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The Application of Generalised Methodology of Systems Analysis To Library Systems

.....Being a paper read at the National Library Senior Staff Seminar by Mr. O. Osundina, Senior Principal Librarian and Chief, Bibliographic Service Division.

The purpose of this paper is to generalise at an elementary level a methodology or approach which can be used in conducting a systems study for the library. Systems work is discussed here as a point of view; a logical, coherent, from the top down, preface to decision making and resource allocation which utilizes a very powerful body of sophisticated techniques.

The approach and techniques discussed in this paper, however, are those on the elementary level, first because the writer is not an expert in systems analysis, secondly because systems analysis, though is a feature of effective administration, has not been taken up at the sophisticated level by libraries.

No attempt is made to discuss the techniques of queueing, inventory management, linear programming, simulation, marginal analysis, game theory, statistical inference or any of the other high-powered techniques available to the operation research/systems analyst. Rather than a review of the tools themselves, a delineation of this systems methodology and point of view are considered.

The methodology discussed embraces a number of standard techniques used by the systems engineer, time and motion analyst, operations researcher and the librarian. Examples of these techniques are scattered through the professional literature of librarianship/information science, management, industrial engineering, and operations research/systems analysis.

Some of the more important references on OR/SA in the library are included in the bibliography at the end of this paper. Unfortunately, many of the most basic concepts of these twin fields remain poorly understood and are consequently seldom applied by libraries. Above that, systems analysis is the only known approach to the identification of problem areas in any organisation and the National Library will surely find itself in a position where systems analysis becomes a matter of prescription.

AN IDEAL SYSTEMS STUDY

A true systems study should be able to document for the library administrator the goals of the unit being studied and the resources available to that unit, as well as suggest alternative methods for achieving these goals within a given set of constraints.

All of this must be accomplished in such a fashion that

the library administrator is permitted to select the proper alternatives by manipulating resources to reach his predetermined goals. Fundamentally, this is a process of balancing goals with resources based on the facts gathered by the analyst.

Facts needed by the library administrator in this case include such items as unit costs, unit times, costs of materials and equipment, opportunity costs, configuration and availability of equipment, staff and material movement, and staffing patterns. It, is the job of the analyst to ferret out these facts and present them to the library administrator with a full supply of available options.

A true systems study must examine both the economic efficiency of the unit being studied as well as its operational efficiency, always being careful to study each in great details. Economic efficiency can be judged in either of two ways: the ability of the system to produce or process the same number of units for less cost; or the ability to produce more units for the same cost.

The savings achieved by library automation seem largely to accrue from the second advantage. Operational efficiency is a much more subtle concept and, indeed, involves many of the intangible values with which all libraries doing systems work are constantly confronted. One measure of operational efficiency derives from user satisfaction and can be determined by questionnaire/interview method or by the study of user behavioural patterns.

It must be stated quickly, however, that user satisfaction, as a measure of operational efficiency, is not valid for all library systems. The example of the National Library which, essentially, is not a lending library, but rather, or more appropriately, a national bibliographic centre, by my own concept is one which illustrates the limited use of user satisfaction as a measure of operational efficiency.

Conversely, the National Library does have users in the form of other libraries, and so use can be applied to identify the core of the collection and hence user satisfaction in a way.

The achievement of maximum efficiency within a system is an extremely subtle process requiring the finest tuning and sensitive ear which one expects of a skilled violinist or guitarist. It is by no means in the sense most administrators believe it to be.

An efficiency system is one which has reached a correct balance between the resources and the system's performance. There is a distinction between efficiency and the measures of efficiency. It is quite common for people to confuse the ways of measuring efficiency within sub-systems (such as decreased cost, increased loans increased acquisition, increased reference satisfaction, increased production, etc.), with the efficiency goals of the total system.

True efficiency can only be discussed validly in the context of a total system's operation. Surely the efficiency goals of the National Library or the Ibadan University Library are different from those of their respective sub-systems.

A SYSTEM DEFINED

The first task in discussing systems work is to develop an ambiguous definition for the word System. Although it is widely used, the implications of the concept are seldom fully understood. As Nadler rightly states, there are almost as many definitions as there are people writing about the field.

After examining the various definitions of the word, several ideas emerge which are common to any systems effort, no matter what it may be called. The ideas of interrelated parts bound into a coherent whole possessing a common goal or objective are crucial to the systems concept.

The library is a system comprising components which are inter-related and bound into a coherent institution possessing an objective. It is on these basic attributes that the writer builds his methodology for a system study.

In this paper, attention is focused on the four phases of a study, which the writer calls the systems survey, the systems analysis, the systems design and the implementation/evaluation. This somewhat arbitrary division should not be taken to infer that these are discrete operations with a systems design proceeding only when the systems analysis effort has been completed.

This would be a highly idealised solution since in actual practice the pressure to get the job going will usually force the telescoping of these efforts. When this is done with care and in a recursive manner, the chances of success are usually good. Each of these phases should be viewed as complementary to the others and, although they are similar and related, each must be performed in a sequential and discrete fashion preferably in tandem. Some interlocking is permitted, but the analysis phase always begins before the design phase, and the design phase always begins before the implementation phase.

BASIC CHARACTERISTIC OF A SYSTEM EFFORT

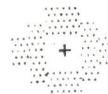
Several generalisations should be accepted about the entire systems effort. This always helps to understand the type of problem which one is faced with.

- (a) Attention to detail lies at the very heart of the systems effort and thorough precise work demands an intense pre-occupation with every detail, no matter how small. Indeed, the entire systems effort hangs on the ability of the analyst to unearth and articulate all the minute of a procedure. If, for instance, an analyst ignores the minute procedure for recalling an overdue loan, his chance of success in the effort is already in jeopardy.

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An analyst who thinks that the procedure of taking pains to record every reader-disappointment is minute to care about will be faced in latter efforts with a loss of a vital link. It is difficult to over-emphasize the importance of this aspect of systems works, for the most minute detail can jeopardize the success of an entire operation.

- (b) Every system is a sub-system of a larger system and each system is itself composed of a number of component sub-systems. The selection system is a sub-system in the acquisitions system which in turn is a system of the entire library system. Therefore, all systems exist in both a micro and macro hierarchy depending on the perspective of the analyst.
- (c) Systems work is a much more subtle process than simple fact gathering. It involves a thorough understanding not only of who, what, when, where, why, and how, but also of the relationships which exist between the system and all of the other systems with which it interacts, as well as the component sub-systems which make up the system being studied.
- (d) It is therefore necessary in library systems study, to thoroughly excavate the relationships between selection, ordering, claiming, receiving, accessioning, etc., in the acquisitions department and bibliographic checking, searching, copying cataloguing, classification, etc., in the cataloguing department.
- (e) There is no single definitive measure for the effectiveness of a system, because there exists only circumstantial optimums, each of which must be weighed against all other possible options available.
- (f) Systems are generally designed for the normal operation, and only rarely will the goals of the system permit design for the exceptional conditions.
- (g) Each systems work is recursive with each successive repetition performed either at the same time or at a different level.
- (h) Continuous feedback and monitoring are essential aspects of the systems effort. One of the major difficulties in optimising present manual library systems has been the lack of adequate provision for valid feedback.
- (i) By definition, all systems must exist within an environment. The environmental factors are those which affect or relate to the system but which are not part of the system. The analyst cannot successfully describe the system without delineating its environment.
- (j) There is a danger in systems study that over-quantification can be introduced. This can constitute a serious problem and it often leads to a credibility gap in the efforts.
- (k) Documentation is an important part of the systems work. If this is ignored it can be disastrous to the entire effort.
- (l) There is never a final phase to any systems work, what exists is only interaction.

Library systems work provides us with excellent illustrations for each of the foregoing axioms. How many librarians have knowingly insisted upon a system which will handle all characteristic routines and then wondered why the system

took so long to develop or refused to work at all.

Library systems are very difficult to analyse, not because of size, but because they are unstructured, lack adequate provision for feedback and monitoring and are always so inter-related and inter-dependent that the best descriptions of them are of dynamic systems which have evolved over a long period of time through a trial and error process.

In fact, most of the dilemmas which plague all systems work also exist in the library systems effort. As with any systems work of magnitude, the analyst finds himself on the horns of complications at the very beginning of his study. Machol has pointed out that the problems of designing a large system are often of such dimension as to make the problem unsolvable if attacked all at once.

Yet the analyst can not arbitrarily divide the problem to study it piecemeal without running the risk of losing the continuity of the whole. Where then does a realistic approach exist between these two extremes? The answer may be in the perspective of the systems worker, in his ability to maintain a continuing balance between the unity of the whole and the detail of the part.

Each library administrator has at his disposal five categories of resources: staff, space, funds, time and information. It is the responsibility of the library administrator to balance continuously the availability and consumption of these resources with his goals in order to assure that the goals are reached in the most efficient fashion.

A large portion of systems work consists of no more than asking questions about all those operating norms. But how does this apply to the library environment where the goal is that nebulous entity called "SERVICE"? In order to answer this question, one must first decide what constitutes the library's service goal.

Mackenzie defines the library's goal as "to assist in the identification, provision and use of document or piece of information which would help the user in his study, research or teaching, at the optimal combination of cost and elapsed time. . . Efficiency, when used in this context, becomes either answering more of the needs of clientele while holding cost and elapsed time constant, or meeting the same needs while cutting down costs and elapsed time.

Whatever happens, the writer believes that neither of the explanations of efficiency is entirely satisfactory when used in this fashion because the process described here is one using only quantification as the valid criterion for evaluation of its success. This belief is not to imply that there are no areas in library system analysis which can be evaluated in quantitative terms there definitely are.

It is merely to emphasize to the systems person that he cannot quantify all aspects of a library system. Indeed, insofar as any systems work attempts to use quantitative methods where they are not appropriate, the study is sure to fail, but, unfortunately, the reasons will not always be clear to all concerned.

What the analyst cannot do is quantify the intangible benefits from a course of action, and it is here that the library administrator will need to depend most heavily upon his own intuition for guidance.

THE PHASES OF THE SYSTEMS STUDY

1. THE SYSTEM SURVEY

In the first phase of the systems study, the analyst should conduct the systems survey, during which he relates the system to other systems in which it is embedded or to its environment, determining what is germane to the problem being studied. Once these boundaries have been recognized, the analyst should then begin to lay out the problem in very general terms, specifying the goals and functions of the system.

This will involve familiarization and departmental orientation, preparation of such tools as a list of the files maintained, their contents, and the organization of each; a list of the forms being used with examples of each; a description of their movement, and related activities; a review of all procedural manuals and job descriptions; and finally a documented statement of the system's goals.

When used in this context, a goal can be accepted as either a direction or an objective or a combination of both. It can be a point to be reached or a line of march to be followed in moving towards this point. But each goal must also be defined in terms of the expected performance of the system.

In fact, any discussion of goals which does not include a statement of the performance expected from the system will be so innocuous as to be irrelevant and make the entire discussion meaningless. Statement of performance coupled with goals have the advantage of helping to prevent a dichotomy from developing between the real and stated goals.

II ANALYSING THE SYSTEM

In this phase, the analyst has to prepare a block diagram or system schematic, which will outline the tasks performed by the system and the relationships which exist between the sub-systems. For a library circulation system these blocks might be searching, charging, discharging, shelving, etc. Each block will be further divided into its appropriate tasks down to the procedural level, showing the movement of people and materials through all sub-systems. This could be accomplished by using flow process charts first and then by using flow decision charts.

Flow process charts enable the user to visualize at once the movement of a person and, for example, the distances travelled in charging out a book. The chart will also indicate how many times a book is inspected as it moves through a given routine. The flow decision chart, on the other hand, uses a different set of symbols and indicates at what points decisions are made and how these decisions affect the flow of people and materials.

In his charting, the analyst should work at a very specific level where he is concerned with discrete entities capable of quantification in terms of how long, how many, how much and how often. Parallel to this effort, the analyst should be identifying activities and compiling them into document known as standardized activities list.

It is also customary to document the various level of personnel performing these tasks. Thus far, the analyst has dissected the system - in this case, a loan desk, through the activities (charging, discharging, etc.) and procedures (how a book card is returned to a book in the discharging activity).

As he does this he should begin to time the component sub-systems at the procedural or task level, at the same time, he should begin to derive costs by determining what are the real wages (direct and indirect/productive time on job) paid to

staff in order that the analyst may be able to translate unit times into unit costs.

When this exercise has been completed, he should be in position to measure quantitatively the available alternatives, at least in terms of costs. Many librarians are always tempted to wonder how the process of cost derivation applies to a library sub-system. The process is applicable to any system at all where wages are payable.

III DESIGN OF THE SYSTEM

This phase usually follows when the analysis efforts have been completed. Usually design consists of a modification of the existing system - a reorganisation of the components in the old system - but with possible additions or deletions modifying any or all inputs of the resources discussed earlier, and always within the context of the systems goals.

IV IMPLEMENTATION AND EVALUATION OF THE NEW SYSTEM

The final task begins with the implementation of the prototype system and its evaluation. This is often the most expensive single phase and its success depends on the completion of earlier phases. Up to this point the entire process has been a recursive type of dividing, measuring, charting relationships, defining, then repeating the whole process of quantifying the characteristics of the component systems, charting relationships again, and repeating the cycle.

Because of economic constraints, however, the implementation and evaluation phase cannot be repeated easily. This is why the analyst will be wise to work with meticulous care once he has entered this phase. An important point is that first time processing costs, procedures, etc., are normally a typical and cannot be assumed to remain constant throughout the life span of a system. There is always the problem of the unforeseen, and no analyst, no matter how good, is ever able to plan for all contingencies.

Hopefully, the reader of this paper now has an understanding of the intricacies and nuances inherent in library systems work. In essence, library systems work is a method - part science, part art - whereby one determines the correct balance between constraints and the resources necessary to realise pre-determined goals. Library Systems Analysis (LSA), therefore is likened to a medical diagnosis.

All libraries, and indeed, the National Library, have a lot to learn from systems work, more especially because the scope of the latter is untrammelled by geographical, institutional, functional or subject limitations and this makes the challenges enormous.

The writer's stand is that library systems efforts should go beyond traditional boundaries. It should cover both the sociological and psychological aspects of human factors. This is because a complex technological society demands an adequate supply of men with skills and experience in technical knowledge, administrative ability, capacity to control others and professional know-how.

The skilled practitioner must be capable of policy formulation and planning the setting of objectives and standards, interpreting a variety of data, forecasting, evaluating, and making decisions. These and other elements are meant to generate the dynamism essential for institutional growth.

Unless human weaknesses and merits are thoroughly recognised, and unless analysis takes into account human elements, the desired results will never open the gate to decisive solutions, and yet systems analysis is meant to open that gate.