Planning for Systems Study and Systems Development

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THE CAUSES of increased complexities in libraries may be epitomized as: (1) the increased quantity and sophistication of the demands of library users; (2) the substantial increases in book funds; (3) the increase in interinstitutional cooperation; and (4) the frequent inability of professional staff to realize the professional potential for creative endeavor which may be traceable to a greater extent than known to the many manhours misused in clerical functions. A systems study or analysis is indispensible when a library faces these problems and admits that it is no longer serving its community effectively.

Systems study is equated to the phrase "let's get organized." It is prerequisite to a well-designed and successful automated system. Study methods and techniques can and should be used in analyzing, evaluating and designing all levels of data processing. The librarian familiar with the concepts and techniques of systems study and planning should be able to increase the efficiency and productivity of the library even if the only available mechanical equipment is the typewriter.

SYSTEMS STUDY CONCEPT

The systems study or systems analysis is defined as the logical analysis of the present systems; the evaluation of the efficiency, economy, accuracy, productivity and timeliness of existing methods and procedures measured against the established goals of the library; and the design of new methods and procedures or modification of existing methods and procedures to improve the flow of information through the systems.

The main distinction between the analysis and design phases is that analysis is a rigorously controlled inquiry into existing conditions, while

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design is the resulting synthesizing process in which new ideas are generated and refined. Design is the final phase of a systems study involving creative thinking, coordination of the conclusions reached in the analysis, and deductive reasoning directed toward realization of the stated objectives and goals of management.

The concept of systems study consists of three interdependent phases:

1. Analysis, which is the accurate delineation of the requirements placed on a system; the current procedures by which the requirements are met; the outputs of the system in satisfaction of the system's requirements; and the inputs used to generate the outputs. The four items under analysis represent concurrent identification of the areas of inquiry, coupled with the charting of all operations, functions, decisions, and action, the gathering of data produced and forms used, the listing and evaluation of available personnel and equipment, all synthesized into a report of existing conditions.
2. Evaluation, which is the detailed examination of current procedures with respect to their adequacy to supplement the mission of the system.
3. Design, which is the action taken by validation of the existing system, by modification of it, or by substitution of a newly designed system to satisfy the demands being placed on the system. The problems to be solved and the techniques employed in designing systems are well stated by Ackoff.[1]

Systems study and planning for improved operations are inextricably intermeshed activities. Problem recognition is the prelude to systems analysis and the development of plans for desired ends. Systems analysis is indeed the basis of effective planning to reach operational goals. Such analysis supplies the means of validating the efficacy of plans: Do they work as envisioned or projected? Thus systems study or analysis is the mechanism of planning efforts and plans' testing.

DEFINITION OF TERMS

The use of terms in detailing phases of a systems study can be a source of confusion. It is the intention here to avoid technical language as much as possible in order to serve better the understanding of the nonspecialist. The simple terms chosen are applicable to processing by any means, manual or machine, and can be expanded or modified where appropriate. It is suggested that the following terms are commonly in use and therefore can be helpful in effective interchange of ideas with management specialists. The arrangement of the terms attempts to indicate their logical and hierarchal interrelationships.

Goals: the objectives of the total system that establish demands placed against each component system and its subsystems and "whose attainment is desired by a specified time."[2]

Demands: the established requirements of a system and its subsystems.

Requirements: the supply of data, information, action taken resulting from a demand.

Input: the printed form, written record, oral information, or instructions needed to satisfy a requirement.

Output: the answer to the requirement of a system in the form necessary to convey or transmit information.

Subsystem: a major part, component, or activity of a system.

Operations: the major, specific units of work.

Procedures: used synonymously with operations.

Jobs: used synonymously with operations and procedures.

Elements of operations: the functions, decisions and actions comprising operations.

Functions: the processing steps in operations.

Decisions: the determination of the steps to be taken to complete a function.

Action: the course taken as a result of the decision.

LIBRARIANS AND THE SYSTEMS STUDY

Essential to the success of any study to effect operating improvements in a system is the interest, participation, and committed involvement of all members of the professional staff, managerial and nonmanagerial, as well as all personnel responsible for major, specific units of work.[3] The systems study must be done by the organization itself, not done for it, if the study is to be successful. Lacking in-house expertise in study techniques, outside support should be obtained for on-the-job training of the library's personnel.[4] In order to consolidate the gains that can come from a systems study, the personnel must be capable of maintaining surveillance of the recommended operational structure and procedures. As indicated, the principal requirement here is complete staff involvement in the analysis and planning leading to redesigned operations.

A systems study is the beginning of a different administrative and organizational work pattern that must be monitored in order to maintain and improve the library's ability to achieve the goals set for it. The study is not directed toward producing an end-for-all plan but for ini-

tiating an on-going process of operational evolution and improvement as demands placed against the library change.[4] Continuous analysis and evaluation of current methods and procedures should insure that the demands for information and action being placed on the systems are being met. If they are not, the design and modification of methods and procedures become necessary.

Thus it would appear desirable for a library to have on its administrative staff at least one full-time staff officer whose responsibility is that of continuous guidance and assistance in the improvement of systems and procedures, problem anticipation, and modification of processes and procedures as demands or requirements placed on the organization change.[5] The size of a library is not a factor in the need for systems study. In the case of the one-man library it would be left for the librarian himself to acquire the requisite management study skills. Medium-to-large-sized library organizations might well think in terms of full-time staff specialists.

Since this "systems analyst" or "manager of systems and procedures" is a staff officer, established and accepted as an agent of the library's director, this point of view and interest must be coterminous with those of the director. He should have or acquire a full and broad understanding of management's problems and should be involved in the director's decision-making sessions.[6] The responsibilities of this position, in cooperation with library department heads, include the following functions.[7]

1. Assisting management in the review and evaluation of operations and services to meet the established goals of the library.
2. Designing and implementing, in cooperation with supervisory staff, new or improved operating systems for increasing effectiveness, strengthening operating or management controls, and expediting performance of routine work.
3. Developing operating manuals and reviewing, improving, and planning statistical and accounting reports for managerial control at all levels.
4. Evaluating existing forms and, as necessary, designing new or improved forms.
5. Conducting training programs for staff management in the regular application of systems study techniques to daily operating problems and in the capabilities and use of the computer in operations and library services.
6. Directing the design and programming of computer-based systems, representing the library's interests in shared computer facilities and avoiding the many errors that can occur during introduction of such

systems. (Bernstein discusses twelve principles "which absolutely must be applied during the introduction of a mechanised system.")[8]

7. Keeping abreast of new developments in data processing, together with associated equipment, and their potential application in library operations.

The responsibilities of this type of position, well established in the business world, are listed in considerable detail in Neuschel[9] as well as in other management texts.

Library systems analysis, evaluation, and design will be ineffectual unless done by persons who are trained or formally educated in librarianship. Although without experience, the library school graduate is prepared to learn the nuances of library service that can only be gained through experience. At least his schooling has made him aware of this contingency and he is prepared to develop professional attitudes. This cannot be safely said of one trained solely in managerial techniques.

Many library schools are beginning to recognize the need for an introduction to systems study and data processing. A survey of thirteen selected library schools during 1972 revealed that ten were offering courses, for which course outlines were submitted, in library systems analysis and data processing.[10] Wasserman suggests that the library school should offer programs in these subjects to the practicing librarian at an intermediate level, "not necessarily tied to any formal degree offering, although some type of certificate mid-way between the master's and doctorate might be devised."[11] Conversely it is suggested that programs in the specific functions of the control systems of a library be offered to management degree holders. This is being done by some libraries through inservice study programs. In institutions where both a library degree and a management degree are offered, an interdisciplinary program could be profitable in making available to libraries management personnel knowledgeable in library operations.

LIBRARY MANAGEMENT AND THE SYSTEMS STUDY

Modern library management, aware of the need for systems study, has no recourse but to learn the techniques and tools of systems analysis and the skills to apply them—the basis of good management.[12] If a library is to examine itself with the techniques of management science, the responsible personnel should be trained to do so.

Because systems study represents a demanding total library effort that may result in major operating changes, the entire library staff—administrative, professional and unit management—under the strong lead-

ership of the library's chief executive, should be fully involved in planning and conducting the study. Thus everyone at every level of responsibility is forced to review and gain detailed understanding of the problems and objectives of his operations, from the least significant organizational unit through top management.[13] Here the guidance, direction and personal participation of the chief executive of the library are critical.

All authorities in management science agree that the chief executive is responsible for the proper execution of the study and its results. This is not to say that he personally does all the study planning, but rather he sees that it gets done through key second level people who are responsible for implementation of the study plans.[14] The chief executive's primary task is that of leading in the identification of study objectives, and of reviewing, accepting, approving and authorizing implementation of each element of the study plan.[15] Reasons why the chief decision-making executive should assume primary planning responsibility are explored extensively by St. Thomas.[16] To control the quality of the outcome of the study: (1) top management must take a positive rather than "a passive, problem-solving approach"; and (2) the study program should be planned and developed with a total systems approach.[17]

The questions usually uppermost in the chief executive's mind in approaching systems analysis and planning are: (1) What are the systems problems that should be solved in relation to organizational goals? (2) Can these problems be resolved by redesign of operations and procedures? and (3) Will the redesigned systems be operationally accepted by the personnel responsible for implementing them?[18] Answers to these broad questions obviously require the help of key administrative and line staff. An advisory committee consisting of the chief executive as chairman, second level management and selected staff people is suggested. Regarded as workable is a membership of six to eight supplemented from time to time by individuals who can supply specific experience, information or knowledge needed to confirm or fill in certain planning elements. The chief executive should chair at least a majority of the meetings of the committee if he is to assure his colleagues of his positive, problem-solving interest. He should have a specific agenda for orderly evolution of meetings.[19] The committee's overall objective is to develop the information and data for a *written* statement of the organization's goals and the unit operational problems it sees preventing achievement of these goals. Such a written statement is the

document needed by the systems analysts assigned to probe for solutions of the stated problems.

It appears axiomatic among management authorities that "when the top executives are not personally engaged in the process, it can be doomed from the start."[20] Many of the reasons for failure of study programs revolve around management: (1) the study is not integrated into the total management system; (2) it is not recognized as a way of managerial living; (3) line management at all levels is not engaged in the process; and (4) management fails to operate by the plan.[21]

Although assessment of the techniques and methods of a proposed program of systems study is of concern to management, this is not nearly as important as the designation of study elements appropriate to organizational goals and objectives.[22] Continuous monitoring of the study through required interim reports will or will not reveal progress in the direction of decision-making information needed in coming to solutions in systems problems selected by management. The only criterion, if the study procedures are not tending to yield the required decision-making data, is to stop and seek revision of procedures. Otherwise the study will reach faulty conclusions of no use to management's requirements.

STUDY STAFF

Having decided or received governing administrative authorization to proceed with the detailed systems study based upon the preliminary findings of the advisory committee discussed above, the chief executive or library director selects and appoints the staff to make the study. The principles to be observed here are: (1) the assignment to the study staff must be clear and precise in *written* form and not given verbally; (2) the study staff must be given sufficient time to develop procedures for execution of the assignment;[23] (3) a good systems study cannot be done on a part-time basis; and (4) the person selected to direct the study preferably should possess a combination of education in librarianship and training in the methods of systems analysis as taught in modern management courses. Since satisfaction of the latter prerequisite probably is not possible in most instances, two courses are open: to release a senior or general-manager level staff member from other duties to prepare himself for the conduct of a study, or to bring in a skilled systems analyst unfamiliar with the library's organization. The latter course holds the danger that the library staff may tend to abro-

gate their responsibilities in the study to the outside expert. Should this occur, then the systems study "has been given the kiss of death."[24]

The outside analyst skilled in modern management techniques should become fully familiar with the library's problems and responsibilities. He should develop a rapport and identification particularly with management personnel at all levels in order to insure supervisory acceptance and cooperation in the analytic procedures of the study. He should not approach the study with preconceived notions of the local problems to be solved, possibly arising from his work with another library or with what he feels is an analogous organization. Although the conditions he sees in a cursory inspection may appear to be the same as he has encountered before, the causes of the conditions to be studied frequently are completely different. The analyst's responsibility is to verify *what* problems exist, *how* and *where* they originated, and *how* the conditions at hand can be corrected.

The composition of the study staff should be as follows:

1. A library officer possessing general-management responsibility and authority within the library's organization, to take supervision of the study and regularly report to the director and his executive group. Since interdepartmental problems are involved in a total systems study it is not advisable to assign the head of a functional department to this job since his functional interests may bias his interdepartmental views.[25]
2. At least one member of the study staff fully trained and sufficiently experienced in the application of management-analysis techniques, preferably a librarian.
3. At least one member of the staff skilled in electronic data processing (EDP) methods, particularly if an automated system is contemplated; this member should also be a librarian.
4. Clerical assistance adequate to support the work of the study staff.

It is conceivable that the requirements in items 1-3 could be met by one person. However, it is more likely that two persons will be needed, even in a relatively small library, to furnish mutual stimulus, thus making "their efforts far more productive than one person working alone."[26] This applies particularly in the design phase of a systems study to insure consideration of design alternates reducing the chances of a single solution with faulty characteristics.[27]

DEFINING THE STUDY PROBLEMS

The study staff is to develop, with the library's management, a detailed procedural plan and time schedule for the study, the first step of

which is the general definition of the problems to be studied and the identification and description of the specific problems involved.[28] It is the responsibility of the library's management to supply a clear and concise statement of these problems in the form of a *written* report or assignment prepared by management's advisory committee alluded to above. Problem definition must be in sufficient detail to serve as a guide to the study staff members and to inform the other members of the library's organization who are concerned with the activities named as areas to be covered by the study.

LONG-TERM GOALS

The next step, critical in planning and conducting this study, is the study staff becoming fully conversant with the library's overall goals in relation to the problems to be studied. Goals are those factors that the management of the library determines to be important for accomplishment; the "planned projection" of the library's aspirations.[29] The statement of goals, the heart of the advisory committee's written assignment, determines the major requirements resulting from demands that should be satisfied by the library through its data processing and informational systems. Goals then, are basic in evaluating the current system and in designing a new system. If the goals are not precisely and correctly defined and understood in detail, the results can only be an inaccurate evaluation of current operations and the design of a faulty system. For example, it is not enough to simply state that "improvements of service to users" is a goal. The written assignment should define each of the many factors suggested in this generalized statement of a major goal.

In any event the study staff should verify the validity of stated goals through discussions with library users, department heads in the library, department heads of the parent organization of the library, and with the key administrative officers of the library's governing organization.

Long-term planning is implicit in defining the library's goals. Because most libraries are in a period of dynamic and presistent growth, systems to satisfy long-term goals should be designed with the capability of handling increased demands. Thus computer-based systems are suggested. Such systems have the capability of less costly and more efficient growth as demands on the library grow. Today's commonly applied manual systems often become more costly and less efficient under increasing demand and do not possess the "stand-by" qualities of the computer system in adjusting to growing requirements.

SCOPE

After the goals which indicate the purpose of the study have been defined, the scope of the study should be stated in written form and agreed upon by management and the study staff.[30] Here the particular data processing systems within the library that are to be studied, as well as the organizational units in which the operations are performed and the activities involved, are identified in order to prevent wandering into other systems with which management is not concerned at this juncture. Within the system, priorities are established for the components thought to need early attention by the library's administration. It is important in specifying scope and priorities that the systems study staff not be too rigidly restricted, but rather be allowed a degree of flexibility permitting recognition of other areas that might be affected by the particular system directly assigned for study.

LIMITS AND RESTRICTIONS

Within the written scope of the study, management also should define any limits or constraints to be placed on the development of a system as well as the limits beyond which the study need not be carried to reach the desired solution of a problem.[31] Examples of limits and restrictions are: (1) the type of system wanted—whether or not computer-based; (2) number and proportional distribution of personnel to be in the system; and (3) tolerable unit or total costs of operations of the system.

METHODS AND TECHNIQUES

In further preparation the study staff members should decide on the methods and techniques to be used in the study for obtaining and recording the necessary information.[32] These should be determined in order to assure a logical, systematic study and to permit comparison of findings within the systems. For example, if statistical work sampling is to be used, the confidence level to be accepted must be agreed on in advance with applicable sampling techniques being uniformly employed; survey forms must be designed for each survey of requirements, current procedures, and inputs/outputs to be conducted;[33] type and format of reports to be presented must be determined—that is, graphic reports such as organization charts, procedure flowcharts, PERT charts, graphs, tables, models, simulation, etc.; and written reports or other narrative materials must be agreed on.

Also involved in the methods used are designation of the persons to be interviewed, the records to be obtained and analyzed, the equipment available and its use, and a detailed outline of the specific types of information to be sought. With respect to this latter specification, Optner supplies checklists which can be helpful.[34] Adoption of uniform methods and procedures assures that the results reported by each study staff member are consistent in content and format and allow uniform comparison and evaluation by the staff in consultation.

WORK AND TIME SCHEDULE

As terminal planning steps the organization of the work of the study staff should be set down and a time schedule measured by man-days or man-months should be prepared for completion of its assignment. The types of skills needed for each assignment have to be determined—that is, managerial analysis, clerical, programming, and so forth. The responsibilities of each person in prosecuting and completing his study assignment should be explicitly defined based on a list of specific identifiable study stages, each with a target date for completion. Target dates for interim reporting to the library's management and to the study group as a whole should be set as well as the target date for submission of the final study report. The time schedule is not only important to the orderly and expeditious prosecution of the study, but also to administrative knowledge and acceptance of how long current library operations will be slowed or otherwise adversely affected by the study's demands on the operating time.[35]

ANNOUNCEMENT OF STUDY PLAN

As the plan for the systems study is being formulated the director of the library should have introduced the idea to the library staff, indicating the reasons for the study and its objectives. Such an announcement would include: (1) an indication of the reasons for the study; (2) a description of its principal goals; (3) a description of the benefits expected; and (4) solicitation of the full cooperation of the members of the library staff, assuring them of their major roles and engendering their full support and interest in order that the study be successful.

When the planning is completed, the director should review the finished plan with the study staff and with other members of the library's administration. When he has approved the plan, the director of the library should make formal announcement of the undertaking of the systems study to the community served by the library, indicating the rea-

sons for the study and its objectives and anticipated benefits as well as explaining what problems the user of the library may temporarily encounter during the period of the study.

The library staff should be reassured at this time of the administration's awareness and sympathetic understanding of the disruption of each staff member's assigned duties and should be assured of the administration's firm support of the study. It should be demonstrated to the staff that without the cooperation and participation of each member, the study cannot lead to results beneficial to the staff and to the library.

STAFF TRAINING PROGRAM

Following the announcement of the starting date of the study, it would be well to conduct a short staff training program detailing the techniques used in a systems study. Discussion of these techniques should bring a better understanding of the study, generate the very necessary staff interest in it, and furnish knowledge of what information the analyst will be seeking in his contacts with individual staff members. The training program might well include description of the potential use and contribution of computers in library data processing operations and library services. At the same time the library staff should be provided with selected references to the current literature on library automation.

It cannot be overstressed that staff understanding, perceptiveness, support and participation down to the unit supervisory and key clerical levels are prerequisite to a systems study resulting in practicable systems design. Support in this phase of organizational improvement efforts will be carried over into the successful implementation of the study's recommendations and attainment of the operating objectives sought.

With the permission of the Association for Systems Management (formerly the Systems and Procedures Association), chapters 1 and 2 of J. W. Greenwood's *EDP: The Feasibility Study–Analysis and Improvement of Data Processing* have been used for basic guidance in preparing this paper which is an adaptive expansion of chapter 2 of Edward A. Chapman, *et al., Library Systems Analysis Guidelines*, New York, Wiley-Interscience, 1970.

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