

# Preface

A library, like any information system, requires management. Management serves to plan, organize, staff, direct, coordinate, report, budget, supervise, and administer the library. It is difficult to imagine a library without a management function. Who would do the hiring, who would specify the hours to remain open, who would determine the loan period, and who would decide whether or not to offer users free or fee-based access to nontraditional services?

The importance of studying management is seen in the growth of business schools in academia, the growth of related disciplines such as industrial engineering and the policy sciences, and the growth of literature expounding new concepts about management. Yet, this does not completely answer the question as to why librarians should be concerned with the study of management, and particularly with the quantitative analysis of methods of problem-solving to be found in this book. The modern library is faced with rising costs, increasing competition for funds, an increasing variety of client demands, increasing information technology, the possibility of library unionization, intellectual freedom considerations, and increasing demands for accountability and expenditure justifications. Most libraries are not run by professional managers. This means that the burden for much, if not all, of the management function falls on the professional librarians whose training in the area rarely exceed two courses and may be nonexistent.

Hospitals and local governments are currently being staffed by administrators trained in management techniques. Hospital managers certainly do not have the professional background in medicine that a doctor or nurse would, but must help manage the hospital based on managerial and administrative skills. Librarians may wish to explore such a paradigm for libraries in the future, but money to train and hire such people will be hard to find.

Most librarians, therefore, can expect to find themselves carrying out management functions at some point in their professional careers. Some supervision of personnel (e.g., hiring or training) and some decision making (e.g., which serials to purchase, which bindery to use, or which reference tools to acquire) will be commonplace. Thus, the study of management should be an important

part of librarians' formal and continuing education. One is fortunate to be able to find good textbooks on the general subject of management principles applied to libraries. Management is now an object of legitimate scholarly inquiry, and out of such inquiry will come understanding and strategies for progress, innovation, and enhanced professionalism. Librarians must be familiar with management principles if they are to properly apply them to library management problems.

One key aspect of modern management is the use of a systems approach to problems whose result is a model of the situation under examination and an understanding of the underlying goals. When these models incorporate quantitative measures, which make the evaluations of alternative decisions possible, this activity has come to be called operations research.

Operations research, in essence, is the application of mathematically based methods, within the framework of a systematic approach to problem solving, to help managers make decisions. It involves the application of modern scientific methods, tools, and techniques to provide the best possible solution to problems. The traditional aim has been to use techniques to improve a system's performance while not exceeding limitations on limited resources. Operations research, called operational research in England, has several near-synonyms such as "management science," "systems analysis," "systems engineering," "policy science," and "quantitative analysis." It is often abbreviated as "O.R." It began in the study of military problems in World War II, involving interdisciplinary teams of outstanding scientists. As new techniques developed, O.R. expanded into business, industry, and recently into the public sector.

If the need for a study of library management is accepted, it is legitimate to ask why one need study operations research techniques. Quantitative and analytical methods have been found to be quite useful in military, industrial, and business applications. Moreover, decision analysis in the public-policy arena has aroused recent interest, including work on library management problems.

There have been a number of academic research studies of library decision problems analyzed through the application of operations research techniques. There are examples of libraries using operations research to solve problems quite successfully. But, one fact has become readily apparent, successful implementation of library operations research requires professional librarians as a vital part of the analysis team. Librarians know the library, its problems, and reasonable approaches to solutions. Such librarians must be able to communicate with and understand the operations researchers. Thus, it behooves librarians to be at least familiar with library operations research. Some librarians can and should develop expertise in this area.

This book is intended for those in the library community with an understanding of library processes and a desire to actually make use of scientific management techniques. The assumption we make is of a very limited mathematical background. Our emphasis is not on understanding the theory behind the tech-

niques we present, but rather in giving the reader a toolbox and some insights into which tool might be appropriate for a particular problem.

We make no attempt to show the mechanics of a solution, except for purposes of illustration. Rather, we suggest available software packages that will provide solutions if presented with the necessary parameters. Our emphasis will be on the choice of technique, the discovery of the parameters, and the evaluation of the output.

The construction of models of problem situations is an art, and one cannot totally bound it with objective rules. We do not wish to imply that models must be formulated to fit the techniques that we present here. There is, however, an advantage to doing so. If a situation can be realistically modeled in the forms we present, it can be analyzed using well-tested procedures and the results interpreted in the light of considerable experience. It is also the case that there exist not only established algorithms but tested computer software packages for their execution.

Our emphasis will be on modeling library problems to fit algorithms for which microcomputer software is generally available. We will not attempt to detail the algorithms but instead influence the choice of technique, the formulations of the model, the gathering of the data, and the interpretation of results. It is our intention to provide an introduction to the principles of operations research as it is applied to libraries. This book is intended to be an introduction to the principles of operations research and their implementation for the librarian with a nontechnical background.

The first part is concerned with the “whys” and “wherefores” of operations research. Chapter 1 presents the systems approach as a reasonable paradigm for problem solving and includes a basic set of definitions of terms used in systems work. Moreover, the library is viewed as an information system, an information storage and retrieval system, and a social system. Operations research is shown in Chapter 2 as a set of techniques that can and has played an integral role in library systems analysis. There is also a frank discussion of the difficulties facing the implementations of library operations research and a section devoted to the examination of library goals and performance measures. The concepts of modeling and simulation are presented.

The second part is a large-scale tutorial of the techniques of library operations research. Each chapter will follow a consistent format and will be concerned with a particular O.R. technique. We shall begin with the enumeration of a set of library problems that might well be addressed by the technique in question. This will be followed by a brief explanation of the techniques, using some of the problems as examples. We will suggest formulation of the models for other examples, showing the data that would be necessary to supply to a software package in order to successfully apply the techniques and the problems associated with gathering these data. This will be followed by a brief discussion of the output to be expected and its meaning in regard to the specific problems. Each

chapter will end with a list of software packages available to carry out the needed algorithms.

We begin in Chapter 3 with decision theory, since the main goal of operations research is to improve management decision making. The emphasis is on suitable evaluation of alternative courses of action. The role of information in decision making and the potential of game theory as a related technique is also discussed. The next chapter presents a number of techniques that focus on the decisions relating to resource allocation. The notions of an objective function, constraints, and decision variables are introduced. The concept of optimization, solution algorithms, sensitivity analysis, and duality are illustrated for the linear case. The notion of cost–benefit is demonstrated as arising from a discrete example of resource allocation in a library situation. Chapter 5 is devoted to graph theory. Mention is made of scheduling via PERT/CPM graph models and the use of graphs to model both data structures and library networks. Chapter 6 looks at queuing processes and introduces the concept of operating characteristics as opposed to a unique objective function.

Part III is devoted to a discussion of the significant applications of operations research techniques to libraries. We examine the question of data collection activities required to properly support a library operations research study and review some past work.

The reader will note that there are problems and exercises at the end of each chapter. It is imperative that anyone trying to learn a subject should apply the new concepts to specific problems—forcing that person to think and to understand. The reader is encouraged to try his/her hand at some, if not all, of these problems. There are both computational and thought-provoking exercises.