for those who control both revenues and costs; (b) revenues - for those who contribute directly to income; (c) costs - related to output on responsibility basis, separating expenses not subject to manager's control.

Performance budgeting provides measure for organization units which cannot be measured by profit, revenue or cost per output unit. Program must be determined before budget, according to three categories: (a) advice to improve effectiveness of other departments; (b) surveillance of operations of departments; (c) service functions performed for other departments, at expense of department or general administration. Evaluation of performance for manager of such a unit is achievement of predetermined program within budget.

320 Ohlman, Herbert. The activity spectrum: a tool for analyzing information systems. In Lawrence B. Heilprin, Barbara E. Markuson and Fredrick L. Goodman, Eds. PROCEEDINGS OF THE SYMPOSIUM ON EDUCATION FOR INFORMATION SERVICES. (American Documentation Institute) Washington: Spartan Books, 1965. p. 155-166.

Proposes the activity ratio as a prime tool for the classification of information activities. The monthly activity ratio (α_i) is defined as the number of potential transactions completed during one month, n_i, divided by the number of potential transactions available at the end of that month (for example, total number of items stored), N_m. The ratio multiplied by 100 becomes a percentage.

$$\alpha_i = \frac{n_i}{N_m} \times 100$$

An alternative way of examining library activities is the unit activity time, t_i, or average time required to complete a transaction. The monthly unit activity ratio is:

$$t_i = \frac{\sum_{j=1}^{n_i} t_i^j}{n_i}$$

Activity ratios are storage oriented. Unit activity ratios are input oriented.

Library activities examined with these formulas are charge-out; entire circulation control cycle (borrower registration, charge, discharge, overdues, reserves); reference service; reader service; shelf search; technical processing of new books (including binding, acquisitions); periodicals processing (including weeding, preparation of bibliographies and cumulative indexes, maintaining archives).

321 Oldaker, L. T. Adm[illegible]ion problems of a special libr[illegible]e service and its staff. ASLIB PROCEE[illegible]. 5:307-308, 1953.

Summary of qualities needed by staff in library or information service, noting that requirements will vary with nature of organization served.

1. Personal qualities. Adaptability, loyalty, tact, commercial-mindedness, versatility, ability to gain and hold confidence of technical and other experts whom library serves.

2. Subject and professional qualifications.

3. Experience. Not only in subject and library field, but relating to organization, its policies and people. New employees must be capable of rapidly acquiring this understanding.

4. Attitude. Must recognize need for active encouragement in use of library facilities rather than passively waiting for user's requests.

Also discussed were:

1. Status of head of information section or library should be at same level as other section heads. However, the inquirer has greater responsibility than librarian since he must determine final validity and usefulness of information.

2. Information officer should have sufficient technical knowledge that user can approach him as an equal.

322 Oltman, Florine A. Tools for the military librarian. SPECIAL LIBRARIES. 51:112-113, 1960.

A discussion of special problems of the military librarian and some suggested solutions. Military libraries frequently contain material ranging from early historical studies to the latest scientific information. The lack of cumulative military index with bibliographic information on specialized military literature increases the difficulties of learning what is available and how to obtain it. Some solutions are:

1. Examination of mission of organization served. This will determine functions and services to be provided by library. These should be coordinated at highest possible military level to maintain support and interest of organization served.

2. Determination of materials being issued by use of (a) distribution list of own military agency; (b) consultation with and help of users and military staff members; (c) accession lists and bibliographies of similar libraries; (d) indexes to reports by ASTIA, Rand Corporation, etc.; (e) reviews and reading lists of military journals; (f) Air University Periodicals Index, Union List of Foreign Military Journals, and other special tools.

323 O'Neil, John Tettemer, and others. Standards for controlling performance In QUANTITATIVE CONTROLS FOR BUSINESS - AN INTRODUCTION. Homewood, Ill.: Irwin, 1965. p. 238-257.

Analytical procedures helpful in interpreting data are examined. Questions asked in this procedure are:

1. How can standards be established for useful and meaningful application?
2. If standards have been set, must all results conform, or is some departure from standard permitted?
3. Within what limits is performance to be judged under control?

Accumulation and summarization of supporting data is necessary for all procedures leading to establishment of standards.

Methods are examined which are useful in establishing standards, cost or other aspects of performance. Several case studies illustrate application of methods.

324 Operations Research Incorporated. Appendix A - Active Navy. PROGRAM DEFINITION STUDY FOR TOTAL INFORMATION FOR MANPOWER MANAGEMENT SYSTEMS. Washington: Bureau of Naval Personnel, Personnel Research Division, New Developments Research Branch, 1964. NONR 4511(00) (AD-469 280)

Effective performance measurements consist of two main types: (a) operational effectiveness and readiness measurement for operating forces, and (b) productivity utilization and cost effectiveness in clerical areas of manpower management.

Six areas of performance measure are:

1. Navy manpower validation program.
2. Table of organization revalidation project.
3. Standard Navy maintenance and material management system.
4. Material essentiality through readiness indices.
5. Manpower control and utilization program.
6. Manpower utilization and productivity improvement program.

325 Operations Research Incorporated. Appendix B - Navy Reserves. PROGRAM DEFINITION STUDY FOR TOTAL INFORMATION FOR MANPOWER MANAGEMENT SYSTEMS. Washington: Bureau of Naval Personnel, Personnel Research Division, New Developments Research Branch, 1964. NONR 4451(00) (AD-469 281)

A measure of performance in the Reserves is determined by readiness of the units for mobilization. In aviation, the staffing criteria lean

heavily on engineered maintenance and operation (M & O) factors. Various criteria, such as flying hours, go into readiness reports.

Because of the subjective nature of the assessment, little basis exists for consistency and uniformity in performance measurement. Insufficient quantitative measures and methodologies are available to assess manpower readiness of the Naval Reserves.

326 Operations Research Incorporated. Appendix D - Navy civilians. PROGRAM DEFINITION STUDY FOR TOTAL INFORMATION FOR MANPOWER MANAGEMENT SYSTEMS. Washington: Bureau of Naval Personnel, Personnel Research Division, New Developments Research Branch, 1964. NONR 4451(00) (AD-469 283)

Report of study of manpower management in the Navy, to develop specific objectives for design of Total Information for Manpower Management Systems (TIMMS). Appendix presents information for civilian manpower management in terms of TIMMS.

Measures of performance were collected in terms of productivity, utilization, cost-effectiveness and statistical measures for all elements of organization and all types of support activities.

327 Optner, Stanford L. SYSTEMS ANALYSIS FOR BUSINESS AND INDUSTRIAL PROBLEM SOLVING. Englewood Cliffs, N.J.: Prentice-Hall, 1965.

This book gives an understanding of the role of a system in problem solving for private enterprise, government, and the military.

The author states that the generalization of problem solving methods does not infer that there are universal methods at the disposal of the systems analyst. To the extent that the reiteration of alternatives is an intrinsic part of the method, the method remains heuristic. Trial and error persist, but are in a slightly more formal arrangement. The method of problem solving fixes the critical elements

of analysis in appropriate relationship to the problem. This gives the analyst an understanding of how to structure parts of a problem and how to derive consistent solutions. In problems that are inherently ill-structured, the method provides a set of components to assist in the structuring process.

328 Organization for Economic Cooperation and Development. SETTING UP YOUR COMPANY'S TECHNICAL INFORMATION SERVICE. New York: McGraw-Hill, 1965. OECD unit. TMIS Annex. No. 18 081.

Provides basic information needed for the practical setup of an information service:

1. Initial setup costs. Room and furniture, collection, an appropriate abstract journal or two, stationery, duplicating or photocopying machine. Most of these are already on hand, and this cost is fairly small.

2. Running expenses. 65% to 85% of total cost will be salaries.

Many companies already receive and pay for journals; these expenses are not totally over and above current expenses. The library will save the time of valuable, high-salaried people and information will be retrieved more rapidly and efficiently. The cash outlay for initiating and operating an information service is an inaccurate measure of its real cost to the company.

329 Organization for Economic Cooperation and Development, Directorate for Scientific Affairs. PROPOSED STANDARD PRACTICE FOR SURVEYS OF RESEARCH AND DEVELOPMENT. (3rd Rev.) Paris: OECD, 1963. DAS/PD/62.47.

Discusses methods of defining and measuring national R&D activity.

Three steps are outlined to determine extent of R&D activity:

heavily on engineered maintenance and operation (M & O) factors. Various criteria, such as flying hours, go into readiness reports.

Because of the subjective nature of the assessment, little basis exists for consistency and uniformity in performance measurement. Insufficient quantitative measures and methodologies are available to assess manpower readiness of the Naval Reserves.

326 Operations Research Incorporated. Appendix D - Navy civilians. PROGRAM DEFINITION STUDY FOR TOTAL INFORMATION FOR MANPOWER MANAGEMENT SYSTEMS. Washington: Bureau of Naval Personnel, Personnel Research Division, New Developments Research Branch, 1964. NONR 4451(00) (AD-469 283)

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329 Organization for Economic Cooperation and Development, Directorate for Scientific Affairs. PROPOSED STANDARD PRACTICE FOR SURVEYS OF RESEARCH AND DEVELOPMENT. (3rd Rev.) Paris: OECD, 1963. DAS/PD/62.47.

Discusses methods of defining and measuring national R&D activity.

Three steps are outlined to determine extent of R&D activity:

1. Identification and measurement of total activity of research organizations.
2. Subtraction from total of non-research activities of research organization.
3. Addition to total of R&D activity performed outside research organizations.

The National Science Foundation criterion is recommended for determining cut-off point between development and production. Activities to improve products or processes are considered development, and activities to develop markets or do pre-production planning are production. Thus, design, construction and testing of prototypes falls within R&D.

The first stage in measuring R&D output is a precise evaluation of the input with which it must be compared. The two principal methods are:

1. Measure of R&D expenditures. Difficult because of shared overheads and capital expenditures.
2. Measure of R&D manpower. Considerably easier but requires man-hour calculations for personnel dividing time between R&D and other activities.

330 Orth, Charles D., Bailey, Joseph C., and Wolek, Francis. ADMINISTERING RESEARCH AND DEVELOPMENT: THE BEHAVIOR OF SCIENTISTS AND ENGINEERS IN ORGANIZATIONS. Homewood, Ill.: Irwin, 1964.

This collection of 36 cases on the management of research and development groups constitutes the first volume of clinical reports on administration in this area. These cases display the range of administrative response to the specialized situation--obtaining scientific and technical productivity from professionally-oriented men in an industrial environment.

Some of the areas discussed are work assignment and inter-personal relations, the optimum climate for industrial research and the nine dilemmas in industrial research.

331 Paisley, William J., and Parker, Edwin P. Information retrieval as a receiver-controlled communication system. In Laurence B. Heilprin, Barbara E. Markuson and Fredrick L. Goodman, Eds., PROCEEDINGS OF THE SYMPOSIUM ON EDUCATION FOR INFORMATION SCIENCE. (American Documentation Institute) Washington: Spartan Books, 1965. p. 23-31.

Outlines a communication researcher's view of the communication process underlying information storage and retrieval. System evaluation must involve detailed consideration of users' information needs and preferred search strategies. User satisfaction is the ultimate criterion. Psychological research is needed on: (a) information needs-recording perceived need and observing what information is utilized; and (b) information-seeking behavior.

The components of user satisfaction are classified as:

1. Probability that desired information is included in system.

2. Correspondence of users' search strategies with indexing strategy; extent to which system can accommodate search strategies and association patterns of variety of users.

3. Efficiency of form of information; extent of discrepancy of message retrieved from original messages; extent to which form of message meets user's needs and information processing ability.

4. Costs of information. Financial outlay, amount of time and effort expended by user, psychological costs to user.

332 Papier, Lawrence S. EVALUATION OF SCIENCE COMMUNICATION SYSTEMS. Edgewood, Maryland: U.S. Army Edgewood Arsenal, Chemical Research and Development Laboratories, 1965. CRDL Special Publication 4-65. (AD-615 108)

An evaluation of communication systems must encompass seven areas: objectives, user requirements, external relations, system properties, system efficiency, technical aspects, and operational aspects.

Criteria for the evaluation of systems are derived from a consideration of ultimate overall management objectives, user requirements, system properties, and design constraints of the system. While the fulfillment of user requirements can be considered to be merely one management objective, it is often considered the major objective of the communication system and receives special treatment.

The following statements might be used to evaluate a system:

1. Attract and retain productive scientific personnel.
2. Improve the quality, timeliness and relevance of the information.
3. Cut cost of research effort.
4. Cut cost of science communication system.
5. Develop new products.
6. Improve the profit situation.
7. Meet competitive challenge.
8. Increase efficiency of scientific technical personnel.

333 Patrick, A. W. Some observations on the break-even chart. In Lemke, Bernard C., and Edwards, J. Don, Eds., ADMINISTRATIVE CONTROL AND EXECUTIVE ACTION. Columbus: Merrill, 1961.

This text reviews the break-even concept and discusses its application in situations when production does not equal sales, during a given period.

Also included is the break-even chart, which relates dollars of cost and sales to volume of units produced, and guidance on the determination of product cost.

334 Payne, Bruce. Steps in long-range planning. In LONG-RANGE PLANNING FOR MANAGEMENT. New York: Harper & Brothers, 1964. p. 113-135.

Outlines six criteria useful to top management in evaluating long-range plans.

1. Determine the key influences in the growth of the industry and evaluate influence of each.
2. Evaluate the strengths and weaknesses of the company accurately.
3. Capacities of different company functions to support the plan must be projected far ahead.
4. Determine a practical timetable.
5. Consider alternatives.
6. Provide for future reverses.

335 Perry, James W. Defining the query spectrum - the basis for developing and evaluating information retrieval methods. IEEE TRANSACTIONS ON ENGINEERING WRITING AND SPEECH. EWS 6:20-25, 1962. (AD-434 293)

An information retrieval system is an interaction between an information requirement and a given file of documents. The degree of satisfactory service provided for queries that constitute a given query spectrum is essential in evaluating benefits.

Research management is responsible for providing such facilities as special libraries, IR systems, etc., and urging effective use. Among problems which confront research management are:

1. Active scientists prefer laboratory to library work.
2. Library administrators often prefer traditional indexing and classifying methods to newer retrieval methods.
3. Determining type of query that receives the best response from available information without incurring additional expenditure of time or money.

Queries to a Patent Office IR system have the following characteristics:

1. Represent broad and diverse fields of technological research and development.

2. Are diverse in scope and evoke responses useful in planning, conducting and evaluating R&D.
3. Relate directly to well-defined statements.
4. Pertain to two types of queries. (a) Provide information for direct application. (b) Provide background information for planning and conducting R&D.

336 Perry, James W., and Kent, Allen. DOCUMENTATION AND INFORMATION RETRIEVAL; AN INTRODUCTION TO BASIC PRINCIPLES AND COST ANALYSIS. New York: Interscience, 1957.

Selection operations for large collections should be: (a) capable of eliminating irrelevant items, (b) able to select items of pertinent interest, (c) reliable.

Decision making should include benefits lost, expenses incurred, information not retrieved, extent to which greater costs for information systems are justified by more reliable results.

A mathematical analysis of various operations involved in using recorded information centers upon: (a) costs of processing information; (b) costs of conducting searches and achieving correlations when information is processed in various ways; (c) storage of graphic records, compartmentalized classification and alphabetized indexing.

Operations are ideal when:

$$m = w = x$$

where m = selected items, w = number of items within m of pertinent interest, x = items pertinent to given problem.

337 Personnel Survey, 1959. SPECIAL LIBRARIES. 51:133-155, 1960.

Data summary of the 1959 Special Libraries Association Personnel Survey, involving 1130 special libraries and 2311 professional librarians in the U.S. and Canada.

Average percentages of time devoted to various duties:

Administration and supervision	16%
Reference	16%
Cataloging	10%
Literature searching	8%
Acquisition	6%
Classification	6%
Indexing	6%
Planning, policies, procedures	5%

Less than five percent to the following:

abstracting, editing, research, translating, archives, bibliography, circulation, filing, other duties.

338 Peterson, H. N. Performance budgeting, work measurement, and the public library. WILSON LIBRARY BULLETIN. 27:620-623, 1953.

The Bureau of the Budget has defined work measurement as a system of establishing an equitable relationship between volume of work performed and time expended. In performance budgeting, work measurement helps to (a) determine, explain, and evaluate program cost; (b) determine personnel requirements and appropriate unit costs; and (c) support requests for personnel ceilings and fund allotments.

In the area of management improvement, work measurement helps to: (a) keep workload and personnel in balance; (b) analyze performance in comparable operations; (c) indicate need for management studies; (d) check results of action taken; and (e) relate personnel program to management needs.

The following criteria of a valid work unit for work measurement purposes have been listed by the Bureau of the Budget. It must (a) be countable (expressed in quantitative terms); (b) express output (volume of work completed); (c) reflect work effort; (d) have consistency; and (e) be expressed in familiar terminology.

339 Peterson, Robert L. OFFICE WORK STANDARDS. (Bureau of Business Management Bulletin No. 501) Urbana: Univ. of Illinois, 1951.

A standard is essentially a criterion of measurement, quality, performance, or practice. Values of work standards are: (a) uniformity of product, (b) higher work quality, (c) increased productivity, (d) production control, (e) fuller utilization of personnel, and (g) improved worker morale.

Quantity standards rate productivity; quality standards rate accuracy and precision; quality-quantity standards consider both number of units and accuracy. Standards should be accurate, workable, and flexible.

Aspects of planning the work standards program are (a) management support, (b) standards analysis, (c) job analysis, (d) work simplification, and (e) measurement.

Work standards can be set through (a) time and motion studies, (b) subjective judgement (not recommended), and (c) study of production records. Adjustments should be made for errors, and some incentive, financial or nonfinancial, should be offered.

340 Pierce, Watson O'D. WORK MEASUREMENT IN PUBLIC LIBRARIES. New York: Social Science Research Council, 1949.

Report of a detailed analysis of library processes in three public libraries of widely different size. Professional and non-professional activities in 21 library operations were classified and library staff kept records of time distribution and work units in these activities.

Operations were acquisitions, cataloging and classification, mechanical preparation of new material, registration of patrons, circulation, work with children, work with schools, information service, reference and advisory service, work with organizations and groups, preparatory activities, administration-general and departmental, administration-personnel, publicity and public relations, binding and repairs, maintenance, printing, security, travel and shipping, miscellaneous.

In conducting such a study, all operations must be measured at the same time. After study has been completed and modifications put into effect, study should be repeated only for departments and individuals directly affected by change.

Values of system include: (a) gives each staff member a feeling of the importance of studying his activities, (b) provides basis for individualized training program, predicting work loads, measuring effectiveness of changes, determining individual differences and using them to best advantage.

341 Poole, Frazer G. Performance standards and specifications in the library economy. LIBRARY TRENDS. 11:436-444, 1963.

Outlines method to be followed in development and use of performance standards for library consumer goods.

1. Developing standards: determination of (a) characteristics of product; (b) need for standards; (c) clear, measurable specifications; (d) economical and practical test methods.
2. Establishing standards: Considerations are (a) scope -- omitting irrelevant product characteristics; (b) level of quality -- balancing cost of producing quality level with degree of improvement achieved; (c) tolerances or permissible variation; (d) flexibility -- to adjust to future technological changes.

342 Postley, John A. REPORT ON A STUDY OF BEHAVIORAL FACTORS IN INFORMATION SYSTEMS. Los Angeles: Hughes Dynamics, Advanced Information Systems Dept., 1965. NSF-C265. (AD-419 622)

Evaluates effects of behavioral factors on the attainment of objectives of computer-based information retrieval systems. Much is applicable to information systems generally. Need for study comes from great variation in total effectiveness of different systems with similar operating environments and objectives.

Measures of effectiveness must consider system goals as well as objective criteria such as cost and machine utilization. Implicit system goals are best understood by increased understanding of system designers and operators. Effectiveness depends upon the attitudes and goals of the people who manage, create, maintain and use the system. The study was concerned with three major areas: (a) attitude identification and measurement, (b) analysis of organizations, (c) descriptive and objective criteria of effectiveness.

The study of the problem of developing criteria for measuring system effectiveness revealed very few common trends. In some cases cost was considered the only criterion, with great divergence on how to determine cost. Others felt that indirect benefits are a measure of system effectiveness and considered such matters as direct service to users, unanticipated benefits, and speed of reporting.

343 Prentice-Hall, Incorporated. HANDBOOK OF SUCCESSFUL OPERATING SYSTEMS AND PROCEDURES, WITH FORMS. Englewood Cliffs, N.J.: Prentice-Hall, 1964.

A handbook which illustrates, from the systems viewpoint, the forms and reports through which systems work. It shows the forms and reports used for each system--whether the system is manual, mechanical or electronic. In most cases, several approaches have been presented for each system and each degree of mechanization, and shortcuts and labor saving techniques have been pointed out. Included in this book are chapters dealing with administrative control, personnel records, systems surveys, forms design and control and production control records.

344 Prevot, George W. Describing and analyzing the librarian's job. SPECIAL LIBRARIES. 52:450-452, 1961.

Discusses job evaluation at the Metropolitan Life Insurance Company.

Job ev luation at this company embraces six factors:

1. Job knowledge--company knowledge (rules, work flow, company organization) and specialized techniques.

2. Machine skills.

3. Special mental abilities (creativeness, judgment).

4. Accuracy.

5. Public and internal relations (tact, patience).

6. Physical working conditions.

Job descriptions are prepared by the immediate supervisor along with the present job occupant, reviewed by the supervisory chain prior to submission to personnel division, where they are reviewed by trained job analysts.

Points are assigned to each applicable factor, and the total converted to a classification. Job evaluation committee then prepares recommendations for management approval.

Process determines worth of job rather than of individual occupying the job.

345 PROCEEDINGS OF THE EIGHTH MILITARY LIBRARIANS' WORKSHOP. Kirtland Air Force Base, New Mexico: Air Force Weapons Laboratory, 1964. (AD-632 300)

Three groups examined military libraries and made the following recommendations:

1. Top management should issue a clear statement regarding position, functions

and responsibility of the library, and the authority of the librarian.

2. The library should be kept aware of long-range policies and programs; placed in the organizational structure at a point which will ensure its optimum performance; located, equipped and funded for the maximum support of the agency's mission; and represented in all matters which affect it.

3. The librarian should publicize library services; attend professional meetings at government expense; hold primary responsibility for the content of collection; impart to subordinates that service to clientele is of primary importance; work to develop improved classification and qualification standards; and exert an influence on educational institutions to develop curricula for special library needs.

4. Management and library should join forces to develop more effective means of communication; all incoming staff members who will be library users should be scheduled for a library indoctrination program.

5. An office of primary responsibility for library matters should be established at DOD level and at appropriate subordinate levels of command.

346 Pundsack, Fred L. What the user expects from a library. SPECIAL LIBRARIES. 46:163-166, 1955.

Defines the areas in which the research man uses the library: (a) mastering facts discovered by previous workers, and (b) stay abreast of contemporary discoveries. Library services should meet the following needs:

1. Accessible reference books. Permanent loan system for frequent users.
2. Highly selective abstract bulletin including patent abstracts, information on acquisitions.
3. Indexing and cross-indexing of company reports.

4. Technical publications file supplemented by copies of articles of special interest, with a means of reproducing copies. Retaining of bound periodical volumes.
5. Translations, by library staff or outside service.
6. Literature searches. User must clearly define subject and time period, should conduct own search when possible.

Two means are suggested for improving library-user relations:

1. Library committee composed of representative users, to (a) furnish liaison between users and library, (b) suggest improvements and new library services.
2. Educate user to services by (a) preparation of written introduction to library, and (b) informal talks by library staff members.

347 Putnam, Arnold O., Barlow, E. Robert, and Stilian, Gabriel N. UNIFIED OPERATIONS MANAGEMENT. New York: McGraw-Hill Book Co., 1963.

This book explains how to achieve maximum operating efficiency through the new techniques of operations research, information flow, and direct cost accounting, together with functional profit-planning under the guidance of a top-level administrator.

Stressing the interrelationships of the different parts of a business, this book indicates how techniques that boost profits in one part of the business may increase costs in another part to the point where all gains from the use of the technique are lost. Also shown is how to avoid the costly pitfalls that can result from misuse of these techniques.

348 Pyle, Helen. Why's, when's, and how's of library planning. In M. P. Hilligan, Ed., LIBRARIES FOR RESEARCH AND INDUSTRY--PLANNING AND EQUIPMENT, New York: Special Libraries Assoc., 1955.

Considerations in planning a special library include: (a) the aim of the library, and (b) the services that will be provided. The report to management must provide specific recommendations on the following space requirements: (a) capacity for books, etc.; (b) reading and circulation area; (c) equipment--usual (card catalogs, files, etc.) and special (map cases, microprint readers, etc.); (d) staff operations -- work and services in a convenient layout; (e) storage; (f) exhibits; and (g) expansion.

Physical factors to be considered include: (a) structural features--lighting and wiring; heating, ventilation, air conditioning; acoustics; telephone locations; height of ceiling; (b) equipment and decor--floor coverings, furniture, decoration, color; and (c) effects of partitions.

349 Quatman, G. L. THE COST OF PROVIDING LIBRARY SERVICES TO GROUPS IN THE PURDUE UNIVERSITY COMMUNITY, 1961. Lafayette: Purdue Univ., 1962.

Report of study at Purdue University to determine average costs of providing library services and facilities to university researchers sponsored by outside organizations. Specific aim was to determine whether a weighting system should be applied to population figures to provide equitable results, and to determine the most appropriate weighting system. Two approaches are possible for allocation of library funds.

1. Intended use. Based on estimated amount of library materials and services intended for undergraduate, graduate and faculty use. From this a ratio of costs for sponsored research to costs for undergraduates was estimated.

2. Actual use. Based on survey of actual usage by undergraduates, graduates, faculty members and others. More objectively quantifiable - method used in study.

Method. 20 library services defined. Usage reported by users on survey cards and by library staff on data sheets during 20-day survey period. Cost accounts used in allocating library expenditures to the 20 services by class of user were: salaries, equipment, space (utilities and building use), supplies, materials.

350 Quinn, James B. YARDSTICKS FOR INDUSTRIAL RESEARCH. New York: Ronald Press, 1959.

In a study of firms involved in research and development, it was learned that many rely heavily on quantitative measures to evaluate R&D effectiveness.

It is a better approach to use some quantitative devices but to depend primarily on individual or group judgment and rely little or not at all on quantitative evaluative devices.

351 Radio Corporation of America, Alexandria, Virginia. CRITERIA FOR VALUE ENGINEERING. PHASE I. FEASIBILITY STUDY. By R. E. Purvis and others. Washington: U.S. Air Force, 1966. AF30(620)-3850 (AD-630 207)

States the evaluation of function as present state-of-the-art of value engineering theory. Value engineering approach represents a qualitative rather than quantitative process.

Proposed technique for value analysis questions (a) constraints of contract, (b) mission of contract, (c) constraints of abilities, (d) alternatives to the design and (e) parameters of the function of the product.

Problems presently existing are the need for quantitative criteria, to orient value analysis to total expected resource cost and a feasible systematic procedure for evaluation of alternatives.

Cost analysis is based on sequential decision processes, using three types of events: (a) feasible alternatives, (b) chance events, (c) program schedule. Detailed cost

procedure defines total cost of a system as T = A + S, where T = total cost, A = cost of acquisition and S = cost of operation and support. Elements to be considered in cost of acquisition include all charges arising from design, development, fabrication and installation of equipment. Cost of operation and support includes costs (for military examples) at organization, at field, at depot and at factory.

352 Rand Corporation. ARMY COST MODEL DATA. By A. J. Meltaner, R. A. Martyn, and J. J. Pringle. Washington: Department of Defense, 1963.

This memorandum documents the Army Cost Model developed for the Programming Office of the Assistant Secretary of Defense (Comptroller). This model is a device used for computing resources and costs required for alternative mixes and employments of Army forces.

353 Rand Corporation. PROGRAM BUDGETING: LONG RANGE PLANNING IN THE DEPARTMENT OF DEFENSE. By David Novik. Washington: Department of Defense, 1962. RM-3359-ASDC

The text describes the planning and programming process initiated within the Department of Defense in early 1961 by McNamara and Hitch. The significant portions of the structure contain such items as: programs in terms of missions, forces and weapons, systems; the analytical comparison of alternatives; a continuously updated 5-year plan; progress reporting against the plan; impact on planning in Department of Defense and defense industry.

354 Randall, Gordon E. Journal routing: greater efficiency at lower cost. SPECIAL LIBRARIES. 45:371-373, 1954.

The AEDC library decided to route copies of the tables of contents of periodicals, then the magazines upon request. These benefits resulted:

1. Prompt notification of the contents of new journals (previous system frequently took three months).
2. Receipt of user requests determined the order of journal routing.
3. Users received only those issues they are interested in.
4. A few journals were routed automatically to appropriate departments.
5. Valid loans increased.
6. Cost was reduced.
7. Length of loan was reduced from from four days to two days with new system--journals were routed twice as fast.

355 Randall, G. E. Special library standards, statistics, and performance evaluation. SPECIAL LIBRARIES. 56:379-86, 1965.

Criticizes 1964 SLA standards as too vague. Provides the following modifications.

1. Staff: ratio of one staff member to 100 potential or 75 actual users for library providing minimal services, additional staff if journal routing, bibliographic compilation, etc., provided.

2. Collection: at least one journal subscription and 15 books per user; at least 85% of loans to come from library's own collection.

3. Circulation:

   a. Six-to-one circulation to acquisition ratio.
   b. Circulation figure equal to 90% of total collection.
   c. Yearly circulation rate per user of 20-30.
   d. Some form of recall system.

4. Physical facilities: 27-75 sq. ft. reading area per reader; individual tables or carrels rather than large tables.

5. Budget: differs from SLA standards in giving literature collection rather than salary allocation the first priority.

356 Randall, G. E. Who uses a technical library? SPECIAL LIBRARIES. 47:195-199, 1956.

A study of Arnold Engineering Development Center circulation patterns disclosed a ratio of one actual user per four potential users; a direct correlation between job complexity and library use (93% of the instrument engineers, 62% of the maintenance or operation engineers, 1% of the wage-earning maintenance service division); that geographic separation from the library facilities did not cause decreased library use; and that of 620 library users, 421 borrowed books, 249 borrowed journals, and 150 borrowed reports; 120 used recreational books, and 89 borrowed recreational journals.

357 Rath, Gustave J. Research on the management of research and development: initial steps toward studies of the informational behavior of scientists and engineers. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 435-445. (AD-632 587)

Discusses some research problems and mentions some systems which would resolve the questions.

Various measures have to be developed to assess empirically the performance of alternative information services, such as:

1. Continued use of the system.
2. Frequency of use.
3. Effect of discontinuance on user performance.
4. Attitude toward system.
5. Content of communication events between scientists.
6. Psychomotor measures of user responses.
7. Direct comments from subjects.
8. Research effectiveness (time, cost and success of problem solutions).

Some methods used in investigating information needs and uses are:

1. Tabulation of published material.
2. Computation of bibliographies.
3. Checking use made of each library item.
4. Reference counting. Counting references in papers users have written.
5. Individual rating. Specialists select key journals in a field.
6. Questionnaires and interviews.
7. Diary.
8. Case study.

358 Rees, Allen M. Criteria for the operation of libraries and information retrieval systems. SPECIAL LIBRARIES. 57:641-642, 1966.

States that two sets of criteria are needed for evaluation:

1. Measure of effectiveness -- extent to which a library fulfills its purpose.
2. Measure of efficiency -- cost and time expended in achieving purpose.

Adequate effectiveness criteria must be based on a clear and quantitative definition of library purpose. To achieve such criteria:

1. Means must be developed to quantify library performance, through cooperative efforts of librarians and systems analysts.
2. Role of the library in R&D must be examined, including patron's use of information, purpose and effect of use.
3. Use of relevance as a criterion measuring customer satisfaction must be decreased because based on subjective judgement.

359 Rees, Alan M. THE EVALUATION OF RETRIEVAL SYSTEMS. (COMPARATIVE SYSTEMS LABORATORY TECHNICAL REPORT No. 5). Cleveland: Western Reserve University, School of Library Science, Center for Documentation and Communication Research, 1965.

Reviews the literature on testing and evaluating information retrieval systems and relates that the subject has been discussed many times but little experimentation actually has been done. The amount of data on this subject is voluminous but still quite cloudy. Discusses the problems of relevance, recall, precision, sensitivity, specificity and effectiveness. Effectiveness is a combined measure of sensitivity and specificity.

$$Es = \frac{a}{a + c} + \frac{d}{b + d}$$

where Es = effectiveness, a = relevant material retrieved, b = non-relevant material retrieved, c = relevant material not retrieved, and d = non-relevant material not retrieved.

360 Rees, Alan M. Information needs and patterns of usage. In Center for Documentation and Communication, INFORMATION RETRIEVAL IN ACTION.Cleveland: Western Reserve Univ., 1963. p. 17-24.

Discusses ways information needs vary in relation to type of activity in which user is engaged.

1. Basic research. User literature-oriented, trained to locate information for himself has high regard for recorded information.

2. Applied research. User less literature-oriented, has less value for recorded information, is more willing to delegate literature searching responsibilities.

3. Management. Has need for technical, economic, political, sociological information, interest in all information which can contribute to furthering of institution objectives.

Problems in satisfying information needs include: (a) difficulty in assessing monetary value and justifying expenditure for information services; (b) dissatisfaction with library-based information services; (c) inefficient utilization of personnel and funds in operation of both library and laboratory-based information services; (d) lack of active library educational promotional services; (e) difficulty of obtaining suitable personnel or determining type of training needed to meet information needs.

Research is needed to define why and how scientists desire information, circumstances and form of information in relation to various needs.

361 Rees, A. M. Semantic factors, role indicators, et alia. ASLIB PROCEEDINGS. 15:350-363, 1963.

Three factors of the indexing variable in retrieval systems were investigated at Western Reserve University:

1. The sensitivity, specificity, effectiveness, efficiency, and performance of indexing languages.
2. The extent to which devices built into an indexing language such as role indicators, thesaurus, interfixing, etc., contribute to sensitivity, specificity, effectiveness, efficiency, and performance.
3. The consistency with which the indexing language is applied by indexers to documents.

User evaluation of system output will provide data with which to assess sensitivity, specificity, efficiency, effectiveness, and performance.

The concepts of relevancy and pertinency are critical to this study. Relevancy is a property which corresponds to a question, while pertinency corresponds to a need. The degree to which relevancy and pertinency coincide is a measure of the questioner's ability to represent his need in terms of a formal statement, the skill of the question analyst, and the effectiveness of the indexing language.

362 Reeves, Pamela W., and others. THE LIBRARY OF TOMORROW--TODAY. Cleveland: Weatern Reserve Univ., Center for Documentation and Communication Research, 1962.

Overriding considerations in every part of information retrieval system are:

1. Identification of users' needs, including scope and depth of user interest.

2. Establishment of flexibility to reflect change in users' needs and character of material as soon as identified.

Unit operations on which all systems can be compared are: (a) identification, (b) acquisition on representative and comprehensive basis, (c) analysis, (d) terminology, (e) searching, (f) dissemination.

Variables to be considered in figuring cost of input are: (a) maintenance of staff, (b) amount of specialization, (c) degree of complexity, (d) urgency, (e) coverage, (f) number of times same question is asked.

Variables in output cost are: (a) question analysis, (b) search, (c) transmission of answer to questioner.

Input cost is a direct function of techniques employed in processing literature. The better the technique, the lower the cost. As training of analyst increases, so does the cost of analysis. Cost of system or any part of system can only be evaluated in terms of criteria used to evaluate that system or part.

363 Riccardi, Michael F. Measuring and appraising maintenance performance. In Elmo J. Miller and Jerome W. Blood, Eds. MODERN MAINTENANCE MANAGEMENT (MANAGEMENT REPORT No. 77). New York: American Management Association, 1963. p. 108-121.

Discussion of reports useful in measuring and appraising maintenance performance.

Routine analysis report is used for analyzing and evaluating the programs to the work being done,

when it is done, the number of times scheduled, the number of times actually started and completed, and the number of man-hours required to complete the work. Column headings include estimated hours per frequency, average actual hours per frequency, times job is scheduled, times job is started, total estimated hours, and total actual hours.

364 Richardson, William H. Circulation control. SPECIAL LIBRARIES. 51:493-496, 1960.

Describes the punched card circulation systems of IBM Advanced Systems Development and Research Library, IBM Research Library and the Sandia Corporation Library. The advantages of these punched card circulation systems are:

1. Manual operations are eliminated.

2. Time spent on circulation processes, both by library staff and machine operators is the same as was spent by the library staff alone, but four times as many overdue notices and twice as many borrower lists can be processed.

3. Can tell easily if an item is charged out, where it is and when it is due.

365 Richmond, Phyllis A. Systems evaluation by comparison testing. COLLEGE AND RESEARCH LIBRARIES. 27:23-30, 36, 1966.

Discusses the difficulties of adjusting for variable factors in comparing information storage and retrieval systems. Distinctions must be made among the purposes and operations of different kinds of systems. The successful use of the special vocabulary of a coordinate indexing system, which has minimally defined terms, depends upon its use in a limited, homogeneous field. The simplicity of the system is the basis for its effectiveness in a narrow field. This disappears when used outside the field, because with exact definition one must have exact rules for application and exact designations of which kind of relationships may be made between terms.

The important factor in comparing systems is not to show whether one is better but whether each system does what it was designed to do, where it fails and where it could be improved. Comparison of unlike systems should be on the basis of clearly stated criteria and lead to possible adoption or adaptation of desirable features from one to another. Questions to be asked are: (a) Are they comparable? (b) What was each system designed to do? The comparison should assess results of input overload. The user is the ultimate authority.

366 Rifkind, Bernard D., Conner, Raymond A., and Chad, Seymour W. Applying work measurement to personnel administration. PUBLIC ADMINISTRATION REVIEW. 17:14-19, 1957.

Discussion of the bases for determining manpower requirements for personnel administration in federal agencies. Three main factors are distinguished:

1. Mission of agency. Agency functions vary in number and degree of technical difficulty. Personnel programs in recruiting, classifying positions and training work force vary with these functions.

2. Scope of field activities. Agencies with some activities performed outside of Washington must determine which personnel activities can be decentralized and which are most efficiently performed by central personnel office.

3. Stability of agency programs. Staffing of new agencies, major expansions and contractions of work force, frequent changes in organization and physical location have direct effect on personnel office work load.

367 Risk, J. M. S. Information services: measuring the cost. ASLIB PROCEEDINGS. 8:269-287, 1956.

Outlines means of applying cost accounting methods to information services:

1. Measuring total cost for staff; material; outside services such as binding, repairs; information and knowledge; external payments

such as legal fees, audits, insurance; charges for equipment use; interest charges on capital invested in books and equipment.

2. Defining activities under direct customer services and indirect work.

3. Determining units of output: (a) Measurable unit of output for each activity, where possible. (b) Measure of work normal person can do under satisfactory conditions at normal pace, or standard hour. This provides common unit to compare and add different activities.

4. Uses of standard hour work measure: (a) Divide standard hours produced by hours worked, multiply by 100 for rate of output. (b) Divide budgeted total cost by standard hour for budgeted cost of services. (c) Use data for planning work loads, forecasting effect of peak periods of work, budgetary control, etc.

368 Roberts, E. B. THE DYNAMICS OF R&D. New York: Harper and Row, 1964.

This is a report of an exploratory study of the dynamics of research and development with special reference to weapons and space projects. The author proposes new systems for studying and managing R&D, based on the concepts of industrial dynamics and using mathematical models as specific measuring devices.

369 Robichaud, Beryl. SELECTING, PLANNING, AND MANAGING OFFICE SPACE. New York: McGraw-Hill, 1958.

A guide to selection, planning and managing office space, answering questions such as:

1. What is the best location for a particular office.
2. Will our needs be served better by an office built to our specifications or by adapting an existing structure.

3. How do we determine how much space to provide.
4. What interior arrangement will best enhance our ability to achieve our objectives.
5. How should we place our office function in the layout pattern.
6. How should we select furnishings to serve our operating demands most effectively and economically.
7. How do we develop specifications for the maintenance of our office premises and furnishings.
8. Should we provide maintenance services ourselves or hire outside contractors.

370 Robinson, Russell L. Managing the office services function in a modern business enterprise. In CHANGING DIMENSIONS OF OFFICE MANAGEMENT. (AMA MANAGEMENT REPORT NO. 41) American Management Association, 1960. p. 21-25.

Organization is considered prime responsibility of manager of the office services function. Clearly stated objectives and well defined areas of responsibility are important.

Guidelines for a sound approach to organization of office services:

1. Determine objectives of office services function.
2. Segregate total work load into clearly defined positions and components.
3. Job descriptions should clearly and sharply define responsibilities.
4. Eliminate shared or split responsibilities.
5. Design organization structure facilitating fast, accurate communication, both upward and downward.
6. Prepare organization chart showing reporting relationships.

Another important responsibility of manager of office services function is control (measuring effectiveness). Profit and loss concept is used to measure effectiveness of office service. To establish operating concept for office services, the following steps are suggested:

1. Organization of each service unit as complete business entity with logical and well defined work scope.
2. Separate financial budgets and measurement systems for each unit.
3. Assignment of definite facilities for each unit.

371 Roman, Daniel D. The PERT system and appraisal of program evaluation and review technique. JOURNAL OF THE ACADEMY OF MANAGEMENT. 5(1):57, 1962.

The author expresses the idea that PERT is essentially a planning and control concept designed to focus managerial attention on key program developmental parts, point up potential problem areas which could disrupt program goals, evaluate progress toward the attainment of program objectives, give management a prompt mechanical reporting device, and aid and facilitate decision making. In order to accomplish these objectives, PERT uses time as the common denominator to reflect three categories of factors which influences success, time, resource applications, and required performance specifications.

372 Rosenblum, Richard S. Information requirements for development decisions. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 391-400. (AD-632 587)

Concerns function and value of information as it affects the conduct of organized development projects. Major function of information in an organized development effort is to guide the decisions which allocate resources to alternative activities.

To acquire information, the value of the result should be comparable in some rough measure to the cost of the activity. This idea underlies the techniques for experimental design and is at the base of the scientific method. The role of information in a purposeful activity should be based on some explicit conception of the character of that activity. A much

closer linkage should exist between the study of decision making and research on information systems.

Measures of value cannot be considered separately from range of economic factors inherent in choices affected by information. Information which does not change behavior has no value within activities having economic aims.

373 Rowland, Virgil K. Other special development techniques. In IMPROVING MANAGERIAL PERFORMANCE. New York: Harper, 1958. p. 152-156.

Discussion on setting standards of performance. Examples are given outlining organization plans for (a) departments reporting to general accountant and standards of performance for superintendents, and (b) some standards of performance for supervisors of the accounting department.

Example (a) is broken down as follows:

1. Organization planning - defining and grouping activities of department for effective performance.

2. Work scheduling - determining when, where and by whom a given job will be performed and amount of time needed to do it.

3. Communication - interchanging information, ideas and opinions for most effective operation of departments.

4. Delegation - assigning responsibility with commensurate authority to perform work and personnel functions more effectively.

5. Supervisory development - helping supervisors improve their present performance to prepare them for advancement.

Example (b):

1. Controlling costs.
2. Organization planning.
3. Assigning work.

374 Rubenstein, A. H. COORDINATION CONTROL AND FINANCING OF INDUSTRIAL RESEARCH. New York: Kings Crown Press, 1955.

There is no fixed or accepted formula for determining the financial return from research. One method of evaluation used is the index of return. This evaluation system involves the preparation of estimated index of return which has the approval of the research, sales, patent and production departments. This estimated index is computed using the actual index each quarter and progress is closely observed.

375 Rubenstein, Albert H. Setting criteria for R&D. HARVARD BUSINESS REVIEW. 35:95-104, 1957.

Discussion of control and evaluation criteria for R&D programs. Major difficulties are (a) uncertainty about outcome of individual projects and entire research programs, time and money required; and (b) difficulty of assessing success of completed project.

Seven categories of criteria for judging progress and results of R&D work established through 1956 M.I.T. survey: (a) effect of sales volume or revenue; (b) effect on materials, labor or other savings; (c) effect on profits; (c) time and cost of technical solution; (e) customer satisfaction; (f) information out-put; (g) success of technical solution.

Mathematical formulas used in evaluating R&D include Olin-Mathieson Index of Return formula, which credits research with sum of process savings for one year and a fixed percent of sales for new and improved products for given time periods.

Control and evaluation considerations must involve design features (facilities, communication techniques, operating procedure, organizational location, information sources, number and kind of people engaged in the activity as well as information output and economic results. The effects of design features on economic results and information output must be examined as well as the effects of information output on economic results.

376 Rubinoff, Morris, and others. THE EVALUATION OF TECHNIQUES AND DEVICES AS APPLIED TO PROBLEM SOLVING. Philadelphia: Goodway Printing Co., 1965. AF30(602)-3065 (AD-614 228)

Discusses the problem of forecasting technological change, examining the use of machines and computer programs having problem solving capabilities and human processes of problem solving. Forecasting is a kind of information handling, with the ultimate goal of retrieving and manipulating information in support of intelligent analysis and conclusions. Manipulation must (a) filter out irrelevant information, (b) guess at missing relevant information, (c) propound goal or goals which information appears to support.

Other tests exist to measure creative abilities. These include the factor analytic approach and the criterion group empirical approach. Techniques which have been used to develop criteria for research are:

1. Overall performance ratings by supervisors.
2. Creative rating by supervisors.
3. Quantity of patents.

377 Ryans, David G. EVALUATION AND THE IMPROVEMENT OF INSTRUCTION. Santa Monica: System Development Corporation, 1964. (AD-443 747)

Discusses the contributions of measurement and evaluation and their role in a theory of instruction. The theory is an information-system model of instruction in which the primary task of the teacher is the selection and organization of information for forwarding to the learner.

Emphasizes the importance of employing measuring and evaluation devices geared to the information to be conveyed, and the need for determining the portion of the students' information resulting from instruction rather than prior knowledge.

378 Sable, Ernest M. A management concept of the modern special library. SPECIAL LIBRARIES. 55:23-26, 1964.

The overall function of the organization guides the purposes, goals and aims of the library. The library should not be an end product in itself, but a support of the total organizational program and goal. The library must constantly test and evaluate systems and procedures to check for consistency with the primary goals and purposes of the firm.

The librarian should:

1. Be a part of the management team.
2. Attract consumers to the library.
3. Sell the library services to the staff.
4. Get full support from management.

379 Sailer, Allen John. LINEAR PREDICTION MODELS FOR A MECHANIZED INFORMATION SYSTEM. Unpublished master's thesis, University of Pittsburgh, 1966. (AD-481 444)

Discusses the growth of information centers, particularly the history of the University of Pittsburgh Knowledge Availability Center.

Regression analysis is an estimation of prediction of value of one variable from values of other given variables. Linear regression is a straight-line relationship between two or more variables. A functional or close relationship is one where a dependent variable can be determined exactly when independent variables are known. In linear regression the relationship is weaker. Non-linear or curvilinear regression is employed where observed data do not possess the characteristics necessary for use of a linear curve and another type of mathematical function must be fitted to the data.

In determining a multiple regression, variables must be readily measurable or observable, contribute significantly to effectiveness of relationship. Number of variables should be limited because three or four

will generally provide satisfactory relationship, work increases rapidly with number of variables and an equation with many variables is seldom easily applied in subsequent predictions.

380 Salton, Gerard. The evaluation of automatic retrieval procedures--selected test results using the SMART system. AMERICAN DOCUMENTATION. 16:209-222, 1965.

Describes measures used to assess effectiveness of automatic data retrieval procedures. These are:

1. Recall (proportion of relevant material retrieved) and precision (proportion retrieved material relevant). Calculating standard recall and precision measures requires relevance judgements and cut-off in correlation between documents and search requests.

2. Generation of relevance judgements: (a) by sampling techniques to isolate and judge a suitable subset, or (b) by formulating search request based on specific source documents and measuring performance as function of retrieval of these documents.

3. Cut-off problem. Alternates are: (a) a cut-off point in correlation between documents and search request must exist, with documents above point retrieved and below excluded; or (b) rank orders of relevant documents, with documents in decreasing correlation order. Recall measure penalizes high ranks for relevant documents (low correlation coefficient); precision measure penalizes low ranks of nonrelevant documents.

4. Normalized recall and normalized precision. A set of parameters which reflects standard recall and standard precision and does not depend on distinction between retrieval and nonretrieval documents. These are average of the recall and precision obtained for all possible retrieval measures.

381 Sass, Samuel. A realistic approach to special librarianship. SPECIAL LIBRARIES. 41:160-161, 194-195, 1950.

A general discussion of the qualifications of a special librarian and training needed to fulfill them.

1. Expert knowledge of sources of information. Know reference tools, how to use them and how to compile subject bibliographics.
2. Administration. Training to include relationship of library to organization and of librarian to clientele.
3. Cataloging. A one-year course covering acquisitions, book and periodical preparation should be sufficient.
4. Subject specialization. Area of specialization should be decided and courses taken before library training.
5. Languages. Admission requirements should include working knowledge of French and German.

Translating, abstracting, literature searching and preparation of critical reports are duties a librarian may be qualified to perform but which are not his basic responsibilities. In a large library, they should be performed by a specialist rather than by the librarian.

382 Sass, Samuel. Work standards for special libraries. SPECIAL LIBRARIES. 49:376, 1958.

States that work standards are as important as professional standards because:

1. They are needed as a guide for those who are directly responsible for the operation of special libraries.

2. They are needed as a guide by higher management, especially in business and industry.

3. They are essential for the recognition of special librarianship as a profession on a par with other types of librarianship.

These standards should cover all aspects of library activities such as staff, physical facilities, acquisition, cataloging, bibliography and abstracting.

383 Sayer, John S. The use of information technology in research and development planning. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 117-131. (AD-632 587)

Research management has three basic functions:

1. Control - adjusting organization performance to some predetermined criteria. These should be measurable in terms of cost, time and quality, applicable in existing research environment and expressed in terms of established organization objectives.

2. Administration - establishing these criteria and providing environment permitting criteria to be placed into use.

3. Planning - evaluating criteria in relation to organization direction.

Organization objectives must be clear to be understood at all levels of organization. Technological, economic and environmental forecasting are necessary in planning program. To accomplish objectives, information systems must meet minimum requirements.

Effectiveness of R&D is decreasing and implementation of R&D product is becoming more costly and complex. Major improvements in R&D performance require full recognition that both research and its management are integral parts of information and communication. Planning is essential management tool.

Research management has major responsibility to assure efficiency and effectiveness in their operation.

384 Schick, Frank L. The evaluation of library resources by standards and statistics. In Edwin, Castagna, NATIONAL INVENTORY OF LIBRARY NEEDS. Chicago, American Library Assoc., 1965. p. 13-23.

The Library Services Branch of the U.S. Office of Education assisted the ALA in this national inventory of library needs.

The collection of statistical data is improved by:

1. Sharing collection responsibility among individual libraries, state library agencies, and Office of Education.

2. Coordinating data collection to save time and funds.

3. Agreeing upon definitions and terminology.

4. Maintaining sufficient flexibility to permit the states to request information for their own needs.

The plan of the project was: (a) to use existing data to save time and funds, (b) to use volumes in the collection, professional staff, and expenditure figures to measure accuracy, and (c) to present conclusions as tables (with explanatory text) wherever possible. ALA standards were used.

Funds, materials, buildings, and primarily more professional librarians are needed to support the libraries. Efficient placement of personnel is essential for effective library service.

385 Schleh, Edward C. The basic management design - management objectives. In MANAGEMENT BY RESULTS. New York: McGraw-Hill, 1961. p. 18-30.

Discusses importance of setting objectives which state specific accomplishment expected of each individual in a specific period of time to blend work of whole management group at a particular moment of time. Stating objectives in terms of final measurable results

such as dollars or percentages, leads to better understanding and direction.

No position should have more than two to five objectives. Creative goals should be set first for cost objectives. Cost should be measured by accomplishment. Discouragement of improvements or new methods because of cost has negative effect. Setting objectives for more than one person encourages cooperation in terms of time schedules, quality of work, and makes accomplishment of objective of value to persons involved.

Objectives also should:

1. Require some improvement in operation from each man every period and some improvement in every position every year.

2. Change every year as conditions change, i.e., force flexibility.

3. Be set in advance of period to be covered.

4. Should be clearly understood by subordinates.

386 Schutze, G. Measure of library service - statistics. SPECIAL LIBRARIES. 43:263-265, 1952.

The quantitative aspects of a library are measured by circulation, acquisition, and cataloging statistics; these reveal work done and are useful in planning for additional staff members for expansion. Circulation of books can be tabulated from charge cards; this information is helpful in book selection by subject groups or necessary duplicates.

Acquisitions should be counted, perhaps as "cards added to the catalog" to cover patents, films, etc. Users should be counted by groups to obtain information useful in book selection, library bulletins, and publicity campaigns to attract new users. Information requests should be recorded as a valuable guide for book selection and determining staff background requirements, and the inquirers should be identified by group for similar reasons.

387 Sengupta, S. S. and Ackoff, Russell L. Information requirements of industrial research and development management. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. p. 133-139 (AD-632 587)

The study is concerned with the improvement of managerial information and decision systems by making more effective use of information that is already available to them and by showing how relatively simple but relevant information can be used to obtain substantial improvements in performance. Paper shows how these approaches can be and have been taken.

Two basic problems facing R&D management are identified as:

1. The allocation of resources which are available to it.
2. The effective use of these resources.

388 Severns, William H., and Fellows, Julian R. AIR CONDITIONING AND REFRIGERATION. New York: Wiley & Sons, 1958.

In uniform environments, with air movements of about 25 feet per minute, sedentary or slightly active healthy men and women normally clothed are comfortable all year when the dry-bulb air temperature is within the range of 73-77° F. and the relative humidity is within the range of 25-60 percent.

389 Shank, Russell. Library service to research laboratories of a large university. AMERICAN DOCUMENTATION. 10:221-223, 1959.

A survey of 33 members of the research staffs in the engineering and physics departments of Columbia University showed:

1. 50% said distance between laboratory and library hindered their work.
2. 64% of the engineers phoned or sent an assistant to the library for required material; physicists usually went to the library themselves (but they were located close by).
3. Technical reports presented the outstanding problem for research personnel. Locating as well as obtaining reports was difficult. Users agreed unanimously that there was a great need for assistance in report area, and asked for bibliographies, abstracts, journal routing, sifting of new literature, and notification of new pertinent references.

The result was a recommendation to strengthen bibliographic services. Library personnel and several indexing services must be added. Acquiring the current Engineering Index on cards was considered essential for adequate service.

390 Sharp, D. S., and McNulty, J. E. INTERIM TECHNICAL REPORT ON A STUDY OF INFORMATION STORAGE AND RETRIEVAL, (MOORE SCHOOL REPORT NO. 65-01) Philadelphia: Univ. of Pennsylvania, Moore School of Electrical Engineering, 1964. NONR 551(40) (AD-602 222)

Report of study involving three tasks:

1. Information content needs of operating personnel.

2. Conditions of cost optimization in man-machine exchange.

3. Recommendations as to desirable equipment characteristics to accomplish first two tasks.

Factors to be considered before making equipment recommendations include:

1. Jobs to be done.

2. Needs of top management.

3. Location of equipment-depends on proximity to user, speed, frequency of usage, cost, environment (noise, ability to withstand some abuse).

4. Ease of operation, training required.

5. Form of data presentation.

6. Protection of file from possible damage by user.

391 Shaw, Ralph R. Using advances in technology to make library resources more available. CONFERENCE WITHIN A CONFERENCE. (American Library Association Conference) Chicago, 1963.

Discussion of the application of technology to the improvement of information services. Three simultaneous approaches are needed:

1. Expansion of basic library and dissemination services to meet the greatly increased volume of research.

2. Application of scientific method in developing a science upon which a better information technology can be built, to replace the present, purely empirical foundation.

3. Rigorous objective investigation of all technological proposals and essays.

392 Shera, J. H., Kent, Allen and Perry, James W. DOCUMENTATION IN ACTION. New York: Reinhold, 1956.

In order to expand information services but conserve effort, cooperative information processing was discussed.

Information problems include (a) prompt availability of information; (b) specific coverage of special fields; (c) conservation of reader's time by holding to a minimum the volume of material to be read.

The following steps of decision-making were discussed:

1. Analysis of the decision area to discover applicable elements.
2. Location or creation of criteria for evaluation.
3. Appraisal of the known information pertinent to the applicable element and correction for bias.
4. Isolation of the unknown factors.
5. Empirical setting of values on the unknown factors.
6. Weighing of the pertinent elements, known and unknown, as to relative importance.
7. Projection of the relative impacts on the objective and the synopsis into a course of action.

393 Siepert, Albert F. Creating the management climate for effective research in government laboratories. In Karl B. Hill, Ed., THE MANAGEMENT OF SCIENTISTS. Boston: Beacon Press, 1964.

This book deals with the creation of the appropriate management climate within which the research process can flourish. Concerned primarily with the climate of government R&D labs, it is still applicable to all types of research organizations.

The author summarizes 13 factors that are important considerations in research management.

394 Simon, Herbert A. The criterion of efficiency. In ADMINISTRATIVE BEHAVIOR. 2d ed. New York: Macmillan, 1957. p. 172-197.

Most organizations are oriented around some goal or objective which provides the purpose toward which the organization decisions and activities are directed When the relationship of an activity is indirect, even if substantial, the problem of evaluation is difficult (e.g., for advertising and supervision). A common denominator for value is the criterion of

efficiency. The criterion of efficiency dictates that choice of alternatives which produces the largest result for the given application of resources; that is, results must be maximized with limited resources.

On the other hand, criteria of "correctness" have no meaning in relation to the purely valuational elements in decision. The distinction of value from fact is of basic importance in securing a proper relation between policy-making and administration.

395 Sinaiko, H. Wallace and Belden, Thomas G.
The indelicate experiment. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCES. Bedford, Mass.: Mitre Corporation, 1966. p. 343-348. (AD-632 587)

Study considers ways of doing experiments that are between the extremes, expert opinion and systematic laboratory experimentation. Measurement and observation are essential elements of the indelicate experiment. One of the possible advantages of indelicate experiments is the ability to get the user of the results closely involved with the planning and conduct of the experiment itself.

Some recent indelicate experiments are:

1. Language translation and interpretation.
2. Multi-party teleconferences or large telephone conferences.
3. Coherent language.
4. Secure voice conferencing study.

Indelicate experiments are likely to produce wrong conclusions if the experimenters are careless or irresponsible. Such experiments are simple to the extent that they can be done with little expenditure of time and money. They depend heavily on user involvement.

396 Slater, Margaret. TECHNICAL LIBRARIES: USERS AND THEIR DEMANDS. London: Aslib, 1964.

Report of a pilot study to determine habits of users of technical libraries, having three main aims.

1. Determination of user demands. (a) Relation to user's work - 66% direct. (b) Form of demand - 50% specific document, 36% specific information. (c) Need for assistance by librarian - 41%. (d) Urgency of demand - 18% needed answer within hours.

2. Classification of user groups. (a) Scientists - most predictable demands, wide range of interests, most capable of conducting own search, least urgent needs, highest success rate. (b) Engineers - less intensive use of library, more difficult and unpredictable demands, needed more assistance, lowest success rate. (c) Non-technical personnel - needed most help, most urgent needs, most time per user, success rate almost as high as scientists.

3. Estimation of significance of above for librarians. (a) Materials 8 or less years old adequate for most inquiries except for scientific workers. Scientific periodical literature should be retained longer. (b) User generally satisfied by three or four useful documents. Success rate or user satisfaction was considered a measure of library efficiency.

397 Slater, Margaret. Types of use and user in industrial libraries; some impressions. JOURNAL OF DOCUMENTATION. 19:12-18, 1963.

The aim of this Aslib study was to classify users of special libraries in order to predict their needs with reasonable accuracy. Important factors affecting frequency of use were management attitude and staff status, attractiveness of accommodations, and geographical location of the library.

Library users were classified as:

1. Administrative/executive type. 12% of sample; asked the staff to locate the answer for them; their queries took longer to answer.

2. Technical/executive type users. 11% of sample; heaviest users; looked up their information themselves.

3. Working scientists and engineers. 50% of sample; looked up information for themselves.

4. Technicians. 20% of sample; used handbooks and textbooks; asked the librarian for help or took a long time to find what they wanted.

398 Smith, Gail. How GM measures ad effectiveness. PRINTER'S INK. 290:19-29, May 14, 1965.

Using questionnaires which cover the following areas, General Motors obtains data for analyzing its advertising effectiveness and cites examples.

1. Preference level measurement in terms of awareness.
2. Product-image test.
3. Message registration, which includes specific product attributes.
4. Market behavior, which includes shopping behavior.
5. Product inventory, which includes its content and condition.
6. Demographics.
7. Media consumption ,includes exposure to television, magazines, radio, and newspapers.

The data collected have no significance until advertising goals are related to them and the marketing information in the first six areas is related to each respondent's opportunity to be exposed to the advertising, as indicated by the seventh area.

399 Spencer, Milton H., and Siegelmann, Louis.
MANAGERIAL ECONOMICS--DECISION MAKING AND FORWARD PLANNING, Homewood, Ill.: Irwin, 1964.

This text shows the development and integration of principles and ideas from various fields of economics and business, with emphasis on management decision making and policy formulation within the firm.

It contains a new and greatly simplified treatment of freehand, simple and multiple regression analysis with extensive applications and illustrations. Basically this is a procedure which permits a maximum emphasis on economic analysis and interpretation of relationships, and a minimum emphasis on computation.

400 Standards of appointment and employment of librarians.
NEW ZEALAND LIBRARIES. 17:207-212, 1953.

Outlines duties of professional librarian and library assistant. Librarian's work includes:

1. Administrative: Directing policy as executive library committee; reporting to committee; supervision; planning accommodations, equipment; preparing estimates, controlling and accounting for expenditures; relations with library suppliers, with other libraries, and with the public; assisting in coordination with authority policy in other fields.

2. Technical: Evaluation, selection, ordering of material; building collection, checking bibliographies, etc.; classifying, cataloging, indexing, assembling information; maintaining accuracy of filing systems, systematic arrangement of books on shelves; determining routines; weeding; maintaining physical condition of stock.

3. Public-educational: Reference, research, readers' guidance and assistance, display and presentation of stock, preparation of lists and bibliographies.

Non-professional library assistant work includes:

1. Clerical: Charging and discharging loans, filing catalogue cards, index cards, typing cards, bibliographies, correspondence, etc., recording accessions, keeping records, cashier, mail, secretarial duties.

2. General: Shelving, mending and cleaning books, messenger.

401 Stanford, E. B. Supervision in libraries; what it is--and what it takes. ALA BULLETIN. 44:119-121, 1950.

Lists these library supervisory duties:

1. Describe each position and select the best candidate for it.
2. Gain the staff members' loyalty by introducing and orienting new members, thoroughly explaining new policies, and informing the staff of new developments before they are publicized.
3. Schedule work assignments; train staff members for increased responsibility; ask their advice on how to improve procedures.
4. Discuss progress at least annually with each staff member; develop esprit de corps by encouragement, impartiality, and individual consideration.
5. Discipline the staff and maintain work standards.

Qualities to look for in a supervisor include: leadership, liking for people, ability to listen, fairness, self-assurance coupled with reasonable modesty, and loyalty.

402 Starch, Daniel. Measuring advertising effects. In MEASURING ADVERTISING READERSHIP AND RESULTS. New York: McGraw-Hill, 1966. p. 143-155.

The NETAPPS (net ad-produced purchases) method is described as a practical procedure for measuring the net purchases attributable to current advertisements. Unique features of NETAPPS are as follows:

1. Measures net advertising effects by comparing attitudes and behavior of ad-exposed test groups with closely comparable non-ad-exposed control groups.

2. Relates buying action directly to perception.

3. Does not require a costly experimental design.

4. Makes possible accumulation of data for individual advertisements which can be combined for analyzing effectiveness of campaigns and forms of presentations.

5. Makes possible evaluation of dollar NETAPPS in relation to dollar advertising costs.

403 Starr, Martin K. PRODUCTION MANAGEMENT. SYSTEMS AND SYNTHESIS. Englewood Cliffs, N.J.: Prentice-Hall, 1964.

This book provides the systems-oriented view of the production management field. An input-(process)-output model has been used to represent the production function and its management, so that a thorough understanding of the available analytic tools may be gained. In this way, production management has been defined in the most general terms so that it encompasses all transformation procedures which fit the input-output concept. Therefore, industries such as those in communication or providing service functions can also be included in this concept.

Some of the areas discussed are break-even charts, decision models, matrix construction, planning models, heuristic models. Plant layout and economic order quantities.

404 Steer, W. S. Measuring the Public Services. PUBLIC ADMINISTRATION. 30:315-320, 1952.

Survey of areas to be developed in creating a practical measurement plan for public services. In order to measure:

1. Objectives must be defined in measurable units.
2. Objectives must have distinct units such as: (a) costs, (b) efforts, (c) performance, (d) results.
3. Measures must show adequacy of service, or total achievement in light of objectives and efficiency, or ratio of effects actually obtained with available resources to maximum possible effects with available resources.

Efficiency studies relative to cost show whether same expenditure could result in better service, through cost accounting and efficient financial control efficiency of effort studies determine whether better service could be obtained by altering proportions of goods and services. Efficiency of performance studies are concerned with obtaining better service by increasing volume of goods and services in certain parts of services and reducing it in others.

405 Stevens, Norman D. A COMPARATIVE STUDY OF THREE SYSTEMS OF INFORMATION RETRIEVAL: A SUMMARY. Washington: Howard Univ., 1966. (AD-621 408)

Findings of a research project conducted at the Graduate School of Library Science at Rutgers State University on the workings and efficiency under actual operating conditions of systems of information retrieval. The study examined a punched card file, a handbook reproduced from that file and conventional library cataloging-reference approaches to the same material. Analysis was carried out in three sections (a) background, organization and input factors of the three systems, (b) use and needs of users and (c) operation of the systems in retrieval of information in terms of time required and comparability.

Input costs of a mechanized data-extracting system were found to be much higher than traditional library card catalog also in terms of cost per use. In terms of output this system is more efficient, but not enough to offset cost in most cases.

The amount of use of mechanized data-extracting system is important and dependent upon user's ability to handle it. A mechanized system is feasible if a) interest, demand and amount of work being done in the area are high and will remain so; b) the mass of data is available, more is being produced at a rapid rate and will continue to be useful over a period of time; c) no adequate conventional reference tools exist and d) those sources which do exist do not provide efficient literature techniques.

A system should meet the following cirteria:

1. Provide complete coverage of existing information sources.
2. Provide critical evaluation of the data it contains.
3. Be up to date by getting information directly from the field.
4. If issued as a handbook, many copies and frequent revisions.
5. Provide the information to the worker in the field before it is officially published.

406 Stevenson, C: G. Standards for special libraries - the the need and the opportunity. SPECIAL LIBRARIES. 50:388-391, 1959.

Discusses the reasons for developing special library standards. These are: (a)as an aid to management--will let management know what library does and provide explanation of its costs;(b)as an aid to those managing library--will help them plan for future needs;(c)gives status to the profession.

407 Stevenson, C. G. Work measurement in technical information activities. SPECIAL LIBRARIES. 47:409-411, 1956.

Discusses how to define a technical information program and how to develop measurement criteria which

will answer questions about the technical information function of a library. The necessary criteria include:

1. What percentage of research and development should be reasonably allocated to technical information activities - determined by management.

2. What percentage of overall plant budget should be allocated to its technical information activities - determined by management.

3. What are the actual costs to get the information jobs done - determined by the librarian.

4. How effective is the program - determined by the user. Can be done by polling the qualified users.

408 Stogdill, Ralph M., and Shartle, Carroll L. A factorial study of administrative performance. In R. M. Stogdill, R. J. Wherry, and W. E. Jynes, Eds., PATTERNS OF ADMINISTRATIVE PERFORMANCE. (Bureau of Business Research Monograph No. 81) Columbus: Ohio State Univ. 1956.

The differences between pattern of performance in industrial and naval organizations on the whole are generally no greater than differences among naval organizations or industrial organizations.

Outline of measures used in examining effect of organization upon administrative performance.

1. Formal organization

   a. Horizontal differentiation. Specialties representing difference in function.
   b. Vertical differentiation. Rank and level in organizational hierarchy assigned numerical scores.

2. Operative organization.

   a. Work performance. Each organization member

estimates percent of time spent in various kinds of work.

b. Effective authority. Each member checks scaled list of items, estimating his degree of authority and responsibility, amount of authority he delegates to others.

c. Personal interaction. Each member receives score on number of members mentioning him as work partner.

d. Leader behavior. Each member checks list of items describing his behavior in relation to his juniors and to total unit of organization he supervises.

409 Stogdill, Ralph M., and Shartle, Carroll. METHODS IN THE STUDY OF ADMINISTRATIVE LEADERSHIP. (Bureau of Business Research Monograph No. 80) Columbus: Ohio State Univ. 1956.

Methods of measuring administrative leadership include: (a) interview, (b) organization charts and manuals, (c) sociometric methods, (d) RAD Scales, (e) work analysis forms, (f) leader behavior descriptions, (g) effectiveness ratings.

The mission of an organization is defined in terms of its purpose and the major tasks it is expected to perform. The mission can usually be broken down into specific objectives which will change from time to time. The characteristic tasks of an organization are known as its functions.

RAD Scales were designed to measure different degrees of perceived responsibility, authority, and delegation of administrators and supervisors recorded by the individual or an observer. Scales are rated for each test, two for responsibility, two for authority, and two for delegation. The test is for research purposes only.

Effectiveness ratings call for ranking people in order of best, next best, etc. It offsets the tendency, especially in military organizations, for most people to be rated "very good" or "excellent".

410 Story, Anne W. MAN-MACHINE SYSTEM PERFORMANCE CRITERIA. Bedford, Mass.: Air Force Systems Command,

Operational Applications Office, 1961. (AD-260 528)

An essential prerequisite to assessment of system-performance is the determination of adequate criteria. Four basic criteria for the evaluation of system performance are:

1. Material--the materials of which the system is composed.

2. Mechanistic--the functioning of the components.

3. Logical--the consistency of the system-design.

4. Final--the attainment of the ultimate goals of the system, which is the most conclusive test of a man-machine system. The ultimate criterion for evaluation of a system is thus the completion of its mission.

Whatever the type of criterion, the problem of validity seems to occur frequently in measurement of system performance. A problem in measuring system performance is to establish similarity of systems. There are several methods of establishing similarity of systems:

1. Create a population of more or less systems than those being studied (the variables).

2. Use of different systems to see if they can apply.

3. A simulated input-output system which has the following disadvantages of rendering validity uncertain: (a) it may differ too much from an operational one under real conditions, (b) it is hard to set boundaries between the input and the output of a system.

411 Strain, Paula M. The circulation pattern of one technical library. SPECIAL LIBRARIES. 56:312317, 1965.

A five-year survey of the Space Guidance Center's technical library, serving 4000 persons, showed:

1. Low points in circulation in July and December, high points in August and October.

2. Engineering and research areas (30% of plant population) account for more than its share of use, administrative-management division less than its share.

3. Administrative division wants specific information; engineering division wants books; operating personnel request reference services and books about equally.

4. Circulation-collection ratios averaged 1:1 over five years.

5. About 25 percent of collection on loan at any one time.

6. One actual user per two potential users.

7. 50 percent of borrowed material returned within two months; 90 percent returned within 13 months.

8. 63 percent borrowed one book; 25 percent took two books; 12 percent have three to nine books out.

412 Strieby, Irene M. Organizational relations of special libraries. LIBRARY TRENDS. 1:173-188, 1952.

Trends observed in organizational relationships of libraries are:

1. Library as a communications center.

2. Company-wide library service instead of library appended to a department.

3. Separate libraries for autonomous divisions of decentralized company.

4. Combination of subject and library training as job qualification.

5. Changes in functional and professional title of librarian.

6. Library part of larger unit of technical literature service.

The organization chart is an important administrative tool, showing (a) channels of authority, and (b) library function in relation to other units. Librarian relations in company are vertical, horizontal and diagonal. Personnel on all levels should have direct access to library. Librarian should participate on interdepartmental level and in financial operations.

Costs and standards for library difficult to assess because results do not lend themselves to measurement. Objective evaluative criteria difficult to produce because of variation in accounting practices, lack of standard terminology, differences in services offered.

413 Sturm, Paul J. Problem mongers, solution mongers, and weapon system effectiveness. DEFENSE INDUSTRY BULLETIN. 2(7): 1-4, 1966.

Discusses the difficulties of determining cost effectiveness of military R&D. Errors in judgement in determining operational characteristics of military equipment must be compensated for by the combat soldier through his own ingenuity because no alternatives are available. Consequently the cost of R&D errors cannot be determined.

414 Swank, Raynard C. The cost of keeping books. In Edwin E. Williams, Ed., PROBLEMS AND PROSPECTS OF THE RESEARCH LIBRARY. New Brunswick: Scarecrow Press, 1955. p. 41-55.

Discusses problems of university libraries.

Characteristics of scholarship which place heavy demands on library are: (a) elastic and ever-expanding nature of knowledge, (b) inconclusive quality of research, (c) unpredictable nature of creative ability. Characteristics of books or library materials which present problems for

library are diversity in content, variance in physical form, particular purpose being used for, and audience.

Areas for study are (a) university functions and library needs specific to each function, (b) book acquisition, (c) weeding, (d) nature and extent of cataloging, (e) stages of accessibility for frequently and infrequently used material, (f) kinds and amounts of reference service, (g) management and application of technological methods.

415 Swanson, Don R. On indexing depth and retrieval effectiveness. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966. . 311-319. (AD-632 587)

Performance or effectiveness of an information retrieval system is expressed in terms of:

1. Recall, the percent or fraction of total relevant material in collection that is recovered in response to any given search question.

2. Relevance, the percent or fraction of retrieved material which is relevant to any given question.

A model system is presented and analyzed theoretically.

416 Swihart, S. J. A SYSTEMS STUDY OF A CORPORATE LIBRARY. Albuquerque: Sandia Corp., 1963.

In order to improve the library operations at the Sandia Corporation, a general survey was made to identify individual problem areas, define each area clearly in general terms and to determine the relative priorities among the problems.

The major problem was in the input of information into the library. Enumerated, these were: (a) slow cataloging

and inadequate indexing, (b) erratic release of new acquisition bulletins, (c) inadequate filing space, shelf space, and storage, (d) inefficient circulation control, poor inventories.

Goals set up were: (a) cataloging within one day of acquisition, (b) announcement of new material within three weeks, (c) mechanizing literature searches and indexing more extensively, (d) reducing clerical effort.

Limitations specified by management were: (a) reduce indexing staff, (b) reduce or maintain cost, (c) improve indexing quality, (d) simplify work flow.

The system was installed in sections to ease changeover.

Phase I.	Preparation of catalog cards
Phase II.	Preparation of seven book catalogs
Phase III.	Conduct literature searches by computer
Phase IV.	Install SDI systems

417 Tait, Robert C. Long-range planning. In LONG RANGE PLANNING FOR MANAGEMENT. New York: Harper & Brothers, 1958. p. 188-196.

Developing long-range planning techniques should assist top management in making decisions with:

1. Stabilizing profits and improving return on investment.
2. Long-range capital program.
3. Development and training of supervisory and management personnel.
4. More effective long-range sales program.
5. Improvement in the procurement of purchased parts and materials.
6. More effective means of smoothing out production peaks and valleys, which should also lead to (a) improved labor relations, (b) sounder basis for divisional and departmental budgeting.

Certain criteria are needed to measure or evaluate long-range plans. One of the most important is return on gross assets. Other important criteria are:

1. Relative stability of project in question.
2. Extent to which a given project supplements present product or market lines.

Tendency exists to establish standards for some of these criteria. Each project should be carefully evaluated in terms of existing circumstances rather than determined by rigid preconceived standards.

418 Taube, Mortimer. An evaluation of use studies of scientific information. In EMERGING SOLUTIONS FOR MECHANIZING THE STORAGE AND RETRIEVAL OF INFORMATION. Washington: Documentation, Inc., 1959. p. 46-71.

An evaluation of the existing literature of use studies having the purpose of improving the dissemination of scientific information and designing more effective reference tools and services. The results and prospects of both quantitative and qualitative studies of cataloging use meet none of the criteria of prescriptive value, leading to no conclusions concerning desirable modifications of cataloging principle. Even if these studies produced reliable data, such data could not supply a valid basis for improving scientific information systems. Operations research studies are concerned only with increasing useful and productive research time.

The principle and rationale of use studies is based upon consumer response. Information service is professional rather than consumer service. It engages in activities to acquaint consumer with its services but cannot be measured by consumer acceptance.

419 Taylor, L. Cost research on a library service. ASLIB PROCEEDINGS. 13:238-248, 1961.

Describes cost research study of Gear Division library, David Brown Industries, undertaken in 1959-1960. Research was undertaken on costs of labor and materials used in the various activities of the library. Time distribution, labor cost distribution and total cost distribution were determined for (a) library operations - including publications, periodicals service, acquisitions and indexing, external relations, loan service, correspondence, training, inquiries, abstracts; (b) secretarial operations; (c) administration; and (d) maintenance and fixed charges.

Study revealed that 32.6 percent of staff time was spent in dealing with inquiries and disseminating information, which cost 28.1 percent of the total expenditure.

420 Taylor, Robert S. AN APPROACH TO LIBRARY SYSTEMS ANALYSIS. Paper presented at Conference of American Society for Engineering Education, Engineering School Libraries Committee, Orono, Maine, June 22-23, 1964.

Library Systems Analysis (LISA) is an attempt to provide a frame of reference for librarians in analyzing their systems for eventual automation. Levels at which a library can be observed include: (a) routine operations, (b) judgement operations, (c) communication flow, (d) success in matching user needs, (e) levels of decision-making, (f) how patrons use a research library, (g) miscellaneous studies.

One method for library systems analysis is the Integrated Procedure Control (IPC) approach, which uses a punched-card model based on measurable inputs and outputs and on observable processes. Data for the model are derived from a series of work, process, and form sampling, to be organized by function and process. Five system categories should cover all activities of research libraries of medium size: (a) environmental, (b) acquisition of material, (c) organization of material, (d) formalizing the user's need, (e) matching need with facilities and material.

Three types of sampling are used: (a) work sampling, (b) direct sampling to determine service to users, (c) sampling of records, materials, etc.

421 Taylor, Robert S., and Hieber, Caroline E. LIBRARY SYSTEMS ANALYSIS (Report No. 3). MANUAL FOR THE ANALYSIS OF LIBRARY SYSTEMS. Bethlehem, Pa.: Lehigh Univ., Center for the Information Sciences, 1965. OE-5-10-235

First step in library analysis was to outline library functions as: (a) environmental--decision and policy-making responses, (b) acquisition of material, (c)

organizing materials, (d) formalizing user's need, (e) matching need with facilities and material.

Information about user was elicited by questionnaires and interviews, including the following questions: (a) reason for visiting library, (b) user characteristics, (c) library material used, (d) time spent on search, (e) changes of objective or additional purposes accomplished, (f) reason (found unexpected information, unable to find answer to original question, error in formulation of question, etc.); (g) persons patron spoke to, (h) measure of success on linear scale from 1 to 4, ranging from complete success to failure, (i) reason for lack of success.

Means of analyzing information included: (a) classifying users by status or department; (b) classifying requests by type or subject area; (c) examining library personnel involved in search, materials and facilities used, traffic in various areas, frequency of successful or unsuccessful searches; (d) examination of entries indicating lack of success and their relationship to other data. The most helpful investigation concerned approach (d).

422 Terry, George R. OFFICE MANAGEMENT AND CONTROL. 4th ed. Homewood, Ill.: Irwin, 1962.

Listed below are the pertinent areas in a comprehensive study on office management:

1. Office automation.
   a. EDP -- managerial and technical considerations.
   b. Application of computers.
   c. Integrated data processing.

2. Information handling.
   a. Correspondence and reports.
   b. Office communicative services.
   c. Storage-effective filing and record retention.

3. Planning.
   a. Work in the office.
   b. For office equipment and machines.
   c. For office space, layout and environment.

4. Controlling.
   a. Office standards.
   b. Quality in office procedures and methods.
   c. Office work fluctuation.
   d. By determining and applying office time standards.

5. Organizing.
   a. Work division and people.
   b. Authority and organizational relationships.
   c. Principles of office organization.

6. Actuating.
   a. Motivating and developing office employees.
   b. Office supervision and safety.

423 Theil, Henri, Boot, John C., and Klock, Teun. OPERATIONS RESEARCH AND QUANTITATIVE ECONOMICS. New York: McGraw-Hill, 1965.

This text covers the area of operations research and the mathematical methods of analysis required to make operations research a useful tool. The most significant areas of discussion involve the following analytical techniques:

1. Optimum path and critical path.
2. Input-output analysis.
3. Uncertainty and probability.
4. Queues.
5. Simulation and management games.
6. Inventory decisions.

424 Thibault, Charles D. SURVEY OF SPECIALIZED ACQUISITION PROCEDURES IN A TECHNICAL DOCUMENTS CENTER; A SURVEY CONDUCTED AT THE ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES. Unpublished Master's thesis, Catholic University of America, 1956.

Selection criteria for a technical documents center serve these purposes:

1. Inform special libraries as to the identity of material that should be processed.
2. Tell clients what they can expect to get from the librarian.

An important consideration must be control of the volume of reports.

425 Thompson, Ivan B., and Tibbs, Harold A. ANALYSIS OF COSTS AND BENEFITS OF EDP SYSTEMS. Master's thesis, Air Force Institute of Technology, School of Systems and Logistics, 1963. (AD-424 885)

A detailed analysis of costs and benefits to be considered in choosing among alternative management information systems. Operational effectiveness is defined as extent to which desired objective is reached. Value of information is determined by usefulness to management. Value of a proposed change is measured by increased operational capability if cost remains constant, by reduction in cost if operational capability remains constant, or by net gain if both costs and operational capability vary.

Two criteria are provided in choosing among alternative management information systems:

1. Added value of benefits must be greater than costs incurred.

2. System selected must accomplish most for given cost or achieve given objective at lowest cost.

In addition to comparison of cost and value of change to EDP system, decision maker must consider:

1. Availability of skilled personnel.

2. Changes in geographical and occupational distribution of skills and employment.

3. Appraisal of organization, long-standing routines, auxiliary objectives.

426 Thompson, John I., and Company. FEDERAL GOVERNMENT'S SYSTEM FOR DISTRIBUTING ITS UNCLASSIFIED R&D REPORTS. By T. R. O'Donnell, J. L. Lewis, and J. I. Glendinning. Washington: National Science Foundation, Office of Science Information Service, 1962. NSF C-224 (AD-283 335)

Describes a study to determine the effectiveness of the DOD system for distributing newly generated technical reports and to suggest possible improvements.

The real value of any information lies in its availability to the user when he needs it. Measures of effectiveness must be in terms of:

1. How much of total available needed information is furnished to user.
2. When information is furnished.

Actual value of the information at whatever time it is received can be expressed as a ratio of time required to make it available for use, to total time it could be of value after a need occurs.

427 Thompson, Victor A. MODERN ORGANIZATION. New York: Knopf, 1963.

The author presents a general theory of modern organization, emphasizing the fact that organizational behavior is, in large part, institutional. It is best explained by analysis of the system in which behavior occurs, rather than by individualistic psychology. This results in the analysis of four subsystems which comprise a total organizational system: (a) authority, (b) status, (c) technical, and (d) informal organization.

428 Thorndike, Robert L. PERSONNEL SELECTION. New York: John Wiley & Sons, 1949.

A job description is primarily a description of what the worker does and the conditions under which he does it. It should include a statement in detail

of the actual activities which the worker carries out, indicate the importance of each activity, identify those activities and characteristics that represent critical requirements of the job, indicate the conditions under which the job is being performed, identify significant factors in the physical, social, and psychological environment in which the work must be carried out, and contain a list and description of the materials and equipment needed.

429 Thorne, R. G. The efficiency of subject catalogues and the cost of information searches. JOURNAL OF DOCUMENTATION. 2:130-148, 1955.

Efficiency of a subject catalog or index is derived from probability of success when using catalog and cost of making and using catalog, compared with cost of finding material in library stock when no subject catalog is available.

In developing an efficiency measure, the following may be used to compare any recording system with situation arising if no records are kept. If no records are kept, the total annual cost is SQN where C = total no. documents in collection, Q = no. searches in year, S = average cost per document of handsorting.

If subject catalog is kept, reduction in annual cost is SCQ-PN-RQ where N = no. documents received in year, P = processing cost to record one document in subject catalog, R = operating cost to conduct one search, since PN + RQ = annual cost of making and using catalog.

Efficiency of a recording system can be defined as cost saved by using system divided by cost if no system is used; the costs being those of satisfying all requests. This implies that if the cost saved is nil, the efficiency is nil and efficiency is unity if all the cost of operating without a system is saved.

430 Tomlinson, Helen. DEFINING TECHNICAL INFORMATION NEEDS FOR A RESEARCH LIBRARY. Lackland AFB, Texas: Personnel Research Laboratory, 1965. PRL-TR-65-4.

A checklist survey form, listing 78 areas of possible

interest to members of a personnel research laboratory, was used by staff members to define the company's technical information requirements and identify acquisition and indexing problems.

Desirable refinements in both data collection and analysis are apparent. The list of topics needs a semantic overhaul to reduce overlap and achieve greater consistency in level of generality. A finer scaling of responses might improve discrimination of common interests.

The method provides an economical and effective means of determining an organization's technical information requirements and its recources of competence.

431 Tompkins, Marjorie M. Classification evaluation of professional librarian positions in the University of Michigan library. COLLEGE AND RESEARCH LIBRARIES. 27:175-184, 1966.

A Classification Evaluation Committee determined that job evaluation factors fall into two groups:

1. Those involving types and levels of responsibilities in the position.
2. Those deriving from formal or informal education or from acquired experience in an area relevant to the requirements of the position.

These factors consist of:

1. Job knowledge.
2. Responsibility--problem solving and decision making, independence of performance, work of others, relationships with others.

The positions must also be described, evaluated, and then classified in order to grade them and the persons filling them.

432 Trueswell, Richard W. A quantitative measure of user circulation requirements and its possible effect on stack thinning and multiple copy determination. AMERICAN DOCUMENTATION. 16:20-25, 1965.

The strategy outlined in this article describes a method for thinning a library's stacks according to the criterion of user needs. It uses the last circulation date as a parameter of user circulation requirements (in-stack use and browsing as well as importance of user's need have been bypassed). The resulting stack collection would, by design, satisfy over 99% of the user circulation requirements and yet be of minimum size.

Preliminary research indicates that the number of volumes in a library's holdings may be reduced by 60% to 70% and yet satisfy well over 99% of the user requirements. It may also be possible to determine which books should have multiple copies and non-circulating copies.

This is a quantitative method of maintaining the library's holdings at a reasonable level, and reducing disappointment of the user who is unable to find the book he wants because of use by another (studies show that there is approximately a fifty-fifty chance of the user not finding the book he wants in the stacks, given that the book is part of the library's holdings).

433 Tucker, Samual A. A MODERN DESIGN FOR DEFENSE DECISION. Washington, D.C.: Industrial College of the Armed Forces, 1966.

The text covers the application of the following methods of analysis and control:

1. Planning and budgeting.
2. Systems analysis.
3. Cost effectiveness.
4. Program packages.
5. Operations research.
6. Planning-programming-budgeting.

434 Twite, Martin J. ORGANIZATION OF STRUCTURED INFORMATION FOR MECHANIZED RETRIEVAL OPERATIONS AND SOME RELATED EFFICIENCY CONSIDERATIONS. Unpublished master's thesis, U.S. Naval Postgraduate School, 1964, (AD-482 242)

Numerous techniques have been developed during the years which evaluate effectiveness (accuracy, sensitivity, discrimination) of an information retrieval system, and efficiency and effectiveness by including such performance factors as item convenience, operating cost and product form. Comparative analysis of efficiency and effectiveness is risky.

Two types of criteria are used to compare storage allocation methods: storage capacity required and the time required to perform any file-processing operation. Storage capacity is measured as (a) number of bits per memory word required to represent both an item and allocation information associated with item. (b) total number of words necessary to represent the file in a particular allocation. (c) total number of bits necessary.

Time required to perform an operation is measured as number of items that must be "handled" (taken from memory and transferred to processing unit for computer decision) in the process.

435 U.S. Air Force. MANAGEMENT-WORK SIMPLIFICATION. (Air Force Pamphlet 25-3-2) Washington: Author, May 1954.

This pamphlet provides a military orientation approach to the industrial methods of work measurement and simplification. Areas covered are:

1. Motion analysis.
2. Work distribution analysis.
3. Process analysis.
4. Work count.
5. Layout studies.
6. Installation and follow-up of improvements.
7. Visual aids and forms.

436 U.S. Air Force Systems Command, Aeronautical Systems Div. PERT POLICIES AND PROCEDURES HANDBOOK. Illinois: Wright-Patterson Air Force Base, 1962. ASD 00-61-1

This handbook was written as a guide and government contractural reference, for use by all echelons of management in the implementation and use of PERT. It was intended as a planning device for projects and systems within the Air Force Systems Command.

437 U.S. Bureau of the Budget, Executive Office of the President. PLANNING - PROGRAMMING - BUDGETING SYSTEM. (BULLETIN 66-3) Washington: U.S. Government Printing Office, 1965.

The Planning-Programming-Budgeting System requires program directors to think and plan farther into the future, to delineate objectives, analyze costs and benefits of existing programs, and find better and cheaper ways to accomplish objectives.

The PPBS is founded on three major concepts:

1. Each agency possesses in-house analytical capability for determining the objectives and programs which they support.

2. A multi-year planning and programming process incorporating and using an information system which classifies and presents essential data required for decision making.

3. A budgeting process which can refine broad program decisions for subsequent review and action by the President and Congress.

The organizational components of PPBS are:

1. Program definition and output objectives.
2. Possible methods to employ.
3. Costs of alternative methods.

4. Establishing evaluation techniques for determining effectiveness in achieving objectives.
5. Informational requirements for continuous cost and accomplishment comparison.
6. Review and analysis of plans and programs and revision where necessary.

438 U.S. Civil Service Commission. EVALUATING---YOUR PERSONNEL MANAGEMENT. (PERSONNEL MANAGEMENT SERIES NO. 6) Washington: U.S. Government Printing Office, 1954.

Pamphlet is designed to assist government agency administrators to appraise their own personnel programs. Three basic methods of evaluating personnel management are described:

1. Personnel office self-analysis.
2. Periodic, systematic reports.
3. On-site review by higher authority.

Reasons for evaluation of personnel program are the same as for making any other systematic appraisal, that is to discover whether or not objectives of program are being attained in the best way.

Ten chapters have been prepared for use in connection with the described three methods. Chapters follow functional breakdown used in the discussion of personnel management programs in the Federal Personnel Manual. Each chapter suggests guidelines for evaluating one of these major functions. Chapters discuss the following:

1. Management control and direction of the personnel program.
2. Formulating and issuing policy.
3. Position classification and pay administration.
4. Staffing.
5. Employee performance evaluation.
6. Employee development.
7. Employee relations and services.
8. Employee recognition and incentives.
9. Personnel records and reporting.
10. Program evaluation.

Chapters are divided into "keys" posing questions as to agency activity in various segments of the personnel program, and

"procedures for evaluation" designed to determine whether or not required program elements are present in agency activities.

In an appendix, guidelines are supplied for carrying out an evaluation program.

439 U.S. Department of Defense and National Aeronautics and Space Administration. DOD AND NASA GUIDE: PERT/COST. Washington: Office of Secretary of Defense and NASA, 1962.

This manual presents a standardized PERT system for use by NASA and DOD. In addition it standardizes certain procedures involving PERT and its use within these organizations. The text discusses PERT under the following framework.

1. PERT/cost management reports.
2. PERT/cost system description.
3. PERT/cost operating procedure.
4. PERT/cost supplements.
   a. time/cost option
   b. resource allocation
5. Computer master file.

440 U.S. Department of Health, Education, and Welfare, Public Health Service, National Institute of Ment 1 Health. EVALUATION IN MENTAL HEALTH. Washington: U.S. Government Printing Office, 1955.

Analysis of studies concerned with evaluation of practical operations in the field of mental health. These activities are generally evaluated by the following approaches:

1. Community estimate of an activity's worth. Judgement totally related to the community's own values.
2. Appraisal by professionals in the field, based on comparison with existing standards. Considers public opinion, uses empirical criteria and subjective judgement.

3. Scientific measurement by scientific method. Should result in overall program improvement.

Sets forth the steps needed in scientific evaluation:

1. Identification of goals or objectives.
2. Analysis of problem.
3. Description and standardization of activity.
4. Measurement of change.
5. Determination of relation between activity and change.
6. Indication of durability of the effects.

441 U.S. Department of Labor. SUMMARY OF PROCEEDINGS OF CONFERENCE ON PRODUCTIVITY. (BULLETIN No. 913) Washington: G.P.O., 1946.

Topics discussed at the seminar were:

1. Productivity and its general economic setting.
2. Problem of concepts and measurements in the field of productivity.
3. Concepts and measures of productivity at the job level.
4. Concepts and measures of productivity at the plant and company levels.
5. Concepts and measures of productivity at the industry level.
6. Concepts and measures of productivity at the national level.
7. Concepts and measures of productivity at the international level.
8. Scope and limitations of existing measures of productivity.
9. Need for additional measures.
10. Presentation of productivity measurements.

In relating output to manhours, it might be preferable to express results in terms of labor requirements per unit of output rather than output per manhours.

442 U.S. Department of the Navy. PERT DATA PROCESSING LESSON HANDBOOK FOR TECHNICIANS. Washington: Bureau of Naval Weapons, Special Projects Office, 1960.

This handbook describes PERT and includes outlines of lessons on programming and processing PERT data.

In addition the text covers such topics as:

1. Introduction to PERT program.
2. The network (flow chart) for PERT.
3. Establishment of event nomenclature.
4. Preparation of input report.
5. Establishment of data control.
6. Review of PERT output.
7. Review of PERT data/processing.

443 Van Riper, Paul P. Military libraries and military management. SPECIAL LIBRARIES. 47:377-378, 1956.

In order to create a better understanding of the research function within the military, give continued support to the military history programs in existence and to improve the methods of access to the vast military material available, the following suggestions were made to the military librarian:

1. Broadening of professional reading lists for military officers, with careful selection and analysis.
2. More bibliographic essays.
3. Adequate descriptions of military literature collections.
4. More lists of possible thesis and research topics for military institutions of higher learning.
5. Better documentation of theses and research studies.
6. Continuation of indexes to periodical literature on military management.
7. Compilation of best current military writing, similar to Brassey's Annual.
8. Compilation of readings in military management and policy.

9. Military logistical journal.
10. Resumes of contents of military reviews.
11. Establishment of central military library.

444 Verhoeff, J., Goffman, W. and Belzer, Jack. Inefficiency of the use of Boolean functions for information retrieval systems. COMMUNICATIONS OF THE ASSOCIATION FOR COMPUTING MACHINERY. 4:557-559, 1961.

Discusses the inapplicability of Boolean functions for information retrieval systems. The basis of many retrieval systems is that logical combinations of indexing terms are used as questions and the answer is formed by properly forming intersections, unions and complements of sets of documents having the appropriate indexing terms as tags. But an indexing system has to optimize overall performance rather than certain detailed parts. If a system responds to a request asking for "a" and "b" by giving the intersection of the responses it would have responded to requests for "a" and "b" separately, it risks giving too much irrelevant material. If in response to a request for "a" or "b" it gives the union of the responses to the request for "a" and "b" if made separately, it risks leaving out relevant material. In both cases it will result in a decrease of efficiency.

445 Vickery, B. C., and Hanson, C. W. Optimum use of staff: the medium library. ASLIB PROCEEDINGS. 3:225-234, 1951.

Discussion of services performed by the library, and staff aptitudes and qualifications needed to fulfill them. Services fall into two groups: (a) technical, requiring set routine and standardization; and (b) reference, requiring flexibility and hindered by standardization. Strict division of labor is not feasible because harmful to morale and advancement of personnel. Even clerical work requires critical knowledge; aspects of work are interwoven.

Tasks of library include (a) preparing journals for binding, (b) cataloging by author and title, (c) identifying vague citations, (d) indicating possible sources of documents, (e) putting accession lists in useful order, (f) classifying and subject cataloging, (g) acquisitions selection, (h) using and preparing bibliographies, (i) indexing material such as abstracts. Small library performing these tasks should have information officer and clerical worker. Clerical worker works down from task (a), information officer up from (i). Library not performing tasks (g) through (i) will have bibliographer instead of information officer. Library of medium size (6-10 persons) should have one qualified librarian, one person with subject qualification. Work should be broadly divided into library and technical inquiry tasks, with further subdivision so that each person is specialist in one job, capable of doing at least one other.

446 Villers, Raymond. RESEARCH AND DEVELOPMENT: PLANNING AND CONTROL. New York: Financial Executives Research Foundation, 1964.

This report explores the means whereby financial management of the corporate research and development function can be made more effective. Included is a survey of practices of major industrial concerns of widely varied interests, and a few non-profit organizations.

447 Vollmer, Howard M. APPLICATIONS OF THE BEHAVIORAL SCIENCES TO RESEARCH MANAGEMENT: AN INITIAL STUDY IN THE OFFICE OF AEROSPACE RESEARCH. Menlo Park: Stanford Research Institute, 1964.

The composition of the R&D work force will probably reflect the mission of the organization. The author reports studies which indicate differences in the values, attitudes and work orientation of scientists whose fundamental assignment is in research, in contrast to engineers who are predominantly engaged in development activities. Engineers more closely associate their goals and career opportunities with the employing organizations, whereas scientists

generally have goals which reflect acceptance by their colleagues and have greater affinity to their profession than to their employing organization. In either event, whether the work is directed toward research or development, the production unit is the individual.

448 Vollmer, Howard M., and others. ADAPTATIONS OF SCIENTISTS IN FIVE ORGANIZATIONS: A COMPARATIVE ANALYSIS. (R&D STUDY SERIES) Menlo Park, California: Stanford Research Institute, 1964.

The third in a series of technical reports issued as a part of a continuing study of adaptations of scientists in different organizational contexts. The work is sponsored by the Behavioral Sciences Division of the Air Force Office of Scientific Research in which university, industrial and government research organizations are compared.

449 Voos, Henry. STANDARD TIMES FOR CERTAIN CLERICAL ACTIVITIES IN TECHNICAL PROCESSING. Doctoral thesis, Rutgers, the State University, 1964.

Determination of standard times of various clerical routines in a library permits:

1. Library administrators to know the cost of deviation from standard procedures.
2. Evaluation of quality of supervisory practices.
3. Improved effectiveness of clerical routines by having trained personnel spend full-time on certain functions instead of fragmenting duties.
4. Establishment of work standards on broad operational bases by preparing a flow process chart for each operation for which a standard is to be prepared.

450 Voos, Henry, and Costello, Michael A. The role of a technical information section in a governmental research and development organization. SPECIAL LIBRARIES. 48:327-331, 1957.

The Picatinny Arsenal Technical Information Section is a link between information and the scientist. Library must: (a) provide rapid and extensive information retrieval service, (b) maintain a tight collection, (c) maintain strict security controls.

In order to carry out these roles the library (a) publishes bulletins of new acquisitions, bibliographies and translations; (b) speeds cataloging by using cataloging slips which can then be used in the publication of bulletins; (c) separates card catalog by corporate author, subject, and project; (d) uses uniterm indices in book form which can be circulated.

A catalog, punch card recording system was rated (a) too expensive for use to answer simple questions, (b) too slow for use in counting the programming and running the card sets through, (c) useful for complex questions or range of answers.

When the library produced tables of contents and included them in weekly new acquisitions bulletin, circulation of periodicals increased 300%.

451 Vormelker, Rose L. Management's responsibility in library communication. In INSTITUTE ON CHANNELS OF COMMUNICATION FOR SPECIAL LIBRARIES. Bloomington: Indiana Univ., 1960. p. 42-47.

Discussion of problems of communication in library management relations. Lack of management understanding creates double job for many librarians - developing their positions and overcoming prejudices of business executives concerning librarians.

Librarian must have open three flows of communication: (a) downward--management plans, policy statements, orders and procedures; (b) upward--employee opinions, grievances, suggestions; (c) sideways--with personnel at all levels.

Including librarian in department head meetings improves communication by (a) informing librarian of information needs for future plans; (b) informing other departments of library problems; (c) informing librarian of problems in other departments.

452 Waldeck, W. F. Research management looks at the technical library. SPECIAL LIBRARIES. 47:22-25, 1956.

Proposes several means of coping with the increased amounts of published research results.

1. Maintaining and increasing the abstracting and indexing services.

2. Producing more review articles.

3. Instituting company abstract leaflets.

4. Developing mechanical systems for searching literature.

5. Supporting programs to mechanize the Patent Office.

6. Utilizing available stores of information.

7. Requesting assistance of commercial firms selling office equipment for setting up adequate systems.

The librarian, familiar with sources of outside information and its proper organization, is best qualified to assume responsibility for organizing such projects.

453 Wallace, Everett M. USER REQUIREMENTS, PERSONAL INDEXES, AND COMPUTER SUPPORT. Santa Monica, Calif.: System Development Corporation, 1966. (AD-636 833)

Discusses the necessity for scientific and technical personnel to maintain personal files and the

limitations of centralized information services in meeting the diverse and changing information access requirements of these personnel. SURF (Support of User Records and Files) is briefly described. This system uses a computer to keep individuals organize, maintain and find what is in their files by means of personalized printed indexes. Through building a machine-readable record of user indexing practice, the service furnishes a means of identifying current user information requirements and improving feedback of these requirements to centralized services.

454 Wallace, Frank. APPRAISING THE ECONOMICS OF ELECTRONIC COMPUTERS. New York: Peat, Marwick, Mitchell, 1956.

Establishes criteria for initiating a study on computer feasibility. The following guidelines are discussed:

1. Organizing and training the computer feasibility study team.
2. Defining the areas to be studied and the sequence of study.
3. Analysis of existing procedures in selected areas.
4. Construction and analysis of projected computer systems for activities in selected procedural areas.
5. Determination of equipment requirements and projection of costs.
6. Major considerations in computer installation which have a significant bearing on system conversion.
7. Costs of preparing for and installing computer and operating costs which are relatively constant form year to year.

455 Wasserman, Paul. Measuring performance in a special library--problems and prospects. SPECIAL LIBRARIES. 49:85, 1958.

The ultimate measure of a special library must be the value added by the library to the company's idea or product flow.

Library goals:

1. Should support goals of parent organization.

2. Must be agreed upon by management, library, and users.

3. Must be explicit as to extent of service and priority requirements.

Measure the goals as to adequacy of performance and efficiency of service, by a combination of:

1. Tabulation.
2. Case studies of tangible accomplishment resulting from library use.
3. Rating various efforts and developing a scale for measuring results.
4. Estimation.
5. Considering service as a marketing problem and measuring use of product lines--reference service, abstract bulletins, etc.
6. Relating service to a standard and assessing degree of completeness--how many questions asked, how many answered.

456 Weber, David. Criteria for evaluating a college library. ASSOCIATION OF AMERICAN COLLEGES BULLETIN. 43:629-633, 1957.

Discusses three major aspects of evaluating college libraries: (a) collection - sufficient quantity of books required and suggested by faculty for subjects taught; (b) ease of access and success in each attempted access - more significant than count of volumes in collection; (c) adequate teaching of these books by professors and librarian.

Also notes that cost of new building construction is about $2 per volume, which justifies cost up to $2 per volume for weeding. Suggests limit of 250,000 volume collection for college of 1000 students.

457 Weed, K. K. A tool for management evaluation of library services. SPECIAL LIBRARIES. 48:378-382, 1957.

Recommends the following in conducting work measurement studies.

1. Start in the present situation so that improvements can be measured against the old system.
2. Include all effort in the report. Include planning and supervisory functions, and count annual and sick leave as non-operating time.
3. Establish as few functions as possible. Begin with broad functions.
4. Determine a work unit and decide who will record it.

It is not necessary to establish special measurement techniques or criteria first; standard work measurement techniques are both adequate and applicable to library work.

458 Wehrli, Robert L. The value of a library to management. SCI-TECH NEWS. 15:42, 1961.

Major management objectives in evaluating library are (a) return to employees, (b) dividends to stockholders, and (c) long-term stability.

Library support of these objectives is based on three factors:

1. Programs. The library (a) provides background on new programs, (b) accumulates information on related and competitive programs, and (c) is central recording agency for past and current programs.

2. Tools. The library is a tool used by technical personnel in performance of their duties.

3. Personnel. Library supplements experience of personnel by opening up to them plans, work and results of their predecessors.

459 Wesner, Jean P. Training of nonprofessional staff. SPECIAL LIBRARIES. 46:434-440, 1955.

Discussion of some techniques in the training of nonprofessional special library personnel (staff members without formal education or experience in library science). The two means discussed are:

1. Outside training: Summarizes survey of library schools and other institutions offering courses in library procedures for nonprofessionals.

2. Training within library: Suggests use of a staff manual covering (a) organization background; (b) product information; (c) library background; (d) library policies for staff and users; (e) sources of information including catalog, indexes, reference tools. Additional manual suggested describing procedures and responsibilities of each particular position.

460 Wharton, Browning C., Jr. THE UNITED STATES AIR FORCE COMPANY-GRADE OFFICER EVALUATION SYSTEM: A STUDY OF PERFORMANCE APPRAISAL. Amherst: Univ. of Massachusetts, 1966. (AD-633 193)

A model for evaluating a particular system consists of:

1. Desired performance and potential factors described in detail as to quantity and quality.

2. Actual observed performance and potential relative to the specified factors.

3. An evaluation tool which accurately evaluates individual performance and potential in terms of organizational needs.

4. A dual-channel feedback mechanism which allows the individual to adjust his actual performance and potential and which serves

as a basis for adjusting organizational goals and performance factors.

Requirements are expressed by a diagram of an appraisal model which requires that performance and potential objectives be defined and compared to what actually exists. If desired state is greater than actual state, the individual is informed so that his performance and potential may be increased. Purpose of a system should be to provide the greatest amount of service for the least cost.

The evaluation system could be greatly improved if (a) the appraisal tool were designed specifically for the position being rated, (b) performance and potential factors were more clearly defined, (c) coaching technique of counseling were made mandatory, and (d) outside influences were minimized.

461 Wherry, Robert J. The past and future of criteria evaluation. PERSONNEL PSYCHOLOGY. 10:1-5, 1957.

A review of the field of criteria research. Criteria in the past for establishing a criterion have been: (a) reliability, (b) accessibility and cost, (c) acceptability to the sponsor, (d) predictability, (e) agreement with other criteria, and (f) acceptability to the personnel technician.

Predominant classification of criteria has been objective (work records, accidents) rather than subjective (ratings, rankings).

Direction of future criterion research and selection predicated:

1. Clarification of purpose, definition and measurement methods in study of ultimate criterion.

2. Increased interest in criterion equivalence.

3. Improved methods of job and situational analysis.

4. Validation studies of rational approaches.

5. Selection of proper criteria for specific tasks.

462 Whisler, Thomas L., and Harper, Shirley F. PERFORMANCE APPRAISAL. New York: Holt, Rinehart and Winston, 1962.

Pertinent areas of the text are as follows:

1. Quantitative measures of performance.
2. Problems related to organizational characteristics and managerial philosophy.
3. Empirical studies on ratings.
4. Rating by supervisors.
   a. Graphic scale.
   b. Forced distribution.
   c. Ranking.
   d. Essay ratings.
   e. Forced-choice performance reports.
   f. Critical incident ratings.
5. Appraisal using performance statistics.

463 Wilson, Louis R., and Tauber, Maurice F. THE UNIVERSITY LIBRARY. New York: Columbia Univ. Press, 1956. p. 552-580.

Describes areas to be covered in a university library survey. True evaluation of a library determined by study of extent to which clientele achieves its purposes. Library expenditures may be justified in terms of patrons' achievements. Surveys need to examine user satisfaction and difficulties.

Principal method of evaluating libraries in past surveys has been by comparisons of various kinds:

1. Present condition of library with that of past years. Helpful in revealing long-term trends, for collection, budget, book use, cataloging production, professional qualifications and salaries.

2. The library in relation to comparable aspects of

university as a whole, only useful where real relationship exists, as library costs related to growth in enrollment, faculty, etc.

3. Comparison with libraries of similar institutions. Need for precise definitions and consistent methods of collecting data, to be certain data are comparable.

4. Use of external standards. Generally products and materials to which standards may be applied are intellectual and not mathematically or quantitatively definable. Main difficulty in developing standards is that libraries vary in their objectives.

464 Wolfe, Harry D., Brown, James K., and Thompson, G. Clark. MEASURING ADVERTISING RESULTS. (BUSINESS POLICY STUDY, No. 102). National Industrial Conference Board, 1962.

Describes the methods now being used by companies of all sizes and types to measure the effectiveness of their advertising. These methods, which often are used in combination, are:

1. Measuring awareness is defined as a respondent's knowledge about a company, its products. Can reveal how effective advertising has been in increasing knowledge.

2. Determining ability to recall advertising messages. Permits a more critical evaluation of whether people comprehended advertising messages and believed them.

3. Ascertaining attitudes and attitude changes, which measures favorable impressions of a company or its products.

4. Psychological measurements, to determine how people really feel about product or service.

5. Sorting and counting the number responses to an ad.

6. Analyzing sales results, a direct measure of advertising effectiveness. In situations

where the results of advertising are clouded by extraneous marketing factors, changes in sales are studied in conjunction with other measurements, such as awareness and recall, to obtain a better understanding of advertising's contribution.

7. Analyzing secondary effects, such as fluctuations in repair work, if free maintenance is offered, as an indication of the effectiveness of advertising.

8. Seeing the use made of the advertising, such as catalogues, price lists, directories, and other shopping guides, a measure of advertising effectiveness.

46. Woodruff, Elaine. Work measurement applied to libraries. SPECIAL LIBRARIES. 48:139-144, 1957.

Work measurement is important for balancing workload and personnel, improving operating efficiency, evaluating performance, and formulating a budget. The librarian of the United States Civil Service Commission suggests these rules for setting up a work measurement program:

1. Secure employee participation at all stages of program.
2. Have each employee do his own reporting.
3. Review and revise the system continually.
4. Allow enough time to get a true average before using figures as definitive.
5. List activities clearly and without overlapping, record time spent and number processed daily according to clear-cut directions, summarize data for a summary work report.
6. Status of workload should be shown since this is important to management as well as to library supervisor.

466 Wylie, Harry L., Ed. OFFICE MANAGEMENT HANDBOOK. 2d ed. New York: Ronald Press, 1958.

An analysis of the phases of management office activities, covering office organization, personnel development, supervision, salary administration, location and layout, physical environment, furniture and fixtures, supplies, forms design and control, reproduction methods and control, systems and procedures, methods study, work simplification, correspondence, communications, financial planning and control.

Discussion of job evaluation describes four methods:

1. Job ranking method. Supervisor ranks jobs in order of difficulty without distinguishing different elements, must be personally familiar with contents and requirements of each job.

2. Classification method. Job classes or grades predetermined, various job classifications slotted into these grades. Difficult with jobs containing varying levels of responsibility.

3. Point method. Separate appraisals of several factors, such as skill, effort, responsibility, usually subdivided into subfactors. Point values determined for each factor, and subfactor or degree. Difficult to construct and define degrees.

4. Factors comparison method. Uses broad factors not broken down into specific subfactors. Jobs compared to determine degrees of factor required. Factors generally are mental requirements, skill, physical requirements, responsibility, working conditions. Evaluator must guard against bias, leniency, harshness and other rating errors.

467 Wylie, Harry L. OFFICE ORGANIZATION AND MANAGEMENT. 3d ed. New York: Prentice-Hall, 1953.

A survey handbook which describes the following areas of office management:

1. Organization - The office survey and analysis.

2. Methods.
   a. Control of office work.
   b. Establishing and improving routines.
   c. Preparation and use of office manuals.
   d. Work simplification.
   e. Services in the office.

3. Personnel.
   a. Employment and selection of personnel.
   b. Job analysis, study and evaluation.
   c. Merit rating.
   d. Training the employees.
   e. Salary administration.
   f. Labor turnover and work distribution.

4. Physical Factors--Equipment.
   a. The influence of physical factors.
   b. Office equipment and arrangement.

5. Management--Expense Control.
   a. Budgetary control.
   b. Developing leadership effectiveness.
   c. Maintaining good employee--employer relations.
   d. Reports to top management.
   e. Administrative standards.

468 Wynar, Don, and others. Cost analysis in a technical services division. LIBRARY RESOURCES & TECHNICAL SERVICES. 7:312-326, 1963.

An analysis of direct and indirect time and cost figures for professional and clerical duties in three sections of library, using data obtained in the Technical Services Division of University of Denver Libraries. Results are summarized as:

1. Order department. Time per book was 37 minutes,

54 seconds which cost $1.03.

2. Cataloging department. Time per book was 72 minutes, 40 seconds which cost $2.74.
3. Mechanical preparations and supply activities. Time per book was 6 minutes, 48 seconds which cost $0.56.
4. Overall total cost of preparing new non-fiction title, $4.33.

Important factors in overall low cost per new title processed have been (a) examination of suitability of supplies prior to purchase, (b) purchase in quantities large enough to secure price advantage, (c) dropping of use of date-due slips, since a transaction type of charging is used.

469 Yoder, Dale. PERSONNEL PRINCIPLES AND POLICIES. Englewood Cliffs, N.J.: Prentice-Hall, 1959.

This text provides a systematic outline of the guiding generalizations and recognized objectives of manpower management. Specific techniques are mentioned and illustrated, but are only introduced as evidence of current practice. These are directly related to questions of policy or objectives upon which the major emphasis is given.

Also discussed is job analysis, organizational planning, training programs, employee motivation, wage and salary administration, personnel rating, and personnel selection.

470 Yovits, Marshall C. Information requirements and use for research and development planning. SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCE. Bedford, Mass.: Mitre Corporation, 1966, p. 99-103. (AD- 587)

Discusses ways to improve effectiveness of R&D planning. Some studies currently being pursued are:

1. Influence of organization on performance of research.

2. Investigation into process of scientific creativity.
3. Evaluation of R&D personnel and management.
4. Processes of utilization of research results.

Important ingredients of R&D management are communication and coordination.

The area of research and development program management was analyzed and divided into several major components, such as:

1. General theory and methodology.
2. Planning of research programs.
3. Implementation of research programs.
4. Evaluation of research programs and management - (a) measurement and data acquisition on qualitative effectiveness criteria; (b) output evaluation - theoretical advances, utilization rates, and development of effectiveness criteria; (c) measurement of originality in research; (d) adaptability of cost-effectiveness concepts to the management of basic and applied research; (e) evaluation of contractors and proposals; (f) evaluation of research-management processes, including overall program effectiveness.

471 Zeyher, Lewis R. COST REDUCTION IN THE PLANT. Englewood Cliffs, N.J.: Prentice-Hall, 1965.

This book provides tried and proven methods for reducing plant costs and affords a panorama view, with some depth, of the typical manufacturing plant and its operating problem areas. Operations most sensitive to a cost reduction campaign are identified, and suggestions are advanced for the introduction of remedial actions. Plans also are described for a continuous program of attack against high cost. In addition, techniques are indicated for the control, surveillance and maintenance of satisfactory operating conditions. There are 19 functional and departmental areas analyzed where these methods are discussed. Some

of these areas are value analysis, equipment analysis, work simplification, cost cutting, standards, effective use of control and paperwork analysis.

472 Zimmerman, Carma C. Using the standards in studying library needs. ALA BULLETIN. 52:761-762, 1958.

Discussion of the use of new ALA public library standards in studying library needs. Essentials include:

1. Understanding that standards must apply to all public library services, even in small libraries.

2. Appraisal of library or operation in terms of best available standards. California public library improvement program, for example, has been to (a) develop standards of measurable library performance; (b) have statewide survey to show how systems compare with standards; (c) create a program for future development to correct discrepancies.

3. More research and experiment to verify or correct existing standards. These include (a) forms and devices for interlibrary cooperation and systems which yield best results; (b) controlled studies of man-hours and results of various library systems.

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APPENDIX D

COMPONENTS OF A LIBRARY

A. Library mission and placement in organization
   1. Definition of the mission of parent organization
   2. Definition of mission of library for parent organization
      a. Administration
      b. Management
      c. Legal
      d. Scientific
      e. Engineering
      f. Technical
      g. Others
      h. Combinations of a-g
   3. Types of clientele served
   4. Placement of library organizationally in parent

B. Budget allocated to library
   1. Relationship to overall budget of parent organization
   2. Library allocation of budget
      a. Maintenance and update of standard collections
      b. Procurement of new collection items
      c. Maintenance of equipment
      d. Procurement of new equipment
      e. Special services (e.g., contracts)
      f. Research

C. Physical layout
   1. Space
      a. Geographic location
         (1) Relationship to library administrative superior
         (2) Relationship to majority of clientele
      b. Size and type
         (1) Arrangement
         (2) Work flow
   2. Equipment
      a. Standard office equipment
      b. Standard library equipment
      c. Special equipment oriented to non-standard services
      d. Relationship to staff size and type
      e. Relationship to budget
      f. Equipment procurement and maintenance

D. Library staff
   1. Qualifications
      a. Education
      b. Experience

2. Size and ratio of staff
   a. Professional
   b. Nonprofessional
3. Salaries
   a. Professional
   b. Nonprofessional
4. Personnel utilization of professional and non-professional
   a. Job descriptions
   b. Personnel selection in relation to job to be done
   c. Utilization of personnel at highest capacities
   d. Duties performance measurement
5. Administrative aids
   a. Staff manuals to clarify:
      (1) Library mission and tasks
      (2) Staff job classifications
   b. Standards

E. Library contents (in relation to its mission)
1. Collections
   a. Orientation to mission of parent organization and library
   b. Orientation to clientele
   c. Orientation to services provided
   d. Makeup of collections - composition
      (1) Journals - primary
      (2) Journals - secondary (listings, abstracts)
      (3) Books
      (4) Standard reference works
      (5) Reports, theses, manuscripts, drawings notebooks, bibliographies, catalogues
      (6) Special collections
   e. Makeup of collections - extent

F. Library contents control
1. Cataloging, classification, subject heading assignment
   a. Shelf list
   b. Card catalog
   c. Special lists
   d. Miscellaneous arrangements
2. Application of automation to library operational procedures
3. Application of special systems to subject matter control
   a. Manual card systems (e.g., Uniterm, or DMIC)
   b. Edge-punched cards (McBee)
   c. Field-punched cards (Termatrex)
   d. Automated card-sort systems (IBM, Remington Rand)
   e. Computer systems

G. Library services
   1. Circulation services (loans on demand within parent organization to primary clientele, including temporary acquisitions from other libraries on demand)
      a. Books
      b. Periodicals
      c. Reports
      d. Miscellaneous
   2. Current awareness services to primary clientele
      a. Listings - preparation and dissemination of listings, abstracts, extracts
      b. Current literature dissemination
         (1) Routing new material (journals, books) on predetermined basis
         (2) Selective dissemination of listings or articles
   3. Bibliographic services
      a. Literature searches
      b. Compilation of bibliographies
      c. Compilation of bibliographies annotated
      d. Organization of reports
      e. Preparation of summaries
      f. Maintenance of special routine bibliographies
      g. Maintenance of special subject references, files, and indexes
   4. Editorial assistance with publications
   5. Translation services
      a. Internally
      b. Externally
   6. Other special services

H. Other considerations in establishing, operating and maintaining library services
   1. Professional activities
      a. Society memberships
      b. Meeting attendance
   2. Contract performance of some library operations
      a. By other government agencies
      b. By commercial contractors
   3. Research in library operations, services, etc.
   4. Training programs
      a. Library staff personnel
      b. Non-library staff (utilization of library)
   5. Incentive programs

APPENDIX E

GLOSSARY OF MANAGEMENT SCIENCE TERMS

Basic motion time study.- A basic motion is considered to be a single complete movement of a body member. A basic motion occurs every time a body member which is at rest moves and again comes to rest. Factors influencing motion and time determination are:

1. Distance moved.
2. Attention required.
3. Precision requirements.
4. Weight.
5. Simultaneous arm motions.

Break-even analysis.- This analytical method provides a quick insight into sales, income, costs and profits, and how they are related to the different volumes of production and sales. It involves plotting lines on a graph representing fixed costs, variable costs and sales. The vertical axis is normally displayed as dollars of sales and costs, and the horizontal axis as volume of production. The point at which the total cost line and the sales line intersect is considered the break-even point. The area above the break-even point where sales volume exceeds total costs is the area of profit, and the area below where the costs exceed sales is the area of loss.

Budget.- A budget is an authorization of resources, which can be expressed in terms of people or money. Generally a budget converts resources into money. Authorization by means of the budget may be made to a function, a division or the total organization. The budget should be correlated to planning for the accomplishment of objectives. It should represent a decision on the utilization of resources after alternative courses of action are evaluated. The budget gives management a quantitative base for measurement and evaluation. It represents delegation and delineation of responsibility, and promotes organizational stability and continuity. The budget is a communication and coordination tool.

Charting techniques.

Flow diagram.- In its simplest form, this chart shows a rough view of the space in which the activity being studied occurs, the location and the extent of work areas, machines or desks, with a connecting series of arrows and lines to indicate the route of travel. Flow diagrams are often made up in conjunction with process charts as they are helpful in visualizing the process and conceiving changes in it.

Flow process chart.- This is a graphic representation of the sequences for all operations, transportations, inspections, delays and storages occurring during a process or procedure and includes such information as the time required and distance moved.

Linear responsibility chart.- This technique combines the organizational chart and position descriptions, covering every person appearing on the chart. Functions are listed on the left side and personnel across the top. Eight kinds of actions are depicted by symbols and should cover all actions necessary to organize or analyze the organization of any department. The basic chart permits analysis of the contents of a person's job, and an overlay may be used to show which tasks are routine, which are supervisory and which are administrative. An overlay can also be used to designate the technical level of each task performed.

Man process chart.- The man-type flow process chart shows a process in terms of the activity of the individual performing it.

Multiple activity chart.- This is the symbolic and systematic presentation of the method of work performed by a man when his work is coordinated with one or more cycle time controlling devices, such as another man, a machine or process, or several machines, and when a large number of activities are performed coordinately. Types of multiple activity charts are man and machine charts, multi-man and multi-machine charts, Therblig and Simo charts.

Procedure flow chart.- This is sometimes known as the form process chart. It is a symbolic and systematic presentation of the procedure used to modify, work on, and handle a form or forms. It may be thought of as a specialized flow process chart of the product or material kind.

Process chart.- A process chart is a device used to visualize an entire process and determine hence a means of improving it. As each step in a process is affected to some degree by an earlier detail, the process must be visualized in its entirety before changes can be made in any subdivisions. Changes made without due consideration of the whole process will be unsuitable for the ultimate plan of operation. Therefore, the process chart is useful at every stage in improving a process. The three most common types of charts are the flow, or product, chart, the multiple activity chart, and the operation, or right and left hand, chart.

Product process chart.- The material-type flow process chart, sometimes known as the product process chart, represents the process in terms of events which occur and materials used.

Right and left hand chart.- This is a symbolic and systematic presentation of the method of work performed by the hands and the other body members when work is performed at one place and cycle time controlling equipment is not used. This chart is also called the operation or operator chart and is a graphic representation of the points at which materials are introduced into the process and of the sequence of inspections and all operations, except those involved in material handling.

Simo chart.- The Simo chart, short for simultaneous motion chart, is a detailed, symbolic systematic and time representation of the method of work performed by the worker's body parts, at one work place, recorded by motion pictures. The volume of work must be rather large before this technique is worthwhile. The Simo chart is a kind of Therblig chart.

String diagram.- This diagram is like the flow diagram except that pins represent work places and string is used to show product flow. Heaviest concentration of strings indicates greatest traffic flow.

Chrono-cyclograph.- To obtain a record of a motion and its general speed, a light is attached to the middle finger of each hand. Using a still camera, a relay in the circuit of the light causes it to flash on and off with a variable amount of electricity, forming a pear-shaped dot on the exposed film. This dot shows the direction of motion, and the spacing of the dots gives the general speed.

Correlation analysis.- The coefficient of correlation provides a measure of the degree of relationship between variables. It has a possible range of -1.00 to +1.00. If one variable increases while the other decreases, the result will be a positive coefficient. If there is no relationship between the variables, the coefficient will be zero. In general, the closer the coefficient of correlation comes to equaling plus or minus one, the better the relationship is for forecasting purposes.

Cost effectiveness analysis.- An economic analysis applied to resource allocation. It relates tangible costs to meaningful end-producing missions or programs, instead of to the cost of individual segments. In economic analysis, the concern is with objectives rather than objects. Cost effectiveness can be determined by identifying the performance or accomplishments of a program needed to achieve objectives, and evaluating all resources associated with the program in relation to the benefits anticipated from the program.

Cybernetics.- Cybernetics is the study of control principles applicable to mechanical, electrical, biological, organizational and economic systems and the similarities among all these systems. Control normally works with a low expenditure of energy exerting just enough influence to signal an increase or decrease in the main flow of energy when needed.

Control objectives are necessary in an organization. In an organization with material products or homogeneous operations, operational objectives, even if not communicated by management, can be determined by inference. Control objectives can be developed which are consistent with organizational objectives.

To establish control, predetermined standards of performance must be used to measure actual accomplishment. There must be a system for performance appraisal. When information indicates performance deviating from a standard, there must be a follow-up and planned improvement over substandard performance. If performance is satisfactory, but objectives are not being accomplished, planning parameters must be re-examined and necessary changes implemented.

Control also involves the correlation of functional activities into an integrated reporting system which is accurate, objective, fast and action-directed. To be effective, control must give management an early warning detection system. If variances from plans are detected early enough, corrective action can be taken before over-expenditure of resources has progressed to the point of impairing program objectives. Control essentially includes the appraisal and interrelationship of three critical factors examined in total perspective: (a) actual performance compared to planned performance, (b) time of accomplishment, and (c) expenditures related to accomplishment.

Cyclograph.- This device is similar to the chrono-cyclograph, except instead of flashing lights a continuous white light or line is recorded on the film.

Dynamic programming.- This is a method of solving multistage programming problems in which the decisions at one stage become the conditions governing the succeeding stages. Some of the problems which can be solved with dynamic programming are:

1. Long-range capital budgeting.
2. Timing of equipment replacement.
3. Smoothing of production levels to meet variable demands.
4. Allocation of limited resources between current consumption and reinvestment to increase future output.

Econometrics.- This is the science of economic measurement, which is based on the idea that changes in economic activity can be explained by a set of relationships among economic variables. It explains the past and predicts future economic activity by mathematical equations that express the most profitable interrelation-

ships within a set of economic variables. The best mathematical arrangement is a model which takes the form of an equation or system of equations that best describe the past set of relationships according to economic theory and statistical analysis. The model, in other words, is a simplified abstraction of a real situation expressed in equation form and applied as a prediction system that will yield numerical results.

Economic order quantities (EOQ).- Techniques used to determine economic order quantities are useful in inventory management and procurement when making decisions concerning quantity. These analytical approaches indicate the quantity per order which will minimize total incremental costs. In most cases, total cost is defined as the sum of procurement costs and inventory carrying costs. Therefore, when the quantity ordered increases, procurement costs decrease and carrying costs increase.

Flow diagram.- (see Charting Techniques-Flow diagram)

Flow process chart.- (see Charting Techniques-Flow process chart)

Game theory.- A game is conceived as a situation in which two or more parties are engaged in making choices, in anticipation of certain outcomes or pay-offs which may be rewards or penalties. Games may be classified according to the number of players and degree of conflict of interest among the opponents. There are two different types of pay-off arrangement. In the zero-sum game, the amount one player wins is equal to what his opponents have lost, so that the total payments of all players is zero and the conflict of interest among players is complete. In the non-zero-sum game, the amount gained by one person is not necessarily equal to the amount lost by the others. Hence, the conflict of interest is not complete. Considerable analytical complexity may arise as a result of non-zero-sum games.

Industrial dynamics.- This method of systems analysis deals with the time-varying interactions among the parts of management systems. These parts are identified as flows of information, orders, materials, money, personnel and capital equipment. All information feedback characteristics of industrial activity are

examined to show how organization structure, amplification, policies, time delays and decisions in action interact to influence the success of the enterprise. The interactions are accomplished in a computer model by employing feedback routines that express the structure delays in the amplification system. The structure of a system shows how the parts are related to one another. Delays always exist in the availability of information, in making decisions based upon information, and in taking action based upon the decision. Amplification usually exists throughout the subsystem, especially in the decision policies of our industrial and social systems.

Information theory.- A fundamental means of measuring the information content of both symbolic and verbal languages and relating the characteristics of an efficient communication system to the information content of the messages transmitted. Models have been made of a decision problem in which the costs of obtaining additional information for a commodity-trading organization, as well as the costs of added internal communications, can be compared with the probable gains resulting from the information. The point beyond which the costs of additional information are no longer paid for by improved performance can be calculated.

Input-output analysis.- This analytical method determines the change in direct and indirect requirements for goods and services which will result from a change in demand for other related products. The solution is accomplished by the use of matrix algebra, which describes the problem as a matrix in which the input-output relationships among pairs of products are entered into the appropriate cells of the matrix. The disadvantage of a matrix is that it is a major undertaking and quite costly to construct.

Job standardization.- A recording of the exact method of an operation on an instruction card, with the usual time spent for each aspect of the operation.

Linear process chart.- (See Charting Techniques - Linear process chart)

Linear programming.- A mathematical technique for deriving optimal solutions from a large number of feasible combinations involving linear relations. Any economic problem concerned with maximizing or minimizing linear objective functions, such as total costs or net profit and subject to a set of linear inequalities in the form of constraints due to limitations of men, materials, capital, or other resources, is a linear programming problem. The two most common types of linear programming are the graphic and simplex methods. The analytical procedure in all instances consists of four parts:

1. Arranging the alternative possible goals to be sought.
2. Defining the assumptions to be employed.
3. Determining the balance of net advantages and disadvantages in selecting the optimum goal.
4. Modifying selection by relating the alternatives to the organization's overall objectives.

Man process chart.- (See Charting Techniques-Man process chart)

Marsto-chron.- Originally, this was considered a time study timing device, but it is used for some motion study research in industrial purposes. The slow moving tape is marked for time by depressing a key. Other keys can be depressed for coded information about the element or activity being used.

Method study.- Method study is a systematic analysis of work to:

1. Eliminate unnecessary work.
2. Arrange the remaining work in the best possible order.
3. Standardize usage of proper work methods.

Memo motion.- Memo motion is not a very highly detailed type of motion study. It normally requires motion pictures, usually at one foot per second or 100 feet per minute, but the speed may be increased to 8 feet per second or 500 feet per minute to obtain slightly greater detail. Memo-motion study is less detailed than micro motion study. It is generally used for analyzing longer cycles of work and work which requires three or more people working coordinately.

Methods-time measurement.-MTM is based upon research on basic motion, the factors which affect them and the normal times required for their performance. It has predetermined time values for the following categories of motion: reach, move, turn and apply pressure, grasp, position, release, disengage, eye travel, eye focus, body, leg and foot motions. The basic unit of time measurement is called time measurement unit (TMU) and equals .00001 hour. This technique permits determining effective methods before they are introduced into a shop. The data provide a satisfactory degree of accuracy in all phases of the work involving manual motions.

Micro-motion.- An analysis and improvement of an operation employing a motion film and special timing devices to provide quantitative and qualitative information concerning the motion pattern of an operation. In order to define the elements of the motion, special symbols dividing the work into fine detail were devised. These symbols are called Therbligs and are used in the analysis of work. Motion pictures with a timing device are used to obtain times for each motion or Therblig. Generally, micro-motion studies are made with 16 foot per second or 1000 foot per minute motion pictures.

Model, mathematical.- In mathematical analysis, the word "model" is used to mean a mathematical description of an activity which expresses the relationships among various elements with sufficient accuracy that it can be used to predict the actual outcome under any expected set of circumstances. The advantage of a model is that it, instead of the organization it simulates, can be manipulated in a variety of ways until the best solution is found. The disadvantage is that no model can duplicate reality completely.

Model, wire.- After motion pictures or still pictures have been taken on a job, it is occasionally desirable to make a three dimensional model of the activities. This is done by bending wires into the shape of the motion paths.

Monte-Carlo method.- This method, closely related to probability theory, refers to the use of simulations of gaming methods in operations research.

Many problems in an analytical model may be too complex to manipulate. It may be possible, however, to construct a numerical model in which tabulated probability distributions state basic functions, specified transition, probabilities and the like. Since most management problems in which uncertainty exists involve the interaction of several random events, it is necessary to calculate the probability of each of the different outcomes arising from these interactions. These problems may be solved rigorously by mathematical means or by the Monte Carlo technique, acquiring data through the use of a random-number generator.

Motion Study.- A technique used to determine the best possible way to perform an activity. It is directed toward the development of optimal procedures and working conditions. Several aspects of an activity are investigated in motion study. The principal component of a job is the set of human movements used in the job. The arrangement of the work place, the design of the product, the design of tools, fixtures, and jigs, and the materials-handling process are also examined.

Multiple activity chart.- (See Charting techniques-Multiple activity chart)

Operation.- An operation may be described by functional, time or motion elements. Functional elements are arbitrarily descriptive subdivisions of work cycles, readily defined and identified. Time study elements are capable of being timed with a stop watch. Motion elements are subdivisions of a motion pattern employed by the operator to complete a unit of output.

Operations analysis.- This term encompasses all those procedures concerned with the original design or improvement of production or service operations and may be described as a method study. Studies of an entire provess may be made to determine whether operations or elements of them can be eliminated, combined, changed in sequency or improved. Analysis is made of the method, motion pattern, materials, tools and equipment used in an individual operation to determine the one best way. Work measurement is an integral part of operations analysis as a method of quantitative analysis.

Operations analysis is divided into the following steps:

1. Preliminary analysis. Recording of existing conditions or proposed specifications.
2. Description of an operation. Dividing the operation into arbitrarily defined functional and motion elements and systematically charting these elements to describe the existing or proposed method.
3. Detailed analysis. Critical study of the elements in the operation to determine which ones may be eliminated or improved.
4. Work measurement. Analysis of the time consumed by productive and non-productive elements of the existing or proposed operations.
5. Synthesis. Integration of improved elements into alternative operation designs.
6. Evaluation. Selection of the best alternative in terms of specific criteria such as unit time, cost and space required.
7. Job standardization. Standardization of job, method and unit production times, by reducing them to some form of written standard practice.
8. Installation. Signing and executing the introduction and installation of new methods.
9. Control. Maintenance of standard working conditions, equipment, methods, material, quality, supplies and standard times in the life of the operation prior to formal redesign of the method.

Operations Research.- An application of the scientific method used to study the operations within complex organizations or activities. Its objective is to provide top level administrators with quantitative basis for decisions to increase the effectiveness of such organizations in carrying out their basic purposes. Operations research provides a basis for arriving at an integrated and objective analysis of operating problems, as well as helps in improving inventory and reordering policies and estimating amount of clerical help needed.

Plant Layout.- Plant layout deals with the arrangement of facilities and personnel. Effective layout calls for a minimum of movement of both materials and personnel, and a minimum of time and process for any individual

part. The less time a piece of material spends in the plant, the less opportunity it has to collect charges against it in terms of labor and overhead costs. Plant layout may also be defined as planning and integrating the path of the component parts of a product to obtain the most effective and economical relationship between man and equipment and the movement of material from receiving through fabrication to shipment of the finished product. Principles to be considered in planning a layout are:

1. Over-all integration.
2. Minimum distance moved.
3. Flow.
4. Cubic space.
5. Satisfaction and safety.
6. Flexibility.

Probability.- A measure of the likelihood of occurrence of event. It is used to predict behavior of a group, but not a single item in the group. It is determined by dividing the total number of occurrences possible for all results.

Procedure flow chart.- (See Charting techniques - Procedure flowchart)

Process chart.- (See Charting techniques - Process chart)

Product process chart.- (See Charting techniques - Product process chart)

Production Allocation and Control of Expending Resources. (PACER).- The PACER system is a mechanism which delineates responsibility, gathers cost data from the various functional areas, evaluates these data against forecasts to arrive at realistic cost estimates, and provides the means for controlling costs after the contract is received. The PACER method is based on decentralized authority with centralized control. The project manager, the manager of the cost-estimating department and the cost-estimating engineer identify each work phase and cost element and erlate them to a specific area of responsibility within the company. The project

manager is given total responsibility for all the phases of a potential program, including scheduling, finances, and the technical aspects of the program. He is responsible for allocation of the various resources to the areas which, in turn, will support and assume responsibility for their own performance on the program. The system provides current information on the planned-versus-actual performance within each area by means of monthly reports of expenditures and estimated cost through completion of the contract.

Program Evaluation and Review Technique. (PERT).- PERT is a planning and control concept designed to focus managerial attention on key program development parts, point up potential problem areas which could disrupt program goals, evaluate progress toward the attainment of program objectives, give management a prompt mechanical reporting device, and aid and facilitate decision-making. In the accomplishment of these objectives, PERT uses time as a common denominator to reflect three categories of factors which influence success--time, resource applications, and required performance specifications. Some of the important PERT terms are given below:

Activity.- An activity is a time consuming process in research and engineering. It is the work in process between two points or events in time. An activity is represented by an arrow in PERT network systems.

Activity time.- Estimate of the time required to complete an activity in a specified manner is called activity time. There are three types of estimates:

1. Optimistic time--the shortest time in which an activity can be completed if there are no problems.

2. Most likely time--the estimated time to complete the activity under normal working conditions. This is the modal estimate of time that would occur most often if the activity were repeated under exactly the same conditions many times.

3. Pessimistic time--the longest time an activity would take if major changes in approach or design were required, for example, if the product were more difficult than it first appeared.

Critical path.- The particular sequence of activities from beginning to end of a project which has no slack and therefore, slippage of any event would be expected to produce slippage in the final event.

Event.- A specific accomplishment recognizable by a particular instant in time.

Network or flow plan.- A diagram or topological representation of a project made up of one or more series of sequential events joined by activity lines to show the time and relationships among events.

Slack paths.- Slack or float-time is the excess of time available over the time required to complete an activity. Slack paths are sequences of activities which have excess time as opposed to critical or zero slack paths. A negative slack occurs when there is insufficient time to complete an activity. Positive slack provides flexibility within the path.

Milestones.- The significant events or selected points on which progress information is needed in order to evaluate performance with regard to meeting final project objective.

Quadratic programming.- An algebraic technique that differs from linear programming in that it includes a second order in the equation. Quadratic programming can handle problems in which the cost relationships are non-linear. For example, direct costs per unit can change with volume or demand and fluctuate over successive time periods. A method has been developed for quadratic curves which permits a closer approximation to actual cost relationships than can be obtained with linear programming. Quadratic programming allows the computational work to be reduced to a linear form and, therefore, made relatively simple.

Queuing.- Queuing provides a means of predicting the probable length and delay of a "waiting line" formed by random arrivals at a servicing or processing facility of limited capacity. It is used in problems in which one or more elements occur at a rate that management can neither control nor predict precisely. This is of special interest because in many operations there is a tendency for lines to form.

Regression analysis.- A form of statistical curve-fitting with the added benefit that it tells something about how good the fit is. An advantage over ordinary curve fitting is that a many-variable curve can be fitted in one computation, by performing a multiple regression. A statement of the equation which shows the extent of relationship between the two variables.

Right and left hand chart.- (See Charting Techniques- Right and left hand chart)

Servo theory.- A methematical method used to assist in the analysis and design of automatically or remotely controlled systems. Feedback, or information on the past behavior of a system is used to control it in the future. Lag or reaction time is the time needed for a command from the control system to take effect. The stability of a control system is its tendency toward some normal or desired state. Types of control systems are integral control, in which the system responds to cumulative rate of change, and differential control, in which it responds to current rate of change.

Simo chart.- (See Charting techniques- Simo chart.)

Simulation.- Simulation is the experimental analysis of operating systems by means of symbolic models. It involves duplication of a system by artificial means. A symbolic model is an abstract logical structure which operates in a manner similar to an operating system under analysis or which represents the operation under investigation. Since a symbolic model is actually a logical structure, its logical objective is to determine the validity of all the propositions included in the problem under investigation. Symbolic models generally employ mathematical and logical symbols which can be used to represent almost any system. Therefore, these models are probably the most valuable to management in making decisions. Electronic computers can be used very effectively in working with symbolic models because computers are logic machines dealing with symbols. Any system which can be reduced to a set of definable elements for which operating rules are available can be simulated on a computer, and almost all operational problems which arise in an organization can be duplicated by a simulation process.

Standard data.- Standard data are predetermined time values, tabularized or reduced to simplest terms, and compiled to larges time values consistent with accuracy, flexibility, and speed required for the establishment of time standards for manual operations. The work factor system divides standard data into two classes, general and specific. General standard data are time values developed for a relatively small work segment, not normally subdivided and usually not applicable to several classes of work. Specific standard data are usually developed for larger work segments occurring in specific operations or classes of operations. The time values in specific standard data are usually combinations of value selected from a general system.

Standard time.- The results of the application of a formal time study or work sampling may be a standard time which represents the gross time required by a normal operator working under normal conditions and with normal skill, at a suitable pace to complete a unit of work of satisfactory quality.

Statistics.- A general term for a large group of mathematical tools based on laws of probability, used to collect, analyze, and interpret numerical data. The purpose of statistical analysis is to provide methods of treating data so that the maximum information can be obtained with a predetermined risk of drawing false conclusions. No method of analysis can extract more information from a set of data than is contained therein, and no method, statistical or otherwise, can draw conclusions from experimental data with zero risk of error.

String diagram.- (See Charting techniques - String diagram)

System.- A system is comprised of components designed and integrated to meet objectives. In a hardware system, the objective is to meet performance requirements. Each component is theoretically assigned a functional contribution compatible with performance objectives. A system can also represent procedure to assist an organization in achieving its performance objectives. A management system can cover one or several organizations, or a part of an organization.

A system also can be described as having some objective (plan), input requirements, means for integration (consolidation and interpretation), output and dissemination of output. A total system may consist of subsystems or components. The components should work and mesh with the total system objectives.

Therbligs.- The symbol of any basic elemental hand motion. Originally, seventeen were defined by Frank Gilbreth and since then other industrial engineers have made revisions and expanded the list. Any manual job can be described, analyzed, and often improved by dissecting it into its basic elements or Therbligs. This is usually an important part of methods analysis.

Time study.- This procedure is used to determine standard time for an operation by direct time measurement and by use of a stop watch as the measuring device. The concept of time study is often expanded to include approval of an operation resulting from the time measurement.

Universal operator performance analyzer and recorder. (UNOPAR).- This is an electronic device for determining velocity, acceleration, deceleration, position, distance, and time for every motion involved in an operation, even when performed on three planes. The device is used for the same measurement on each of the three planes as well as for resultant combinations of the measurements. Thus it is possible to decide whether the motions are efficient or can be improved.

Value analysis.- This control method is a means of finding new ways to lower cost of a product or process while retaining or improving quality, function and reliability. Value analysis works through the application of common sense, observation, investigation and imagination. It can be applied at any stage in the production cycle and provides a step-by-step process which facilitates analysis. It departs from traditionsl cost reduction or cost-control programs by providing a

job plan consisting of six basic steps systematically setting up control: (a) information, (b) speculation, (c) analysis, (d) planning, (e) execution, (f) follow up.

Value analysis not only locates non-contributive costs, but considers applicability of technological progress. The inclusion of value analysis as a continuous control has increased awareness of the necessity for considering product function and performance.

Work analysis (non-repetitive).- Most analytical techniques are only applicable to repetitive or slightly varied cycle work. However, much work in industry is of a non-repetitive type. Four techniques are used for analyzing non-repetitive work:

1. Observation of the worker.
2. Memo-motion study.
3. Work sampling.
4. Operator recording his own work.

Work measurement.- The procedure involved in measuring or forecasting the rate of output of an existing or newly designed operation and determining how much time is consumed with various productive and non-productive activities of a process, operation or job. Also involved is the determination of standard times which represent allowable time for the performance of work. Work measurement is a generic term and pertains to all types of time measurement work systems. It can be applied to current work methods or proposed operations. Through the use of the stop watch or other measuring and estimating devices, the time for various elements of the productive cycle of an operation are measured. Analysis of the results can indicate delays as well as areas where time may be reduced. There are four areas of work measurement: time and motion study, motion and method study, work simplification, and process charts. These are not entirely independent and should therefore be studied together.

Work sampling.- A method for analyzing work to find delay allowances applicable to a given job, to determine percentages of machine and operator utilization and to establish production standards. It utilizes random sampling observation of activities going on at randomly selected times of a given operation.

Work simplification.- The organized use of common sense to find easier and better ways of doing work. The organization of thinking in terms of a specific pattern makes this procedure effective, accelerating the rate of improvement within any enterprise. Work simplification procedure is as follows:

1. Select a job to be improved.
2. Get the facts and process charts.
3. Challenge every detail and list the possibilities. This is organized creative thinking and brain storming.
4. Develop improved methods.
5. Install the improvements.

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13. ABSTRACT

This report summarizes the findings of a search in the library and management sciences literature to determine the standards and methods of evaluating the efficiency and effectiveness of library services and operations. A matrix was used to show which management techniques, either analytical or operating, may be applicable for evaluating the efficiency or effectiveness of the library components and determine criteria for them. A chart was used to show the relationship of library operations to activities and how they both support the library's goal.

Existing criteria and standards were found to be unsatisfactory because only some aspects of libraries lend themselves to quantitative measurement, such as number of items cataloged, ordered or found in a period of time. The quantitative measurement of the value of a library service or product such as a literature search, bibliography or current awareness service seemed more difficult to assess.

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	ROLE	WT	ROLE	WT	ROLE	WT

INSTRUCTIONS

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