DOCUMENT RESUME

ED 134 097 HE 008 575

AUTHOR Shoemaker, William A.
TITLE A Systems Approach to College Administration and Planning: A Descriptive Comparison of Selected Models, Programs, and Services. Suitable for Use in Small Colleges.
PUB DATE 73
NOTE 266p.; A dissertation submitted in partial fulfillment of requirements for the degree of Doctor of Education, Temple University.

EDRS PRICE MF-$0.83 HC-$14.05 Plus Postage.
DESCRIPTORS Budgeting; *Colleges; Cost Effectiveness; Critical Path Method; Doctoral Theses; Educational Administration; *Institutional Administration; Management Information Systems; *Management Systems; Models; *Planning; Program Evaluation; Simulation; *Small Schools; *Systems Approach
IDENTIFIERS PERT; Planning Programming Budgeting System; PPBS; Program Evaluation and Review Technique

ABSTRACT

A systems approach to college administration and planning is probably the most valuable tool available for coping with the complex problems facing institutions of higher education today. A system is defined as a set of interrelated elements, units, or subsystems that work together toward a common goal. If a college functions as a system, the systems-related techniques become available for use in college administration. The techniques defined include program evaluation and review technique; critical path method; planning, programming, budgeting system; management information systems; cost effectiveness; and simulation. The relationship of a systems approach to planning is discussed and potential developments in the field are considered. Sixteen systems models, programs, and services illustrating developments in the field are categorized and described according to function and cost. Some general implementation and operational factors are outlined for each. A list of significant factors to consider prior to the implementation of a system is presented. A detailed report is made of the actual implementation experience on two campuses for each of three systems. Some conclusions, recommendations, and implications are outlined with regard to the use of a systems approach and related techniques. (Author)

A SYSTEMS APPROACH TO COLLEGE ADMINISTRATION AND PLANNING:

A Descriptive Comparison of Selected Models, Programs, and Services Suitable for Use in Small Colleges

by
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A SYSTEMS APPROACH TO COLLEGE ADMINISTRATION AND PLANNING: A DESCRIPTIVE COMPARISON OF SELECTED MODELS, PROGRAMS, AND SERVICES SUITABLE FOR USE IN SMALL COLLEGES

A Dissertation Submitted in
Partial Fulfillment of the Requirements for
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by

William A. Shoemaker

December, 1972

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ABSTRACT

A systems approach to college administration and planning is probably the most valuable tool available for coping with the complex problems facing institutions of higher education today.

A "system" is defined as a set of interrelated elements, units, or subsystems that work together toward a common goal. If a college functions as a system, the systems related techniques become available for use in college administration. The techniques defined include, PERT, CPM, PPBS, MIS, C/E, and simulation.

The relationship of a systems approach to planning is discussed and potential developments in the field are considered.

Sixteen systems models, programs, and services illustrating developments in the field are categorized and described according to function and cost. Some general implementation and operational factors are outlined for each.

A list of significant factors to consider prior to the implementation of a system is presented. A detailed report is made of the actual implementation experience on two campuses for each of three systems.

Some conclusions, recommendations, and implications are outlined with regard to the use of a systems approach and systems related techniques.

FOREWORD

An undertaking of this sort is only possible because a great many resources extraneous to the author play a part in the process.

First, I want to confess a personal reliance on a loving God, who has revealed Himself through His son Jesus Christ and daily supplies support and guidance through the Holy Spirit and the Scriptures. His only limitation is my human tendency to not trust and obey Him more.

The people listed in the appendices shared, in varying ways and amounts, the burden of identifying, collecting, and organizing the information reported in the study. They have my gratitude for time taken from busy schedules to report on their activity and to reflect with me on other efforts and thought in the field.

I want to especially thank my doctoral committee. Dr. Ovsiew's professional knowledge and general encouragement and wisdom have been of tremendous help personally and professionally, throughout the entire doctoral program. Dr. Fiorino's knowledge about and experience with systems theory was a major resource in the development of concepts and definitions. Dr. Duperre's patience in editorial work, skill in organization, personal concern, painstaking review

for rewriting, and special efforts in expediting a complex process have been an invaluable help.

Mention must be made here of the support of my mother and father, and mother and father-in-law. Their understanding, encouragement, and financial support during the two years of residency, research, and writing were greatly appreciated by our whole family. A special thank-you goes to Raymond M. and Julia Shoemaker, not only for their generous help, but for encouragement, wisdom, and example through the years.

Roger J. Voskuyl, Executive Director of the Council for the Advancement of Small Colleges, deserves special mention. His efforts and that of his former assistant, Richard M. Witter, played an important part in the structure and focus of the project. The financial assistance from CASC for expenses related to the extensive travel required to collect data was greatly appreciated.

The secretarial efforts of Mss. Sandy Downs and Lois Meyers during early drafts and the secretarial and editorial abilities of Ms. Ellen Treem were indispensible. My thanks for their patience, suggestions, and untiring efforts.

My family has been my greatest human asset in this effort. The patience and sacrifices of my boys, Bill, Dave, and Steve, cannot go unacknowledged, and the dedicated,

perceptive, loving care, encouragement, and editorial efforts of my wife, Joan, were, and are, of indescribable value.

The errors and oversights are, of course, the responsibility of only the author. The scattered activity in the field reduces confidence in comprehensive coverage and rapid new developments will make much of the material obsolete, but the author hopes that the report will be of assistance in making better resource allocation decisions in small colleges.

William A. Shoemaker
December, 1972
Washington, D.C.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

Institutions of higher education are facing a difficult era. It appears that they are besieged from every side and from within. Brien noted five major areas of stress:

(1) a growing college population
(2) rising costs
(3) rapidly changing demands for programs
(4) students' wrenching quest for relevance
(5) increasingly repressive public environment.[1]

In addition, many faculties are discontent and frequently find themselves at odds with their administrations and boards. The current economic regression adds its depressing influence to all these problems, affecting constituency, alumni, corporation and foundation giving as well as the students' ability to pay constantly increasing fees. Compounding and compounded by all these problems is the stress created by internal economic pressure evident in austerity budgets, frozen salaries, unfilled positions and generally increased competition for scarce financial resources.

Administrators, board members, faculty, students, legislators and constituents all share the frustration of

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[1]Richard H. Brien, "The Managerialization of Higher Education," Educational Record, LI, 3, (Summer, 1970), pp. 273-4.

trying to cope with a complex problem.

The small colleges are most seriously affected. Many are involved in a day-to-day, or at best, year-to-year struggle for survival.[2] They lack the resources (personnel, time and finances) to either "wait it out" for better times, or to develop and test new ideas and techniques.

Yet on these small colleges rests the responsibility for a substantial portion of the burden of higher education in the United States. The percentage of students in these private colleges may be small (10 percent), but the number is still significant (almost one million).[3] Perhaps the greatest contribution they make, however, is not quantitative, but qualitative, to students, parents, faculty, and society: identification with an institution, interaction with small groups, maintaining, developing and propagating a variety of educational, spiritual, and social viewpoints, permitting and encouraging flexibility and creativity in curricula and techniques, encouraging continuing alumni identification, providing opportunities for direct constituent influence of purposes and program and generally

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[2]William W. Jellema, The Red and the Black: Special Preliminary Report on the Financial Status, Present and Projected, of Private Institutions of Higher Learning, Washington, D.C.: Association of American Colleges, 1970, p. 25.

[3]Kenneth A. Simon and W. Vance Grant, Digest of Educational Statistics, U.S. Department of H.E.W., 1970, p. 85.

perpetuating the American traditions of strength through diversity and freedom of individual choice.

One source of help, and probably the one with the greatest long-range benefit, may be the development and implementation of new management concepts and tools. The "systems" concept and its related techniques appear to hold great promise for a more efficient use of resources.

The focus of this study is on definitions and descriptions of systems models, programs, and services, and consideration of specific factors related to their "on campus" use in small colleges.

Statement of the Problem

The problem of higher education in this decade is not faculty-student-administration relationships, developing and clarifying goals, improving decision-making processes and management procedures, increasing revenue, or any other single known, or yet unknown, stress point, but finding a way to view all of these factors which will produce and/or permit a methodology for coping with them.

The problem is indeed multifaceted, and any considered solution must take into account a large number of variables that interrelate in complex patterns. The most astute observers also note that even these variables and

patterns are in a constant state of flux. Bennis, Beene and Chin pointed out,

> . . . we are beyond debating the inevitability of change, most students of our society agree that the one major invariant is the tendency toward movement, growth, development, process: change.[4]

Even when the variables involved in the administration of higher education were rather stable, the unsystematic nature of the decision-making and planning processes was one of its most striking characteristics. If there was (or is) any "system" at all, its basis was tradition rather than effectiveness, efficiency and productivity. More recently tradition has been hard pressed due to increases in organizational size and complexity, student pressure, constituent influence, and faculty power. Many old procedures, proven techniques, and established methods of operation have diminished in effectiveness, successful policies of the past are regularly found to be dysfunctional, and basic concepts no longer reflect the reality of the situation. In many colleges the result has been a piecemeal "administration by crisis" due to inadequate decision-making and planning processes.

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[4]Warren G. Bennis, Kenneth D. Benne and Robert Chin (eds.), The Planning of Change: Readings in the Applied Behavioral Sciences (New York: Holt, Rinehart and Winston, 1961), p. 1.

Some thought and expression has been given to the application of systems theory to the small colleges. A few attempts have been made to implement a systems approach--at least on a fragmented, or partial, level and some experimental and demonstration projects are now in process. The greater part of the activity has centered on systems applications in universities, of which there are only 159 in the country. By contrast there are 1148 private colleges in the United States and 1049, or 91 percent, have fewer than 2500 students.[5]

Significance of the Problem

Small colleges, while not manifesting the complexity and magnitude of a university operation, are composed of the same general components. Most have developed to a point, and exist in an environment, which no longer permits unilateral decision-making, "seat-of-the-pants" administration, offhand control, impulsive and opportunistic "planning" that does not consider long-range implications, and paper and pencil data collection and manipulation.

The administration and staff of the institutions that

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[5]Simon and Grant, loc. cit.

do sense a need for change lack the time, skill, and experience to develop and implement new procedures, techniques and systems. In fact, they frequently do not even know of new developments in management science, or if they have heard or read something about them, they do not know where to begin in determining which, if any, might be suited to their needs. The executive director of the New Hampshire College and University Council summarized, ". . . the Council discovered that the small institution lacked both the expertise and the facilities so vital to the extension of limited resources."[6]

There is, therefore, a critical need for the analysis, compilation and dissemination of information on the systems approach, particularly to small colleges.

The systems approach has been gaining acceptance in several areas: the Department of Defense and other federal government agencies, engineering, the business management field, and the varied disciplines of political science, biology, physics, and psychology, to name a few.

It is more than just new technology, but it will, almost undoubtedly, use the latest technological developments of this age. It is broad and interdisciplinary in

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[6]Henry W. Munroe, "Executive Director's Message," Program of the National Seminar on Fiscal Management for Developing Colleges held at St. Anselm's College, Manchester, New Hampshire, August 11, 1969.

attitude yet "grass roots' oriented in application.

One definition summed this up as, ". . . a set of components organized in such a way as to constrain action toward the accomplishment of the purposes for which the system exists."[7]

Specifically the systems approach can integrate the use of a variety of recently developed techniques such as Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), Planning, Programming, Budgeting System (PPBS), Management Information System (MIS), Cost/Effectiveness (C/E) or Cost/Benefit (C/B), and Simulation.

The approach can be significantly instrumental in the establishment and classification of institutional and program goals, the evaluation of effectiveness by means of statistical information systems, the development of a broader and more meaningful data base upon which to make decisions, the improvement of communication throughout the organization regarding goals, programs, procedures, resources, and limitations, and the development and rational evaluation of available alternatives for problem solving and institutional planning.

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[7]Kathryn V. Feyereisen, A. John Fiorino and Arlene T. Nowak, Supervision and Curriculum Renewal: A Systems Approach (New York: Appleton-Century-Crofts, 1970), p. 38.

Purposes

In the light of the apparent need for descriptions, definitions, and implementation information on systems approaches this study attempts the following:

To present a review of the literature on the use of systems in higher education administration and to relate it to selected literature from the fields of systems theory, educational administration, planning, and management science.

To define and describe a rationale for a systems approach to higher education administration.

To identify specific systems applications, (models, programs and services) suitable for use in small colleges.

To compile and present data on significant factors (cost, hardware, personnel, start-up time, etc.) related to the use of selected systems approaches in small colleges.

To draw conclusions and make recommendations regarding the use of a systems approach in small colleges.

Methods

First the literature available on the use of systems in higher education administration was identified and analyzed. An initial sampling of developers, users, and potential users were interviewed. The "state of the art" was diagnosed, operational definitions created, and the

focus and parameters of the research project outlined.

It was determined that the potential users of systems, and particularly small colleges, could probably be helped best at this point in time if models suitable for them could be identified and described. It was also decided that specific factors related to the implementation of some of these models was apparently also needed.

Literature related to the purpose of the study was reviewed and summarized in Chapter II.

Then an attempt was made to identify systems models, programs, and services suitable (by claim and/or experience) for small college use. These were identified by examination of the literature and bibliographies, and by personal interviews with people knowledgeable in the field. These findings were catalogued and categorized in Chapter III.

Three models were then selected for more thorough analysis with regard to their actual on-campus use. An attempt was made to make them as representative as possible of the sixteen models and six categories described in Chapter III. The criteria used in the selection of the three were reviewed by seven experts in systems, administration, and educational research. Their suggestions were incorporated into the nine criteria, and the selection process, outlined in the introduction to Chapter IV.

The same experts were also asked to assist in the development of a "list of significant factors related to implementation." The purpose of the involvement of expert help was to try to assure comprehensive consideration of the important elements related to on-campus use (cost, personnel, electronic equipment, etc.).

At least two on-campus implementations of each of the three selected systems were analyzed according to the sixteen "significant factors." These findings are presented in Chapter IV. The information was obtained from written material produced by developers and vendors, the literature of the field, and interviews with research personnel and users.

Conclusions, recommendations, and implications were then outlined and incorporated in Chapter V.

Limitations

The study focuses primarily on administration and planning in small (less than 2500 students), private, four year institutions rather than universities or junior and community colleges.

The literature reviewed is primarily from higher education systems and management although some relevant material from general systems theory, educational administration, political science, and city planning is included. The

emphasis in the review is on recent material being produced by people involved in new systems applications and related techniques at systems research and development centers in the United States. Any publication more than a few years old is cited only because of its apparently important and lasting contribution to the field or because of historical significance.

The systems models, services, and programs considered either claim (in their literature or by their designers) to be suitable for small college use or are now in use by small institutions.

No attempt has been made to evaluate specific programs, services, and models from a technical viewpoint. Research into the adequacy of the model, program, or service to function according to the claims of its designers does not fall within the scope of this study.

There are some weaknesses inherent in the design and implementation of this research. A review of some of these is undertaken here to assist a reader, or user, in judging the value of the material for his own purposes.

The newness of the field makes a study of this type difficult and suspect. Not only is the idea of a systems approach relatively new, but so are almost all of the tools and techniques. Most of the systems models, programs, and services have been created in the last five years. In

addition to the constant release of new developments, the systems in existence are regularly going through changes in design and changes in the factors related to their implementation. The findings and conclusions of a study of this kind, therefore, will have an early obsolescence. The research covered information available through 1972.

Related to the newness of the field is the problem of terminology. As has been noted previously, the term "systems" has become very popular. Even in the management science area it is used indiscriminately. Systems related techniques, tools, functions, and products generally lack common definition. It was, therefore, necessary to create definitions for internal consistency in this study, but adjustment may be necessary in the cold, hard world of systems implementation, use, and evaluation.

The literature available on most systems models, programs, and services is quite limited and not available yet through any organized method. Aside from some descriptive brochures and technical papers, and a few monographs and journal articles related to a couple of the systems, very little has been written. This is particularly true with regard to categorization and comparison of systems, information related to implementation, and small college design and use. It may be, there-

fore, that the efforts of this research in categorization and comparison will be proven by time and subsequent developments to be quite primitive.

Another weakness of the study may prove to be the methods of data collection. No centralized source of data was available on systems or on their implementation. This meant that referrals and suggestions from researchers and developers, users, professors, foundation executives, and people at the United States Office of Education were the primary sources of information. Even though a consistent effort was made to follow up all leads, and it appeared to be the only feasible means suitable to the field, this unsophisticated method of data collection must be considered a limitation. On the other hand, the use of these primary sources can be considered a strength of the study.

Specific limitations of the study resulting primarily from limited resources are also present. One of these is the smallness of the sample of models selected for special study regarding significant factors related to implementation. In addition, it would probably be valuable to interview more on-campus staff regarding a system and its use. It should also be noted, that the administrators interviewed were probably disproportionately interested and active in usage and excited about its potential. Many are

leading the developments in the field. The views of less involved and less sophisticated administrators, staff, and faculty on the campus where a system is in use, would probably reveal more problems related to implementation and use.

Definitions

The field of systems theory and systems application gives no evidence of a commonly accepted nomenclature. These definitions, therefore, are technically only an effort to define terms which the author will attempt to use consistently throughout this report (operational definitions).

These definitions have been arrived at after careful reading in the field and many discussions with people in systems application. It is therefore hoped that they might be a move in the direction of developing a set of accepted terminology -- at least in the field of management information and simulation systems.

Administration -- the direction, control and management of all aspects of an organization in accordance with established policies.[8]

Change -- a discernible difference in individual behavior and/or attitude(s) or organizational activities

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[8] Carter Good, Dictionary of Education (New York: McGraw-Hill Book Company, 1959), p. 13.

and/or climate.

College -- an institution offering post high school education characterized by a four-year baccalaureate program with at least a substantial proportion of the curriculum in general education subjects.

Effectiveness -- related to the achievement of expected or intended goals and objectives.

Efficiency -- a minimal use of resources in a given activity or program.

Functions -- see Systems Functions.

Higher Education -- all post high school undergraduate and graduate degree programs.

Interface -- the point(s) of articulation between two systems, subsystems, or units, usually implying communication and interaction.

Management -- frequently used interchangeably with administration but sometimes concerned with lower than top level supervisory activity (i.e. middle management) or an attitude more related to details of control, operation and production than to top level decision-making. A systems approach, and particularly the use of tools such as MIS, tends to minimize the difference between management and administration.

Operations -- activities related to the daily management functions necessary to keep an organization or

institution operating, as differentiated from policy-level decision-making and planning.

Planning -- "the process of preparing a set of decisions for action in the future directed at achieving goals by optimal means."[9] (See Chapter II.)

Process -- the interaction of a variety of factors and people, or sequence of events, involved in organizational decision-making and planning.

Related Techniques -- procedures, tools and technologies that assist in implementing and/or describing a systems approach. (See Chapter II.)

Research and Development Centers -- laboratories established to discover, test, extend, demonstrate, and disseminate, both in the laboratory and on the field, new tools, techniques, and approaches to education.

Small College -- for the purposes of this study an enrollment of less than 2,500 students has been used which covers over 91 percent of the private colleges in the United States. Some observers feel that the institutional structure and dynamics do not change if the enrollment is extended to 5,000, which then includes over 98 percent of the private colleges.

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[9]Y. Dror, "The Planning Process: A Facet Design," International Review of Administrative Science, XXXIX (1963), pp. 50-51.

Sponsoring Agency -- research and development centers, colleges and universities, private foundations, and commercial organizations who develop and disseminate systems models, programs, and services.

Stress -- conflict and tension caused by unmatched needs and resources, heterogeneity of goals, and lack of understanding and communication.

System -- a set of interrelated elements, units, or subsystems that work together toward a common goal.

Systems Application -- actual use of a systems model, program, or service on a campus.

Systems Approach -- a presupposition or attitude that the phenomenon being studied is a system and any analysis of it must include an understanding of all significant components, their interrelationship, and their individual and combined contribution toward the attainment of system goals and objectives. The application of generalized systems technology and systems theory.

Systems Analysis -- detailed study of a system, its component parts, structure, interaction, processes, patterns of behavior, etc.

Systems Functions -- the purpose(s) or use(s) of a particular systems model, program, or service. That which is performed by a systems product. (MIS for operations, program budgeting, planning procedures, simulation, etc.).

Systems Model -- a graphic, mathematical, or theoretical representation of the key components of an organization, and the relationship between them, developed to represent the actual (descriptive) or desired (prescriptive) system.

Systems Product -- a systems model, program, or service that has been produced by the application of systems technology and systems theory.

Systems Program -- a systems approach organized by a sponsoring agency to facilitate application. The program usually includes a structure, tools, and procedures to be used by campus personnel with consultant assistance.

Systems Service -- similar to a systems program but featuring proportionately greater use of agency tools and personnel.

Systems Theory -- abstract and conceptual constructs relating to definitions of a system, interaction of variables, the unitary nature of a system, etc., and applying these ideas to new situations.

Systems Technology -- the use of a systems approach and systems theory to design products.

University -- an institution of higher education which is usually more complex in structure and function than a college (usually having several colleges within

its structure) and the majority being supported by public funds.

Variable -- an independent (manipulatable), dependent (resulting), or state (relevant) factor, function, or characteristic of a system which can change.

CHAPTER II

A SYSTEMS APPROACH TO COLLEGE ADMINISTRATION: A REVIEW OF THE LITERATURE

Institutions of higher education are facing a severe crisis. In addition to student activism, faculty demands, community criticism and cultural changes, many observers feel that the major problem to be faced in the next decade is economic.

There is no doubt that the financial condition of many higher educational institutions is very insecure. In a recent study for the Association of American Colleges, Jellema concluded that the average private institution is "firmly in the red."[1]

The trend is toward greater difficulty; the average private institution finished 1968 with a surplus of funds, but finished a year later with a deficit. This deficit was more than quintupled twelve months later.[2] In addition Jellema warned that many private institutions may have underestimated the financial deficit they will incur: ". . . some institutions that show a stable or even a declining amount of gifts and grants for the three years

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[1] William W. Jellema, The Red and the Black (Washington, D.C.: Association of American Colleges, n.d.) p.5.

[2] Ibid, p.5.

beginning in 1967-68 suddenly project an astonishing increase in unrestricted gifts."[3] The report concluded that ". . . it looks more like a desperate fiction invented to project a balanced budget."[4]

It is the opinion of some observers, however, that the difficulties are not only financial.[5] More often than necessary poorly defined and uncommunicated goals and objectives serve only to increase the variety and complexity of problems confronting institutions of higher education.[6]

A critical and profitable area of concern might be the underlying functions of administration, decision-making and planning. New perceptions and attitudes as well as clearer goals and more decison-making data and tools may prove to be as valuable as dollars.[7]

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[3] Ibid, p. 6.

[4] Ibid.

[5] Richard H. Brien, "The Managerialization of Higher Education," Educational Record, LI, 3 (Summer, 1970), pp. 273-80.

[6] George B. Weathersby, Educational Planning and Decision Making: The Use of Decision and Control Analysis (Berkeley: Ford Foundation Program for Research in University Administration, University of California, 1970), p. 3.

[7] W. Gary Wagner and George B. Weathersby, Optimality in College Planning: A Control Theoretic Approach (Berkeley: Ford Foundation Program for Research in University Administration, University of California, 1971), p. 2-3.

Problems related to the great increase in size that almost every institution of higher education has experienced in the past decade have been complicated by the increasing complexity of college and university structure. Departments, specialties, services, programs and new technologies have developed at an awesome rate and little thought has been given to overall goals and structure.[8]

The Development of Educational Administration

The field of educational administration in its early stages of development at the end of the last century offered little more than a practitioner's emphasis on procedures. Experienced men told aspiring administrators how they should operate schools.

During the period of 1910-1930, however, the field was influenced by the writing of Frederick Taylor[9] and the work of Henri Fayol.[10] After a period of time the overemphasis on "efficiency" became quite odious to educators as human factors were ignored, or at least de-emphasized. The educational world was a fertile setting, therefore, for the acceptance of the human relations concepts that began

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[8]Juan A. Casasco, Planning Techniques for University Management (Washington, D.C.: American Council on Education, 1970), p. 1.

[9]Frederick W. Taylor, The Principles of Scientific Management (New York: Harper and Row, 1911).

[10]Henri Fayol, General and Industrial Management, trans. Constance Storrs (London: Sir Isaac Pitman & Sons, 1949.)

to influence the thinking of management people during the late twenties and throughout the thirties. Elton Mayo's famous work in the Hawthorne plant of General Electric had an important impact as well as did the writing of Mary Parker Follett.[11]

The next era in the development of educational administration was influenced by men such as Herbert Simon.[12] It is generally considered to have had its beginning in the early fifties. More attention was given to input from the behavioral sciences as the methodology and research base developed and matured. Applications were made from the fields of psychology, sociology, and political science, while educational administration people began to develop their own methodology, theory, and body of literature.[13]

These developments in the field have been logical and healthy, but the complicated problems of the seventies seem to indicate that a new thrust is now necessary; a concept of administration that includes, but goes beyond, consideration of efficiency, effectiveness, human relations factors and

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[11]Mary Parker Follett, Creative Experience (New York: Longmans, Green and Co., 1924).

[12]Herbert A. Simon, Administrative Behavior (New York: The Macmillan Company, 1945).

[13]Andrew W. Halpin (ed.) Administrative Theory in Education (New York: The Macmillan Company, 1967).

accumulated data from research. It directs attention to the structuring of these elements into a total concept for the study and management of educational organizations.

If educational administration is ready for an era of restructuring of concepts, it would be consistent with Deutsch's observation that "the history of many fields of science show a characteristic pattern."[14] He suggests that the pattern moves from (1) a philosophic stage, with an emphasis on general concepts, fundamental assumptions and methods, through (2) an empirical stage concerned with attainment of targets and accumulating experience of testing the underlying strategy, to (3) a stage of revising fundamental concepts and underlying strategy.

Deutsch even points to the inevitability of this third stage:

> If these [concepts and strategy] were inadequate, the revision must come soon. If they were adequate for a time, the revision must nevertheless come later, for the very success of the concepts, methods, and interests adopted will lead in time to an accumulation of data and problems that will p ant beyond the interest and methods by which they were discovered.[15]

Even back in 1963 he said,

> The social sciences today are perhaps approaching another 'philosophic crisis' -

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[14]Karl W. Deutsch, The Nerves of Government (London: Free Press of Glencoe, 1963), p. 3.

[15]Ibid, pp. 3 and 4.

> an age of re-examination of concepts, methods, interests, a search for new symbolic models . . .[16]

This paper attempts to deal with a new approach to the analysis, understanding, and application of administrative practice and theory, particularly as it relates to institutions of higher education.

A Systems Approach: Definition

Popular use of the term "systems" has resulted in confusion. The variety of uses of the term ranges from references to plumbing and electrical wiring, and physiological processes of the human body, to computers, highways, and orderly procedures for doing almost anything. Even the literature related to administration and planning evidences a variety of ideas about systems theory and its application.

The term "systems approach" as used in this paper, involves three basic principles:

1. Concern with detail. Analysis of resources, activities, and results (outputs) of all units of a given institution.

2. Concern with interaction. A systems approach is concerned not only with a detailed analysis of all aspects of an institution or organization but it gives

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[16] Ibid, p. 4.

attention to the dynamic interaction that takes place between and within these units.

3. Overview. The systems approach also attempts to look at the entire network of factors in totality as a "system" with a goal. This is consistent with the concept, "the whole is greater than the sum of its parts." A true systems perspective is also sensitive to relevant factors beyond the parameters of the particular system being studied; i.e., the suprasystem.

Most writers in the field emphasize that a systems approach is basically an attitude or point of view, and a distinctive perspective. Boulding stated that, "general systems is a point of view rather than a body of doctrine."[17] Feyereisen, Fiorino and Nowak expanded and applied the concept in their definition, ". . . a state of mind or point of view plus concepts organized in a logical pattern, ". . . a set of components organized in such a way as to constrain action toward the accomplishment of the purposes for which the system exists."[18]

The point of view of the systems approach is holistic, molar and organismic. It is concerned with the entirety of

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[17]Kenneth E. Boulding, "General Systems as a Point of View," Views on General Systems Theory, ed. Mihajlo D. Mesarovic (New York: Wiley and Sons, Inc., 1963), p. 25.

[18]Kathryn V. Feyereisen, A. John Fiorino and Arlene T. Nowak, Supervision and Curriculum Renewal: A Systems Approach (New York: Appleton-Century Crofts, 1970), pp. 38-39.

the organizational structure, in a dynamic and transactional sense, without neglecting the minutia at any point within the structure that have an important bearing on its functionality. Bertalanffy advocated this approach because he found ". . . systems of various orders not understandable by investigation of their respective parts in isolation."[19]

Churchman also wrote about climbing to a vantage point from which the whole system can be viewed as ". . . a set of parts coordinated to accomplish a set of goals."[20] He added, "Specifically, the management scientist's aim is to spell out in detail what the whole system is, the environment in which it lives, what its objective is, and how this is supported by the activities of the parts."[21]

In order to develop and define the concept further, Churchman went on to outline "five basic considerations" to be kept in mind while thinking about a system:

1. total system objectives and means to measure the degree these are achieved;

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[19]Ludwig von Bertalanffy, General Systems Theory: Foundations, Development, Applications (New York: George Braziller, Inc. 1968), p. 37.

[20]Churchman, op. cit., p. 29.

[21]Ibid.

2. the environment of the system; relevant factors outside the system which have a bearing on its operation and performance (usually unchangeable "givens");

3. the resources of the system; the means available to operate the system (money, people, technology and equipment);

4. the components, units, or subsystems (terms used interchangeably), their activity and measurable progress toward unit and system goals;

5. the management of the system in terms of planning, resource allocation, control, and evaluation.[22]

It is impossible to think about any group of factors without assuming relationships between them. A basic model, of some type, is held by everyone when studying an organization, whether or not there is full cognition and understanding of it.[23] A systems approach is concerned with the relevant elements of an organization and the model or conceptual structure of the relationships between factors.

This approach is also concerned with the assumptions (theories) that are made about their function and interaction. One author specifically pointed out that a system is "made up of concepts and involves theories."[24] The system into

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[22] Ibid, pp. 29-30.

[23] Deutsch, op. cit., p. 12.

[24] Roy R. Grinker (ed.), Toward a Unified Theory of Human Behavior (New York: Basic Books, 1956), p. 373.

which one fits all of his perceptions of the structure and processes of an organization is really the total of his understanding and experience, both conscious and unconscious. The suggestion of the systems approach is that an attempt be made to display verbally, graphically, and mathematically how an organization functions -- or how it could, or should, function.

This paper defines the term systems approach in this broad manner and then attempts to deal with some theoretical factors and practical techniques related to the administration of a higher educational institution from this conceptual base.

An understanding of an organization based on this comprehensive analysis of both static and dynamic factors may be beneficial in (1) determining trends and patterns, based on past and current operations, and (2) developing alternative programs and resource allocations based on improved understanding of the factors involved, their interrelationship, and their importance in achieving system goals. In this sense, perhaps, a link can be created between the descriptive and prescriptive, the "is" and the "ought."

THE DEVELOPMENT OF SYSTEMS

Concept Development

Wiener noted that "the thought of every age is reflected in its technique."[25] The development of thought has moved from the simple, primitive ideas of the past to the variety of complex concepts that now have begun to emerge, relating to (1) reception of impressions (input), (2) effectors (output), as well as (3) the network, or "nervous system," through which communication and integration take place.

Hare suggested that an early illustration of a primitive model is to be found in ancient Egypt. The pyramid was the model of hierarchical organization with the power centered at the apex of the structure.[26] The Judeo-Christian heritage reflected and reinforced this simple hierarchical concept through monotheism and governmental structure. Early in their history the Jewish nation requested of Samuel the judge: "Now make us a king to judge us like all the nations."[27]

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[25] Norbert Wiener, Cybernetics: or Control and Communication in the Animal and the Machine (Cambridge: The MIT Press, 1963), p. 38.

[26] Van Court Hare, Jr., Systems Analysis: A Diagnostic Approach (New York: Harcourt, Brace and World, Inc., 1967), p. 22.

[27] I Samuel 8:5.

Deutsch pointed out that, among other things, increased understanding of the human body has broadened our concept of the functions of organizations.[28] Notions of communication, interaction, structure, memory and recognition have provided new insight.

Wiener's cybernetic concept identified self-steering and regulating mechanisms of systems. It is observable in the sophisticated application of radar to missile control and the gyrocompasses of atomic submarines. It is also illustrated in an increased understanding of the physiological, chemical and neurological mechanisms operating in the human body.[29]

A systems approach tends to make the observer more sensitive to the variety of factors and the interaction between them. It focuses on the inputs, processes, and outputs of the system from a molar or organismic viewpoint rather than a molecular, or piecemeal perspective.

This holistic concept of a system also includes a sensitivity to the gestalt or environment in which this system operates, or in other words, the part that the system plays as a unit or subsystem of an even larger system, i.e., the relationship of the college or university to higher

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[28] Deutsch, op. cit., p. 31.

[29] Wiener, op. cit., p. 43.

education in general, the state, federal government, the hemisphere, the world — perhaps even the universe.

A systems approach is also suitable for an analysis of the various units or subsystems within a given system being studied. In an institution of higher education this might be the faculty, a department, an office or the student body.

In summary, the systems approach is concerned with the perception of the elements of a system, their interrelationship, their environment and their goal.

Operations Research

The development of operational systems models for management is quite recent, aside from a few earlier efforts like Gantt's Milestone Chart[30] and Thomas Edison's work with the Navy during World War I.[31]

The commonly accepted origin of operational use of that which is sometimes called systems technique began with the development of operations research (OR). Operations research had its origin during the Second World War. It is algorithmic, quantitative, and a less heuristic and qualitative systems analysis than some of the techniques that have been developed more recently. In 1952, the Operations

[30]R. I. Levin and C. A. Kirkpatrick, Planning and Controlling with PERT/CPM (New York: McGraw-Hill Book Company, Inc., 1966), p. 3.

[31]Knezevich, op. cit., p. 6.

Research Society of America, at the time of its founding, defined operations research as, "a scientific method of providing executive departments with a quantitative basis for decisions regarding the operations under their control."[32]

In his history of the development of systems thought and technology, Forrester labeled 1956-61 Phase One and described it:

> Structural Concepts and Steady State Dynamics
> The structure of systems was identified in terms of feedback loops and their component substructure. Examples of system formulation were developed. Application of the concepts was made to steady state dynamics which concentrate on the fluctuation about equilibrium conditions and which do not involve the process of growth and decline.[33]

Operations Research contributed a great deal through the development of sophisticated techniques of data collection and manipulation and generally establishing the value of a data base for decision-making. It tended to be quite valuable for management decisions within certain units of an organization particularly suited to quantitative analysis, but failed to assist in top level decision-making.

Systems Application

Without a doubt the Department of Defense has made the

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[32] David S. Stoller, Operations Research: Process and Strategy (Berkeley: University of California, 1964), p. 10.

[33] Jay Forrester, "Industrial Dynamics - After the First Decade," Emerging Concepts in Management, Max S. Worman and Fred Luthans (eds) (Toronto: The Macmillan Co., 1969), p. 373.

broadest and most elaborate functional and operational use of the systems concept. The incredibly complex United States Defense System can only remain functional, understandable, and controllable when perceived and operated as a system.[34] Coordination of the large number of complex activities, facilitation of communication, reduction of duplication, budgeting, control, etc., can be achieved through the several techniques that make up, permit and expedite a systems approach.

The RAND Corporation, a nonprofit research organization noted for stimulating, innovative developments in systems analysis, must be given the credit for suggesting and testing new applications of the systems concept in a variety of fields. Their personnel have produced papers in such diverse areas as program budgeting, general educational systems, defense applications, cost-effectiveness analysis, and the structure and control of municipal social services.

Kershaw and McKean produced an early paper on the use of systems analysis in educational organizations. It was

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[34]Harry J. Hartley, Educational Planning - Programming - Budgeting: A Systems Approach (Englewood Cliffs: Prentice-Hall, Inc., 1968), pp. 79-80.

concerned primarily with elementary and secondary schools and had as its purpose, ". . . to assess the possibilities of making quantitative comparisons of education systems."[35] They defined systems analysis as, ". . . the comparison of alternate means of carrying out some function, when those means are rather complicated and comprise a number of interrelated elements."[36] They emphasized that they were not concerned with mere "economic analysis," but by using the term "system" they were ". . . calling attention to the complex nature of the alternatives being compared."[37]

The increasing complexity of higher education and scarcity of resources, indicates that attention should be given to the application of a systems approach.

Cook, in a presentation at Temple University in 1968, outlined several specific applications of the systems concept.

(1) Instructional Systems -- analysis, restructuring components, and computer-assisted instruction.

(2) Project Management Systems -- planning and controlling various projects through arrow diagrams flow graphs.

(3) Management Information Systems -- data base, for better decision-making and planning, containing information relating to faculty, students, finances, research, etc.

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[35] J.A. Kershaw and R.H. McKean, Systems Analysis and Education (Santa Monica, California: The Rand Corporation, 1959), p. I

[36] Ibid, p. 1.

[37] Ibid, p. 1.

(4) Planning, Programming, Budgeting Systems -- establishment of program goals, selection of alternate means to attain goals, cost/benefit analysis.

(5) Operations Research -- identification of relevant variables, quantification, use of mathematical formulas to evaluate output.[38]

Since 1968 many institutions, commercial organizations, government sponsored research and development centers, and college consortia have given attention to the development of systems models for institutions of higher education. Chapter III of this report describes several of these.

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[38] Desmond L. Cook, "The Impact of Systems Analysis on Education," Systems Analysis Symposium, Ralph L. Spencer and Donald L. Walters, (eds.) (Philadelphia: Temple University 1968), pp. 37-45.

SYSTEMS RELATED TECHNIQUES

A number of related areas of expertise in the application of the systems concept have developed. They have increased the usefulness of the concept, its breadth of application and depth of analysis.

Most of these techniques have been referred to as "systems analysis" or some other systems term by various writers and practitioners. It is more realistic and helpful however, to see each as a tool or technique related to some aspect(s) of a systems approach.

Program Evaluation and Review Technique (PERT)

In 1957 DuPont and Sperry Rand developed a technique for graphically expressing a project, and it was used for "design, construction and plant maintenance projects."[39] The following year the Navy's special projects office developed what has essentially become a contemporary PERT system. Its use spread throughout the entire Department of Defense and many other government offices. PERT is a system of analyzing, planning, diagramming, and managing a project. The project is broken down into small segments and

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[39] J. Horowitz, Critical Path Scheduling (New York: Ronald Press, 1959), p. 5.

then separated into the various activities and elements that are necessary to achieve the overall goal. The information is "networked" and arrow diagrammed. The diagram indicates the sequence and interdependence of activities and graphically reveals the critical processes of a system.[40] Its value in a systems approach is that of expressing the processes of an organization.

Critical Path Method (CPM)

An outgrowth of PERT, CPM is concerned with the minimal time needed to complete individual activities and an entire project. This indication of minimal time permitted on individual activities establishes priorities on indicated segments of the program which in turn give assistance in making management decisions. These priority activities and the path which interconnects them are called the "critical path."

By using a systematic and graphic expression of the program. less time is spent on emergencies and last minute decisions. The administration then has the advantage of having the entire program run more efficiently. The development and application of PERT/CPM has been noteworthy. In 1966 Riggs and Heath commented that "perhaps once in a decade a new management tool is successfully introduced into industry. Such a tool is critical path scheduling.

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[40]R.I. Levin and C.A. Kirkpatrick, Planning and Controlling With PERT/CPM (New York: McGraw-Hill Co., 1966).

Its impact has been amazing. Within half a dozen years it has matured from the experimental concept to a standard scheduling procedure."[41]

The most extensive educational administration use of CPM has been in construction. Dumbrow's work in this area has been one example of its application to preproject planning and construction, as well as budget preparation, curriculum change, etc. He finds it an aid to decision-making, coordination of effort, and communication, in addition to saving time and money.[42]

PERT has also found more general application. Cook, referring to one of these, commented that the use of "PERT or some other formalized management system is already an integral part of the procurement cycle," for research funds through the Office of Education.[43] The extent of its use is apparent from the material produced by the Educational Research Management Center at Ohio State.[44]

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[41] J. L. Riggs and C. O. Heath, Guide to Cost Reduction Through Critical Path Scheduling (Englewood Cliffs: Prentice-Hall, Inc., 1966), p. 7.

[42] Roger T. Dumbrow, "How to Meet Your Construction Deadline," School Management, VII, 7 (July, 1963), pp. 99-103.

[43] Desmond L. Cook, "Program Evaluation and Review Techniques: Applications to Education" (Washington, D.C.: U.S. Office of H.E.W., Office of Education, 12024, Cooperative Research Monograph, No. 17, 1966), p. 9.

[44] _____, References on Network Planning in Education (Columbus, Ohio: Educational Research Management Center, School of Education, The Ohio State University, 1966).

Planning Program Budgeting System (PPBS)

The "program" budget as a component of PPBS provides a carefully conceived framework for systematically relating the expenditure of funds to the accomplishment of planned goals and programs.[45] PPBS is the application of the systems concept to the budget and management procedures. It emphasizes the evaluation of goal achievements to satisfy system goals. Novick stated, "Program budgeting starts with the structuring of the problem and ends with the analysis of the data."[46]

PPBS was given recognition in 1965 when the president announced its use in federal government and stated that PPBS is intended to produce ". . . a comprehensive multi year program and financial plan, systematically updated; analyses, including program memoranda, prepared annually and used in the budget preview; special studies in depth from time to time, and other information that will contribute to the annual budget process."[47]

The traditional "line-item" budgets of higher educational institutions are, at best, tools for accounting and

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[45]Hartley, op. cit., p. 20.

[46]David Novick (ed.) Program Budgeting: Program Analysis and the Federal Budget (Cambridge: Harvard University Press, 1965), p. viii.

[47]"Planning-Programming-Budgeting," Bulletin No. 66-3, Bureau of the Budget, Executive Office of the President, October 12, 1965.

certainly not an aid for decision-making and planning. Grouping all instructional salaries, all physical plant maintenance and operation costs, all administrative costs, etc., does not permit examination of product or even program costs. In addition to noting some possible legitimate opposition to PPBS Hirsch suggested:

> The existing budget and budgeting procedures are so patently uninformative that they effectively conceal most of the needed insight. Many old timers are quite comfortable in such a situation, which makes it difficult for any operation to be judged and evaluated seriously.[48]

Smith dealt with the problem of a more explicit definition of PPBS.

> The term "program budgeting" means different things to different people. To some it suggests no more than (1) restructuring budget exhibits, accumulating costs in more meaningful categories. To others a program budget implies (2) a budget that employs a longer time horizon than the commonly found projection limited to one year. To still another, the concept of program budgeting includes (3) the use of cost-utility analysis, a logical and measuring relation of inputs and outputs.[49]

Farmer points out that PPBS is not only needed for more rational and systematic planning and decision-making,

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[48]Werner Z. Hirsch, "Program Budget for Natural Resources Activities," Program Budgeting: Program Analysis and the Federal Budget, (Cambridge: Harvard University Press, 1965), p. 205.

[49]Lester S. Smith, The Allocation of Financial Resources in Higher Education (Columbus: The Ohio State University, 1967), p. 14.

but that constituencies of higher educational institutions are demanding accountability.[50] This is especially so when state and federal money is involved; and very few institutions find they can operate without government support for themselves and/or their students. Institutions have begun to face a requirement to report in program budget format. To emphasize the necessity of PPBS, Farmer wrote:

> If program budgeting had been discredited or found inapplicable by business, higher education could have avoided PPBS. But this management technology, developed from science, engineering, and economics, is proving its usefulness. Failing to implement the technology and at the same time failing to articulate its inapplicability, higher education, as a whole, appears to resist change - the very "change" that such institutions are expected to foster. While it is clear to the systems analyst that higher education presents difficult conceptual problems the reluctance of institutions to approach such planning technology appears unwarranted.[51]

Management Information Systems (MIS)

Kemeny, speaking out of broad personal experience in both electronic data processing and college administration commented,

> . . . all our systems were dreamed up before the age of computers, they were thought out for less sophisticated purposes . . . there are some great weaknesses in the entire way we keep information. And in the present tremendously tight financial situation of

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[50] James Farmer, Why Planning, Programming, Budgeting Systems for Higher Education? (Boulder, Colorado: Western Interstate Commission for Higher Education, 1970), p. 5.

[51] Ibid, p. 5.

> institutions, these are weaknesses with which we cannot live very much longer.[52]

An adequate information system is the backbone of a systems approach. Sisk paralleled an information system to the entire human nervous system and management to the central nervous system. He added, "Unlike the human organism, however, a company is not created with a complete information (nervous) system; therefore, management must design its own system so the firm may function properly."[53]

A management information system is concerned with organizing and facilitating the collection, processing and distribution of data necessary for discernment of trends, analysis of patterns, planning, control, resource utilization, and evaluation.

The purpose of the information is better management of the organization and its resources, personnel and productivity. If an organization is to be understood as a total system, the MIS must reflect all aspects of the enterprise.

A budget is not an adequate information system although it is an important part of it. The traditional line-item budget is not a management tool but an accountant's technique for controlling funds. The program budget, as discussed in

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[52]John G. Kemeny, "Use, Non-use and Misuse of Computers by Colleges" (Transcription of a tape-recording of an address delivered at the Conference on Computers in the Undergraduate Curricula, Dartmouth College, June 23, 1971), p. 17.

[53]Henry L. Sisk, Principles of Management: A Systems Approach to the Management Process. (Cincinnati: Southwestern Publishing Co., 1969), p. 195.

the previous section, is a more valuable tool for management, but still is not concerned with all aspects of management. There is a sense in which the program budget might be considered adequate for a systems approach in a business where the product may be tangible, and the purpose of the organization is simply to increase the margin of profit in a stable market.

The management of an educational institution, however, requires far more than program budget information about its various subsystems, environment, and products in order to provide a rational basis for decision-making and planning. In a section of his book relating to the special need for MIS in nonprofit organizations, Sollenberger commented:

> The information needs at management control levels are perhaps more demanding since programs and budgets must be set for areas in which the budget can be controlled monetarily but program success can be faraway. The concentration of ill-defined problems makes the management of these activities much more complex.[54]

The development of an information system is not simply the expansion of electronic data processing. Brien warned:

> Information systems and computers are not synonymous, and those who believe they are tend to have either exaggerated expectations about the computer's effectiveness in solving administrative problems or somewhat hysterical notions about

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[54]Harold M. Sollenberger, Major Changes Caused by the Implementation of a Management Information System (New York: National Association of Accountants, 1968), p. 32.

> machine dominance in the cybernetic world of the future.[55]

On the other hand, many writers and practitioners take the more limited view. Morrison emphasized only finances and electronic data processing when he advocated a

> . . . management information system which replaces the traditional academic planning and budgeting process with specific administration "systems," instrument and automated procedures that bureaucratically institutionalize the resource allocation responsibility. . . . Colleges should begin to develop budget execution and control procedures for improved fiscal control, program-project control and activity control. These fiscal planning procedures become the college's management information system.[56]

Even more restricted definitions can be found. "A university information system can be any system that provides data about the university."[57] Baughman emphasized the "descriptive" aspects of a systems approach, but went on to advocate that the information system be tailored to the

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[55]Richard H. Brien, "The Managerialization of Higher Education," Educational Record LI, 3 (Summer, 1970), p. 277.

[56]James W. Morrison, "The Focus of the Fiscal Management Seminars," Introduction to National Seminar on Fiscal Management for Developing Colleges, The Fiscal Management Process, St. Anselm's College, Manchester, New Hampshire, August 11, 1969, seminar program p. 49.

[57]George W. Baughman, "Evaluating the Performance and Effectiveness of University Management Information Systems," Management Information System: Their Development and Use in the Administration of Higher Education, John Minter and Ben Lawrence (eds.) (Boulder: Western Interstate Commission for Higher Education, 1969), p. 3.

needs of the user. The problem is to ascertain what the "needs" are. When the management of an organization does not know enough to ask better questions (i.e. desire more comprehensive and analytical information) before becoming involved in decision-making and planning, it does not have an MIS in the way it is defined as a system technique in this study. It is a "system" only in the sense of a procedure or technology.

The broad theorists in the field advocate a comprehensive information network that reflects the true complexity of the organization. Katz called this a "systemic frame of reference" and pointed out,

> . . . . a systemic frame of reference involves dealing with the whole Gestalt [sic] of the enterprise . . . .
> The emphasis is on identifying tendencies and uniformities in the phenomena, and identifying patterns of relationships among the variables comprising the uniformities and tendencies. The limits and constraints in the situation must also be identified. Within these limits, it is then necessary to predict the expected changes in the total pattern, and in the other components, with change in any one or more of the component variables.[58]

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[58] Robert C. Katz, Management of the Total Enterprise (Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1970), p. 16.

A few writers, such as Brooker, question the theoretical basis of this viewpoint and its operational feasibility.[59] Others, like Churchman, who advocate a systems viewpoint and MIS are merely realistic about its limitations,

> Hence I think it's doubtful whether any technique at the present time — model building or whatever -- is capable of grasping enough of reality to guarantee that management will really improve the system it manages. In other words, at this stage in the 1960's we haven't a technology of any kind -- in old-fashioned management principles or modern mathematical model building -- that really grasps enough of the real system to assure us that what we are changing constitutes a real improvement.[60]

This is particularly true in education where the product, or output, is so difficult to define and measure. The National Center for Higher Education Management Systems in Boulder, Colorado, formerly the Planning and Management Systems Division of the Western Interstate Commission for Higher Education, has given special attention to this problem.[61]

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[59] W. M. A. Brooker, "The Total Systems Myth," Emerging Concepts in Management, Max S. Wortman and Fred Luthans (eds.) (Toronto: The MacMillan Co., 1969), pp. 362-69.

[60] C. West Churchman, "The State of Information Retrieval and Data Process in the Year 2000 and Its Implications for Management," Management 2000 (Hamilton, New York: The American Foundation for Management Research, 1968), p. 51.

[61] Lawrence, Ben, George Weathersby, and Virginia W. Paterson, Outputs of Higher Education: Their Identification, Measurement and Evaluation (Boulder: Western Interstate Commission for Higher Education, 1970).

This area of product definition and measurement gives every indication of being one of the most difficult to resolve in an educational MIS. The difficulties of gaining consensus on what the product is, or should be, along with measurement techniques, standards of evaluation, and cost/utility application will require a great deal of effort due to the nature of man and the learning process. At this point the best that can be done is to try to define purposes, priorities, responsibilities and capabilities. Given this "state of the art" the National Laboratory for Higher Education in its Administrative and Organizational Systems approach advocated the use of the Delphi Technique.[62] Using the Institutional Goals Inventory of the Educational Testing Service they attempted to reach consensus on general institutional goals which, hopefully, can be converted to specific activities. These goal and program specifications may then be incorporated into program budgeting, at least, if not into a truly comprehensive MIS.

Valenski also discussed the complexity of the problem, and a comprehensive MIS:

> Decision theory in addition to dealing with alternate courses of action per se, takes into account three other factors:
> (1) Possible state of nature or events or outcomes to which, in some manner, probabilities of occurrence may be assigned.

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[62]Norman P. Uhl, "Identifying College Goals the Delphi Way," Administration and Organization, Topical Papers and Reprints No. 2 (Durham, North Carolina: National Laboratory for Higher Education, n.d.).

(2) Some method of assessment of the correctness of actions or events and their consequences in terms of profitability or utility.

(3) Some criterion or criteria for the determination of the best or 'optimum' act.[63]

Brien, in advocating functional MIS for the administration of institutions of higher education, said:

> Clearly the flow of information generated within a complex organization must itself be systematized and managed. What is needed is a management (or administrative) information system - a structured, interacting complex of persons, machines, and procedures designed to generate an orderly flow of pertinent information, collected from both intra- and extraorganizational sources, for use as the bases for decision-making in specified responsibility areas. The fundamental concept is as appropriate for a college or university as for a business firm or a government agency.[64]

Drucker prophetically discussed this:

> The new organization, whether an army or a business, is above all an information and decision system. Information, ideas, questions, flow from outside environment as well as from people within. They not only have to be perceived and transmitted; the relevant has to be separated from the merely interesting. Then somebody has to make a decision which in turn has to flow back to the places where it can

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[63] David Valenski, "Statistics," The Encyclopedia of Management, Carl Heyal (ed.) (New York: Reinhold Book Corp., 1968), p. 924.

[64] Brien, op. cit., p. 276-77.

> become effective action. Information and decision systems are around us everywhere; every living being is one, and so is every machine. But the organization is probably the most complex.[65]

Sollenberger summarized what he felt was essential to a practical information system that will serve the decision-maker:

> The basic format of all information management consists of (1) bringing the decision maker the information he needs to make the decision, (2) communicating his decision to generate the desired action, and (3) reporting the results of that action.[66]

Sisk outlined what he called the "components" of an information system:

> . . . an effective information system has the following five parts: (1) input device - a means of placing information into the system, (2) storage unit - provides for the accumulation of information (performs a memory function), (3) control unit - selects the proper information from the storage unit and controls the operation of the (4) processing unit - the part that handles and interprets the data, and the (5) output device - presents the original information in usable form after it has been processed.[67]

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[65] Peter F. Drucker, Landmarks of Tomorrow (New York: Harper and Row, 1959), p. 92.

[66] Harold M. Sollenberger, Major Changes Caused by the Implementation of a Management Information System (New York: National Association of Accountants, 1968), p. 1.

[67] Henry L. Sisk, Principles of Management; A Systems Approach to the Management Process (Cincinnati: South-Western Publishing Co., 1969), p. 195.

Stokes presented what he called, "basic requirements of a controls system:"

> Comprehensiveness . . . The controls system should cover every important aspect of the business.
>
> The controls program must be set up by individuals possessing a total view of the organization, a view usually possessed by only one or very few people.
>
> Efficiency. In most instances, control information should be relayed to management as soon as possible after significant events occur.
>
> . . . the cost of the control information must be justifiable, or we may find that the control costs are more than the advantages provided.
>
> Effectiveness. . . . There is a need for a minimum number of critical indicators; in most businesses, the executive needs between 40 and 60 . . . . They point the way for further investigation, study, and action.
>
> Creativity. Establishing controls cannot be a mechanical process . . . the news and evolving patterns of business require the executive continually to rearrange his experience and up date his thinking in a never-ending process.[68]

Gwynn, out of his experience with MIS in higher education listed four general criteria. These are simplicity, flexibility, comprehensiveness, and efficiency. Simplicity, which is the concept he adds, was defined as a system, " . . . which is easy to learn, install, and use."[69]

Commenting on the problem of determining "boundary conditions" related to the development of an adequate data

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[68]Paul M. Stokes, A Total Systems Approach to Management Control (American Management Association, Inc., 1968), pp. 23-25.

[69]John Gwynn, "The Data Base Approach to a Management Information System," Management Information Systems: Their Development and Use in the Administration of Higher Education, John Minter and Ben Lawrence (eds.) Boulder: Western Interstate Commission for Higher Education, 1969), p. 14.

base for higher education MIS (a balance between simplicity and comprehensiveness), Gwynn wrote:

> Two extremes may be considered to identify the boundary conditions: (1) a data base could be specified to include all of the data elements ever needed to satisfy an information request; (2) an exhaustive study of the information requirements of the multitude of management activities could yield the needed data elements. Neither of these is possible; however, some position between the two may be practical and feasible.[70]

Stokes stated what a good MIS can do for an administrator, "A controls system can assist the executive in four different ways: by informing, by helping to predict events, by helping to diagnose problems, and by reinforcing memory."[71]

In his study Sollenberger noted why

> . . . decision-making data have not been available in an efficient and consistent form. Among the reasons are:
>
> (1) Emphasis has been on historical data with limited applicability to current operations and planning.
>
> (2) A sizable percentage of the data has been defined in financial and accounting terms and oriented toward fiscal control and legal reporting.
>
> (3) Each functional area felt a need for specialized information and sought to meet the need independently.
>
> (4) Interplay among functional information systems emphasized by the introduction of computers, became a major financial burden

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[70] Ibid.

[71] Stokes, op. cit., p. 26.

> causing clerical cost control to receive more emphasis than information requirements.[72]

Kayser wrote, with specific focus on college and university management, "Some administrators have gone so far as to say that a large part of the so-called management data upon which judgements must frequently depend is either 'useless or wrong.'"[73]

Gwynn stated his desire to get information to the decision-maker(s) so that he can " . . . engage the resources at his disposal in such a manner that he may select an alternative which will culminate in an optimal or near optimal realization. . . "[74] of goals and objectives. Focusing on what he called the "crux" of the problem he made two interrelated points:

> How can a data base be built which contains the information needed to support decision-making when there is no formal way of determining what data to put into the data base? And, assuming the data base is available, what kind of management information system is needed to maintain and manipulate the data base when it is not known what data will be used and in what manner?[75]

Gwynn differentiates between two basic concepts, and relates them both to MIS:

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[72] Sollenberger, op. cit., pp. 1, 2.

[73] Arthur B. Kayser, Jr. "Development and Operation of a Management Information System at Portland State University" (Paper presented at seminar entitled, Developing an MIS in Colleges, St. Anselm's College, Manchester, N.H., August 5, 1969), p. 1.

[74] Gwynn, op. cit., p. 9.

[75] Ibid.

> A data management system (DMS) may be defined as a set of procedures to facilitate the construction and maintenance of a data base.
>
> A management information system (MIS) is a set of processes (mechanical or otherwise) which, when properly executed, obtain data or produce information from data in the data base in a manner which is responsive to the needs of institutional management and in direct response to a request.
>
> Often an MIS will be coupled with a DMS, and the combined package is referred to as an MIS.[76]

An issue discussed by many writers in the field is the cost of developing and maintaining a MIS. The people who give greater attention to this appear to be those who are primarily concerned with "grassroots" application.

Rhind simply stated, "The magnitude of development expense is daunting indeed."[77]

Marschak dealt with the problem more comprehensively. He mentioned six factors to be considered when building a system; (1) the data or type of information, (2) the speed and reliability necessary in the communication, (3) the utility of the message, (4) the degree of probability or accuracy needed, (5) the relative importance or critical

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[76] Ibid, p. 12.

[77] Ridley Rhind, "Management Information Systems: What Computers Can and Cannot Do" (San Francisco: McKensey & Co., unpublished paper, n.d.), p. 6.

nature of the alternatives being considered, (6) the cost of the service.[78]

As part of an illustration he made the following comment which focuses directly on the issue of balancing cost with utility:

> If the costs of these various services were equal, I would choose the one which gives data most closely reflecting (in some sense) the actual event I am interested in . . . . But perfection is costly and I shall choose a service that is known not to mislead too grossly or too frequently, yet will be relatively cheap.[79]

Kessel and Mink, in applying the principle to the administration of higher education said, " . . . the cost of obtaining information must be considered, as well as the value of the information."[80]

Kornfeld reports on actual costs involved in operating three advanced systems. The extremely high figures ($600,000

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[78]Jacob Marschak, "Economics of Inquiring, Communication, Deciding," American Economic Review, LVIII, 2 (May, 1968), pp. 1-18.

[79]Ibid, p. 3.

[80]Vicki Kessel and Oscar G. Mink and Members of the AOS Task Force, The Application of Open Systems Theory and Organization Development to Higher Education: A Position (Durham, North Carolina: National Laboratory for Higher Education, 1971), p. 50.

or $800,000 to $1,150,000) are of course for very large and complex institutions.[81]

Current products and services being developed reflect a sensitivity to cost factors, especially for smaller institutions. The National Center for Higher Education Management Systems' Task Force for the Small College Demonstration Project identified two "needs" directly related to cost:

> The need for obtaining estimates of the time and the cost involved in the development of an adequate management system, 'and' the need to develop computer linkages between these institutions so that they can obtain the computing capacity at a price they can afford.[82]

Sollenberger, with his pragmatic emphasis, pointed out:

> The advantages of increased access to data files far outweigh the problems created. Specifically, the increased availability of data can:
> (1) provide increased efficiency in manager's use of time,
> (2) improve the quality of subordinates' reports and recommendations,
> (3) provide support needed for more immediate and thorough analysis of specific problems,
> (4) yield faster and more informed reactions to operational control problems,
> (5) permit the restructure of reports and summaries by direct access to original data,

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[81] Leo L. Kornfeld, "Advanced Applied Management Information Systems in Higher Education," Management Information Systems: Their Development and Use in the Administration of Higher Education, John Minter and Ben Lawrence (eds.) (Boulder, Colorado: Western Interstate Commission for Higher Education, 1969), pp. 85-100.

[82] National Center for Higher Education Management Systems, "Prospectus: Small College Demonstration Project of NCHEMS" (Unpublished preliminary draft, NCHEMS, Boulder: August 19, 1971), pp. 1, 2.

(6) allow increased summarization and more management by exception reporting, and
(7) aid in the justification of mechanization costs for many raw data sources and data storage areas.[83]

Kessel and Mink in summarizing the purpose of an information system in the administration of higher education said:

> In essence the goal of the Information Systems component is to increase the efficiency of administrative record keeping and the quality of information available for planning, decision-making, and evaluation in colleges of diverse sizes and types.[84]

Cost Effectiveness (C/E)

An outgrowth, or logical extension, of MIS is the use of this unified information system to express the costs of each of a set of alternatives from which an administrator may choose in order to achieve a designated goal. Cost effectiveness provides a technique for assigning cost-utility (c/u) or cost-benefit (c/b) to the various alternatives so that an administrator can maximize the c/u ratio. It should be noted, however, that "the cost of the activity is not the absolute dollar value but is interpreted to mean the alternative activities that must be given up in order that a given activity can be implemented."[85]

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[83] Sollenberger, op. cit., pp. 29-30.

[84] Kessel and Mink, op. cit., p. 50.

[85] Frank W. Banghart, Educational Systems Analysis (New York: The Macmillan Company, 1969), p. 201.

In industry the concept is more clear cut in application. The products are tangible and the cost to produce them can be almost totally translated into dollars. Education faces some difficulties in application of C/E because of at least three factors. The first is the nebulous character of the "product" of education. The dilemma is that of defining what an "educated person" is, and doing so in precise enough terms to permit description of degrees or levels of being educated that parallel various activities, courses, programs or degrees. The second is the problem of measuring or evaluating. Even if it could be decided what education is, there is no indication now that "behavior" could reliably and validly be measured. The third is the inability to specify which activities, event , occasions, and experiences have a direct bearing on attaining the status of an educated person.

Due to these and other difficulties, the application of C/E has been limited to the use of traditional factors e.g., expenditures, size of courses, major programs and departments, student services, number of degrees granted, results of standardized tests, etc. The systematic evaluation of the trade-off of these factors, and their expected benefits, for priority items is a valuable tool for educational administrators.

The National Center for Higher Education Management Systems (NCHEMS), formerly the Planning and Management Systems Division of the Western Interstate Commission for Higher Education (WICHE), has been one of the leaders in the development of a structure for the application of MIS and C/E to higher education. Funded primarily by the Office of Education and centered in Boulder, Colorado, it is developing models and taxonomies for categorizing the various budget items.[86]

Simulation

Some programs have been developed to use a computer to simulate the interaction between the various factors and to project the consequences over a given period of time. Changes in basic assumptions upon which management and budgeting have been based can be fed into the simulation and tested for immediate and long-range consequences. Various policy alternatives available to the administration of an institution can also be programmed into the simulation for projection of results in other areas.

As Sutterfield pointed out, the key to the process is to ask "what if" questions:

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[86]Ben Lawrence, "The WICHE Planning and Management Systems Program: Its Nature, Scope and Limitations." Presented to the Federal Interagency Group on Higher Education Management Systems, January 12, 1971.

> What would happen if student-faculty ratio were raised to 16? What would happen if enrollment went to 1,200 instead of going to just 1,000? What are the effects of both of these changes?[87]

Projections have been simulated for student enrollment, faculty needs, general financial needs, space needs, development department goals, tuition increases, etc. The Midwest Research Institute of Kansas City, Missouri, has, at the request of a college and university consortium, used their experience in simulating war games for the military to develop a computer simulation program that they call Higher Education Long-Range Planning/Translator (HELP/PLANTRAN). It is now in operation on several campuses that vary in size and complexity. The HELP/PLANTRAN approach, "is not a model but a system that permits planners to develop models."[88] "The executive becomes the model builder."[89]

> The representation will be based upon the planner's experience and observation of how the organization functions through time. The model will be constructed by the assignment of quantitative values and relationships of the elements, or planning items, which characterize the organization.[90]

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[87]William D. Sutterfield, "Managing Information: College Planning Could Use HELP," College and University Business, 50, 3 (March, 1971), p. 46.

[88]Midwest Research Institute, The Economics and Management Science Division, A Simulation Modeling System for Planning (Kansas City: Midwest Research Institute, 1970), p. 9.

[89]Ibid, p. 11.

[90]Ibid, p. 8.

The National Center for Higher Education Management Systems (NCHEMS) has developed a Resource Requirements Prediction Model (RRPM) which takes a different approach to simulation. It begins with the elaborate and comprehensive data base of the NCHEMS Data Element Dictionaries and Program Classification Structure:

> This historical data is contained in the institution's data base. The RRPM-1 system draws various sets of information from the data base, including enrollment forecasts, information of student preferences, staff and faculty loading factors, salary and various other cost schedules as inputs into the system.[91]

After the "what if" type of questions are programmed as planning assumptions and programmatic changes, " . . . the RRPM-1 system uses this data to compare resource predictions in terms of personnel, facilities, and dollars as an aid to the decision-making process."[92]

Between these two approaches, which are at opposite ends of a continuum related to the comprehensiveness of the data base, are other simulation programs. The Judy and Levine work at the University of Toronto[93] has produced a program, which includes a simulation model, called Compre-

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[91]Warren W. Gulko, The Resource Requirements Prediction Model (RRPM-1): An Overview (Boulder, Colorado: Western Interstate Commission for Higher Education, 1971), p. 6.

[92]Ibid.

[93]Richard W. Judy and Jack B. Levine, "Systems Analysis and Higher Education Planning," (Toronto: S.L. Kentner Systems Research Group and the Institute for Policy Analysis, n.d.).

hensive Analytical Methods for Planning in University Systems (CAMPUS).[94] Peat, Marwick, Mitchell and Company has developed a program entitled Computer Assisted Planning for Small Colleges (CAP:SC) which includes a simulation model called System for Evaluating Alternative Resource Commitments in Higher Education (SEARCH).[95]

Kessel and Mink noted:

> One procedure useful in the development of alternative strategies is called computer simulation. It allows rapid examination of alternatives. . . .
> A computer process known as iteration (repetition) . . . permits projection into the future, allowing anticipated results of alternative programs to be summarized iteratively on a year-by-year basis, so that costs, risks, effectiveness and other outcomes may be simulated years in advance. . . .[96]

Ream spoke to the same point in the use of the computer in industry, education, and government:

> . . . within the next decade it will be generally understood that the prime challenge will turn, not around the production of goods and services, but around the difficulties and opportunities involved in a world of extreme change and widening choices.[97]

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[94] Jack B. Levine, "The Implementation of Campus Simulation in Models for University Planning" Paper presented at the National Invitational Research Training Seminar, Sponsored by WICHE and ACE, Washington, D.C., 1969).

[95] Peat, Marwick, Mitchell & Co., Computer Assisted Planning for Small Colleges (New York: Peat, Marwick, Mitchell & Co., 1971).

[96] Kessel and Mink, op. cit., p. 27.

[97] Norman J. Ream, "Information Retrieval and E.D.P. in the Year 2000," Management 2000 (Hamilton, New York: The American Foundation for Management Research, 1968), p. 80.

His conclusion, therefore, was that, "The most significant role that the computer will play in the future will be as an aid in simulation techniques."[98]

Katz presented a summary of the use of simulation in a systems approach. After identifying values, feelings, perceptual biases, tendencies, uniformities, patterns of relationships, limits and constraints,

> . . . it is then necessary to predict the expected changes in the total pattern, and in the other components, with changes in any one or more of the component variables. Action programs are then thought of as a cyclical single-step-at-a time of (a) changing the characteristics of one or more variables; (b) assessing the outcome on the total system and on the other variables; (c) introducing a subsequent multivariable change; (d) testing reactions; (e) reassessing outcomes, and so on.[99]

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[98] Ibid, p. 77.

[99] Robert C. Katz, Management of the Total Enterprise (Englewood Cliffs, New Jersey: Prentice-Hall Inc.), p. 16.

SYSTEMS AND PLANNING

Introduction

The efforts cited in the previous section are moving in the direction of a new concept and application of the systems approach to planning. It is the synthesis of a variety of concepts, techniques, and technologies that have recently been developed.

Differentiating what he calls "comprehensive" planning from "functional" and "project" planning, Branch suggested the extent of this synthesis by defining it as:

> . . . the ultimate in man's endeavor to perform a major achievement, shape his environment, or affect the future. It includes functional and project planning, but then transcends them in scope, magnitude, and complexity. It includes not only three-dimensional accomplishments in space but social mechanisms such as laws, regulations, policies, and forms of organization . . . . What we are concerned with in comprehensive planning is the spectrum of human awareness, knowledge, capacity to consider and act.[100]

Mannheim differentiated this planning attitude from an "action" orientation and called it the radius of foresight; " . . . the casual chain which can be more or less accurately forecast. . . . "[101]

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[100]Melville C. Branch, Planning: Aspects and Applications (New York: John Wiley and Sons, Inc., 1966), p. 11.

[101]Karl Mannheim, "From Trial and Error to Planning," The Planning of Change, Warren G. Dennis, Kenneth D. Benne and Robert Chin (eds.) (New York: Holt, Rinehart and Winston, 1961), p. 34.

The systems approach is well suited to, and perhaps even implicit in, planning when planning is defined as:

> . . . a systematic effort to establish policies and procedures designed to accomplish the aims of the educational enterprise. It is partly an evaluative process by which present educational aims and practices are placed under continuous scrutiny leading to decisions which attempt to satisfy new or unmet needs.[102]

It features an adequate concept (model) of the enterprise, policies and procedures consistent with goals, and functional feedback mechanisms for evaluation and adjustment.

Everyone plans, in the sense of deciding how to behave. Some of this planning is unconscious, some is the result of conditioning from past experience, and some is cognitive, rational decision-making. The day of institutional decision-making based on administrative feeling and impulse or even individual attempts at rational cognition of all relevant factors may be past -- or probably should be. The complexity of a university or college and the data available through the use of new techniques are beyond the comprehension and control of any one individual in all but the smallest of institutions. Some degree of technical assistance, an adequate model or grid by which the relevant factors may be structured and an established process for feedback is

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[102] Leon Ovsiew and William B. Castetter, Budgeting for Better Schools (Englewood Cliffs: Prentice-Hall, Inc., 1960), p. 105.

necessary. A systems approach encourages a more realistic perception of the network of interaction that gives dynamic meaning to all of these factors, regardless of institutional size.

This most sophisticated use of systems hints at extremely profitable applications. In its use appears to lie the potential for coordinating and testing much of the theory and evidence that has been developed, in a piecemeal fashion, in administrative thought for many years. It also serves as a comprehensive means of coordinating the various techniques reviewed earlier.

Definition and Description

For an explicit definition of planning, one would be hard pressed to find a more composite expression of recent thought than the Kratz summary and compilation of common features found in various definitions:

1. an attempt to foresee a desirable future.
2. an attempt to insure that desirable future comes about.
3. a process.
4. rational.
5. advance decision-making.
6. goal-oriented.
7. a commitment of resources.
8. continuous.
9. based on the best knowledge available.
10. systematic.
11. involved in arranging alternatives and then deciding between or among them.

12. policymaking.
13. considerate of its environment.
14. to improve education.

> . . . educational planning is an attempt to foresee a desired and improved future for education, or some phase of it, through a continuous, rational, and systematic process of advanced decision-making and commitment of resources. Alternatives are arranged and selected in setting goals and policy in order that the best knowledge of the environment available to be used in assuring that the future that is desired comes about.[103]

The only addition that might be made is a more explicit reference to interpersonal factors and human relations techniques. Perhaps the definition is intended to imply this in such categories as, "a process," "best knowledge available," and "considerate of its environment." Many researchers, theorists, and practitioners, however, are giving increased attention to the area in an explicit sense.

The thrust of planning, controlled change, and rational, data based systematic decision-making cannot ignore, in the process, elements which the behavioral sciences have shown to be important in all areas of human endeavor.

In spite of the fact that the thrust of his book was machine oriented, Gagne emphasized the importance of giving

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[103] Robert N. Kratz, "A Study Comparing District Level, Long-Range Planning Practices in Selected Pennsylvania School Districts with the Literature of Planning," Unpublished Doctoral Dissertation, Temple University, 1971, p. 16.

attention to both human and technical aspects of a system.[104]

Bennis stressed the importance of the, " . . . human side of enterprise,"[105] and advocated free communication, the use of consensus instead of coercion or compromise, influence based on technical competence and knowledge, and acceptance of what he called "human bias."[106]

Halpin, writing as a social psychologist with a special interest in application to educational administration, advocated this same point with his "consideration" and "open climate" dimensions. The emphasis was on "friendship, mutual trust, respect and warmth,"[107] and, "high esprit"[108] in leadership and organizational climate.

Griffiths pointed out the necessity of being concerned with the " . . . behavior of human beings in a social organization."[109] Sachs mentioned, "democratic decision-making,"

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[104]Robert M. Gagne, Psychological Principles in Systems Development (New York: Rinehart and Winston, 1962), p. 4.

[105]Warren G. Bennis, Changing Organizations: Essays on the Development and Evolution of Human Organization (New York: McGraw-Hill Book Company, Inc., 1966), p. 7.

[106]Ibid, pp. 18, 19.

[107]Andrew W. Halpin, Theory and Research in Education (New York: The Macmillan Co., 1966), p. 86.

[108]Ibid, p. 174.

[109]Daniel E. Griffiths, Administrative Theory (New York: Appleton-Century-Crofts, 1959), p. 120.

which is concerned with the values, beliefs and feelings of the people,[110] and a sensitivity to ask people to participate in decisions in which they are interested.[111]

Midwest Research Institute noted, "The success of any planning and modeling effort is dependent upon the involvement of those persons who are in a position to incorporate the model alternatives into meaningful policies and decisions."[112]

Mink, former director of the Senior College Division of the National Laboratory for Higher Education in Durham, North Carolina, wrote:

> In today's post-industrial society, new patterns are needed, and the behavioral sciences are contributing significantly to the theory and planning which are pointing the way.[113]
>
> . . . the behavioral sciences may well hold the key to human survival in the social and technological chaos of the next 30 years.[114]
>
> The model for post-industrial organization is evolving from 'systems' theory . . . . In essence, this theory holds that human life is not mechanistic, not dependent on

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[110] Benjamin M. Sachs, Educational Administration: A Behavioral Approach (Boston: Houghton-Mifflin Co., 1966), p. 81.

[111] Ibid, p. 86.

[112] Midwest Research Institute, "HELP/PLANTRAN: The Midwest Research Institute Higher Education Long-Range Planning Service Program." A descriptive brochure, Midwest Research Institute, Economics and Management Science Division, Kansas City, Missouri, n.d.

[113] Oscar G. Mink, "The Psychology of Planning." Unpublished monograph, n.d., p. 1.

[114] Ibid, p. 2.

> simple cause-and-effect relationships, not exclusively rational. Instead it is organic, fluid, dependent upon interpersonal and intergroup relations, and intuitive, embracing not only man's intellect but his emotions.[115]

> The systems approach . . . demands that planning be an organization-wide process, with all members providing input and feedback, with the group as a whole recognizing the special competencies of its individual members, and with competence serving as the crucial element in decision-making.[116]

Goals and Goal Setting

A major advantage of the systems approach is that it encourages the development and clarification of goals. A focal point, and sequential steps leading to it can provide the development of efficient processes. Killian noted as a general management principle that "planning replaces directionless wanderings with firm direction and orientation toward a specific goal."[117]

Bolling, exhibiting an awareness of contemporary problems in higher education commented on the importance of goals:

> What I am concerned about is that the college, as an on-going institution, as a community of memory and of hope, shall have some clear sense of what it is and

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[115] Ibid, p. 7.

[116] Ibid, pp. 14-14.

[117] Ray A. Killian, Managing by Design for Maximum Executive Effectiveness (New York: American Management Association, 1968), p. 84.

> where it is going, what its essential values are, and what expectations it sets for its students. What I am concerned about is that the College, and specifically our type of private, church-related, liberal arts college, not become a flabby, gelatinous mass that its shape is going to be formed by default, by the unrelenting pressures from successive generations of students, and by capricious forces pushing in upon us beyond the campus gates.[118]

The systems approach encourages an identification of all subsystems and encourages the creation of an appropriate scope of responsibility for each. This tends to produce goal clarity and encourages institutional development in a way that satisfies all units or subsystems involved, and, if the systems approach has been used within the units, all individuals.

In an attempt to incorporate students into the decision-making process of an institutional system, Frankle talked about developing and using the sense of responsibility to achieve both institutional and individual goals. He suggested, "By surpassing and overcoming their self-defeating pursuit of happiness, plus their hippiness, the protesters will expand and enlarge their concept of freedom and supplement it by a proper concept of responsibility."[119]

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[118] Landrum R. Bolling, "Relating the Administration to the Individual Student," The Liberal Arts College's Responsibility for the Individual Student, Earl J. McGrath (ed.) (New York: Teachers College Press, 1966), p. 51.

[119] Victor E. Frankle, "The Task of Education in an Age of Meaninglessness," New Prospects for Small Liberal Arts Colleges, Sidney S. Letter (ed.) (New York: Teachers College Press, 1968), p. 60.

In a section entitled "Economic Rationality vs. Political Feasibility," Hartley also dealt with the human side of goal establishment and planning which is so important in understanding and implementing a systems approach. In an effort to discourage his readers from becoming technicians in ivory towers of statistics, formulae and models, he asserted that, "The means for achieving ultimate improvement of schools are as likely to have political roots as economic roots."[120] He cited Bertram M. Gross on this subject:

> Planning is an exercise in conflict management rather than the sober application of technical rationality. Any real life planning process may be characterized as a stream of successive compromises punctuated by frequent occasions of deadlock or avoidance and occasional victories, defeats and integrations.[121]

Excessive use of "sober application of technical rationality" results in complaints from people such as Kirksade about college and university administrators:

> In selecting men of low profile, universities are consciously turning away from men of vision, men of foresight, men of innovative and radical perspective - and it may be that these are the characteristics which are vital to fundamental change.[122]

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[120]Hartley, op. cit., p. 16.

[121]Ibid, p. 17.

[122]J. Kirksade, "Men of Low Profile," Change, II, 4, (July - August, 1970), p. 39.

Baughman also mentioned " . . . insufficient facilitation of integration,"[123] both horizontal and vertical, in management of industry, which has a definite parallel with the impressions of many observers of higher educational institutions. Interested units of the systems must be involved in goal setting and have access to all relevant data that can assist them in the fulfillment of their portion of the collective and continuing process.

Many students of educational administration feel that higher education today is suffering from administrative unwillingness to involve nonadministrators in goal-establishment and decision-making. Commenting on faculty participation, Mayhew said, "The basis of good government is ultimately the quality, character and policy that exists in and between the persons and groups within the government." [124] Wrenn felt that students have not been permitted and encouraged to participate in administration and concluded, " . . . for these sins of omission, colleges and universities are paying dearly in these troubled times of student confrontation and demonstrations."[12

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[123]James P. Baughman, The History of American Management (Englewood Cliffs: Prentice-Hall, Inc., 1969), p. 56.

[124]Lewis B. Mayhew, Innovation in Collegiate Instruction: Strategies for Change (Atlanta: Southern Regional Education Board, 1967), p. 33.

[125]Laurine E. Fitzgerald, W. F. Johnson, and Willa Norris, College Student Personnel: Readings and Bibliographies (New York: Houghton-Mifflin Co., 1970), p. v.

A major facet of the Administrative and Organizational Systems approach, of the National Laboratory for Higher Education, is its program for assisting institutions to identify goals:

> In the continuing clamor for change at universities and colleges across the nation, one of the most problems is overlooked. It is the common lack of clearly defined institutional goals.
>
> So a significant first step would be to ascertain how an institution's constituent groups view its goals, both as they are and as they should be, and to move differing groups toward consensus.[126]

Their procedure includes the use of the Delphi technique and the Institutional Goals Inventory (IGI) developed by the Educational Testing Service. They incorporate input from students, faculty, administration and board.

Peterson emphasized the importance of goals " . . . as a conceptual tool . . . enormously useful in deliberating, determining, and evaluating policy and practice in education."[127]

Peterson also noted, "The goal determination process must be regarded universally on campus as fair if the resulting goal structure is to have legitimacy . . . ."[128]

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[126] Norman P. Uhl, "Identifying College Goals the Delphi Way," Administration and Organization, Topical Papers and Reprints No. 2. Durham, North Carolina: National Laboratory for Higher Education, n.d., p. v.

[127] Richard E. Peterson, The Crisis of Purpose: Definition and Use of Institutional Goals (Washington, D.C.: ERIC Clearinghouse on Higher Education, 1970), p. 1.

[128] Ibid, p. 10.

He outlined specific uses of goals:

(1) As fundamentals of policy
(2) As general decison guides
(3) In planning
(4) In management information systems
(5) In institutional evaluation
(6) In implementing accountability.[129]

The writer of the introductory summary to the report to the Joint Economic Committee of Congress regarding higher education reinforced the importance of goals when he noted what he called a recurring theme, ". . . planners of higher education must continually appraise the success of the system in achieving the equity goals which society values most."[130] This is, of course, true not only with the national system, but with individual institutions.

Wise concluded, after his study of private liberal arts colleges, that a critical factor in their survival is the resolution of "divided allegiances" of faculty, students, administration, and board. He felt that new and unifying purposes must be developed if these colleges are to remain a part of the educational scene.[131]

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[129] Ibid, pp. 4, 5.

[130] The Economics and Financing of Higher Education in the United States. A Compendium of Papers Submitted to the Joint Economic Committee, Congress of the United States, Washington, D.C.: U.S. Government Printing Office, 1969), p. 5.

[131] Max W. Wise, The Politics of the Private College: An Inquiry Into the Process of Collegiate Government (New Haven: The Hazen Foundation, n.d.), p. 10.

Current Practice

The current state of affairs in college planning does not reflect the apparent potential of the concepts and tools available. Jenny noted, after his research:

> When one first tries to apply the rudiments of management science to college finance and college business and educational administration, one discovers soon that decisions in the past must have been made in a basically uninformed and intuitive environment. The number of colleges possessing historical data in appropriate form and sufficient scope for long range planning and logical decision-making remains appallingly small even today.[132]

Caffrey introduced a seminar session of the Small College Planning Process by saying, in part:

> The past emphasis in institutional planning has been upon physical plant planning or campus planning at the expense of omitting comprehensive consideration of the total decision-making environment of the institution. . . . Planning in the small college is a way of handling the increased number of variables which need to be considered in making decisions about financial and academic commitments.[133]

Kemeny stated the point emphatically:

> I would like to say categorically that the manner of designing accounting systems for colleges and universities leaves them almost totally useless for planning purposes. They are designed in order to

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[132] Hans H. Jenny and G. Richard Wynn, The Golden Years, (Wooster, Ohio: The College of Wooster, n.d.), pp. 116-117.

[133] John Caffrey, Introduction to General Session: The Small College Planning Process, National Seminar in Fiscal Management for Developing Colleges. St. Anselm's College, Manchester, New Hampshire, August 11, 1969.

> make sure that the books balance, to make sure that nobody is walking away with it, to meet a number of government requirements in terms of auditing federal grants, and generally they do extremely well at that. The people who designed these systems just didn't think in terms of planning.[134]

When and where attempts have been made to make the planning process a more rational activity other weaknesses have been noted.

Hare spoke of this issue when he warned:

> . . . many symbolic simulations have been constructed by eliminating all qualitative factors and concentrating only on systems factors that can be expressed in quantitative terms for the computer. This is also true in many mathematical studies in operations research and management science, but the urge to eliminate anything that cannot be reduced to a sequence of logical statements is even greater in digital simulation because of the computer's logical demands . . . . If the techniques to represent some object, event or condition are not available, the simulation should be dropped rather than compromising or simplifying assumptions, because the results obtained will be useless, or worse, misleading. Here another approach although less 'precise' would be more relevant and valid for the problem.[135]

On the same point Steven Knezevich in his Administrative Technology and the School Executive cautioned that "one

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[134] John G. Kemeny, "Use, Non-Use and Misuse of Computers by Colleges," Transcription of a tape recording of an address delivered at the Conference on Computers in the Undergraduate Curricula, Dartmouth College, June 23, 1971, p. 16.

[135] Hare, op. cit., pp. 368-9.

of the dangers in education now is that systems analysis will not be adapted sufficiently to the content, purposes and problems of educational institutions."[136]

The application of some of the new techniques to educational planning has been limited, but fruitful. Although frequently labeled "systems", it has tended to be little more than the use of a computer for clerical work, organized procedures for budget making, or at best the application of one of the techniques outlined in the previous section to a small segment of an institution or a special problem such as enrollment projections, space requirements, library use, or simple data management.

These new ways of handling and using data have usually been implemented when a crisis is faced. Frequently the only change from the traditional administrative approach is that more effective tools are now used at critical periods to solve immediate problems. Presumably this is progress, and it can be hoped that the usage of improved procedures will expand; however, it is a misnomer to describe such an approach as "systems." Churchman, emphasizing application to the total enterprise, pointed out that:

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[136]Steven Knezevich, Administrative Technology and the School Executive (Washington, D.C.: American Association of School Administrators, 1969), p. 41.

> Systems are made up of sets of components that work together for the overall objective of the whole. The system approach is simply a way of thinking about these total systems and their components.[137]

It should be noted that it is conceivable to have a systems approach or attitude without using the newer techniques. Many administrators have had the ability to maintain an overview of an organization and its goals while keeping a finger on the pulse of individual units and important details within the framework. The most desirable and even necessary (in more complex organizations) situation, of course, would be an approach of this type in combination with the latest technology.

Casasco, however, in his study of the most sophisticated systems applications being used for planning in higher education reported that " . . . only 29% of the samples exhibited some degree of comprehensiveness in their planning approach." [138] He concluded:

> The main problem identified in this study has not been the lack of real significance of the techniques analyzed, but rather their limited scope within the university's total planning needs . . . .

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[137] C. West Churchman, The Systems Approach (New York: Dell Publishing Co., 1969), p. 11.

[138] Juan A. Casasco, Planning Techniques for University Management (Washington, D.C.: American Council on Education, 1970), p. 75.

> This nonsystems approach indicates a lack of understanding and interest on the part of most university administrators to view institutional development within a total systems plan.[139]

The Total Planning Process

Regarding the entire process, Sutterfield noted that many approaches essentially follow the same process. He identified the theoretical elements involved as: (1) identification of institutional philosophy, (2) establishment of educational objectives, (3) design of programs to accomplish the objectives, and, (4) assignment of resources to the programs.[140]

Casasco proposed a model which he summarized as achieving:

> . . . a. A coherent set of objectives
> b. The development of an information system
> c. Synthesizing and strategizing the course of institutional development.[141]

He outlined eight "tasks" involved in the process and suggested where specific systems related techniques would be appropriate.

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[139] Ibid.

[140] William D. Sutterfield, "Managing Information: College Planning Could Use HELP," College and University Business (March, 1971).

[141] Casasco, op. cit., p. 7.

(1) development of goals and objectives - (MIS)

(2) formulation of alternative routes available to reach goals and objectives

(3) evaluation of alternatives (C/B, simulation, etc.)

(4) selection of alternative

(5) formulation of programming strategies (PERT, CPM, PPBS, MIS)

(6) devising action plan and setting performance standards

(7) evaluation and review (MIS)

(8) recycling of the planning process by reviewing problems, objectives and resources (MIS, PPBS)

These conceptual frameworks illustrate how important units of a system can be involved in the process of planning and decision-making. Casasco suggested specifically how some of the more sophisticated and recently developed techniques of systems and planning could be coordinated.

POTENTIAL DEVELOPMENTS

It is difficult to speculate on specific future development of the technology and individual approaches, or the collective whole, but some generalizations can be drawn.

Implementation

The greatest current problems are those of gaining acceptance and working out the application of the concepts and technology of the systems approach. In addressing himself to these attitudinal and practical problems, John Little advocated, " . . . the model builder should try to design his models to be given away. In other words, as much as possible, the models should become the property of the manager, not the technical people."[142] He suggested, "A model that is to be used by a manager should be simple, robust, easy to control, adaptive, as complete as possible, and easy to communicate with."[143]

Forrester, in an historical review stated, " . . . the field lacks interpretation into the specifics. . . . "[144] In his outline of the development of systems applications

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[142] John D. C. Little, "Models and Managers," Management Science, Vol. 16, No. 8, April, 1970, p. B-483.

[143] Ibid, p. B-466

[144] Jay Forrester, "Industrial Dynamics - After the First Decade," Emerging Concepts in Management, Max S. Wortman and Fred Luthans (eds.) (Toronto: The Macmillan Co., 1969), p. 373.

and projections for the future he identified one current and continuing era as a period which " . . . must provide the literature and educational materials necessary to make the theory and the art of dealing with systems more generally accessible."[145]

Maguire concluded, "There exist . . . few scientifically developed (i.e., theoretically based, empirically tested and revised) tools for use in the task of administering change."[146]

Most of the models that have been developed appear so complex to college administrators that they lack confidence in them. The old ways are comfortable and a great deal of personal and professional security must be risked in the application of new procedures, not to mention the development of a whole new attitude. Either management information systems and simulation models will have to be created with the technically unsophisticated administrator in mind, or new simplified techniques and programs for training and orienting administrators must be developed. Some attempts are being made at each, and these will be identified in Chapters III and IV.

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[145] Ibid.

[146] Louis M. Maguire, Observations and Analysis of the Literature on Change (Philadelphia: Research for Better Schools, Inc., 1970), p. 1.

Cybernation

Another systems related concept, likely to become a force in the future, is cybernetics. One potential application is the classic feedback of an automatic or semi-automatic cybernated (self-steering) mechanism in a system. This would operate primarily through the use of interrelated sophisticated management information systems and simulation techniques.

In a broader sense, however, some writers see value in the application of the concept to change the system itself, and not simply to its activity and/or procedures.

Deutsch, in his criticism of some comprehensive and complicated models commented:

> These organismic models stressed the interdependence of all parts of a system in their structures and functions, but they excluded all possibilities of major internal reorganization, and of any evolution beyond a final point of 'maturity,' prefigured from the outset of each type of organism by its peculiar 'organic law.'[147]

Wiener talked about the same thing:

> Two of the phenomena that we consider to be characteristic of living systems are the power to learn and the power to reproduce themselves. These properties, different as they appear, are intimately related to one another.[148]

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[147]Deutsch, op. cit., p. 33.

[148]Wiener, op. cit., p. 169.

By way of illustration, he commented:

> An animal that learns is one which is capable of being transformed by its past environment into a different being and is, therefore, adjustable to its environment within its individual lifetime.[149]

This application of the concept of cybernetics suggests that an institution should have the intrinsic ability to change completely. If an organization does not have this capacity for change then it tends to serve itself rather than its stated goals and, therefore, society.

John Diebold summarized the content of the last few paragraphs. He suggested that not only is computer conceptualization and technology the reflection of society, but it changes society.[150] The administrator who uses comprehensive and sophisticated simulation and planning must be mature enough to face the fact that much of that which he has taken for granted, and which has given him security in his world, may change substantially. The administrator must be ready to adjust his concepts and his habits. He must, in fact, expect to.

Drucker suggested that we are on the verge of another technological revolution. In light of the experience of the past this would indicate:

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[149] Ibid.

[150] John Diebold, Beyond Automation (New York: McGraw-Hill Book Company, Inc., 1964), p. 23.

> . . . an objective need for social and political innovations, and . . . a need also for identifying the areas in which new institutions are needed and old ones are becoming obsolete.[151]

Dr. Hans Jenny of Wooster College has been developing and directing a systems application at his institution which has been in operation now for three years.[152] He pointed out the practical side of the issue: "The cost per student continues to rise."[153] He felt that this will not be changed with the use of sophisticated systems techniques only, but can be affected as " . . . new relationships between the variables . . . "[154] are created within the institution. All that management information systems and simulation can do is to provide fuller and more accurate data on probable consequences of various alternatives. Changes in structure, decision-making procedures, goals, internal mechanisms, programs, services, etc., must be implemented in order for full benefits of the system approach, and the cybernetic concept, to be effective.

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[151]Peter F. Drucker, Technology, Management and Society (New York: Harper and Row, Publishers, 1970), p. 127.

[152]Hans H. Jenny and G. Richard Wynn, op. cit.

[153]Hans H. Jenny, Tape recording of presentation made at Task Force meeting of Small College Demonstration Project, National Center for Higher Education Management Systems, Boulder, Colorado, June 8, 1971.

[154]Ibid.

Communication

As yet, a completely unknown factor is the effect that such complete, accurate, and "pre-interpreted" information such as management information systems and simulation, will have on intrainstitutional relationships. One can hope that it will reduce misunderstanding and suspicion, produce confidence in administrative leadership and faculty decision-making, and encourage a unified effort in the attainment of clear, commonly accepted goals and objectives.

There is a general agreement that the faculty must be involved in decision-making and planning. Corson, however, pointed out that a major weakness in faculty participation has been a lack of adequate and available data for their use.[155]

Thayer defined communication as ". . . the dynamic process underlying the existence, growth, change, the behavior of all living systems . . . ."[156] In essence, he suggested that communication is the system, organization, or institution. If this is so, or if it is only partially true, we can expect substantial change in the internal

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[155]John J. Corson, Governance of Colleges and Universities. (New York: McGraw-Hill Book Company, Inc., 1960), p. 104.

[156]Lee O. Thayer, Communication and Communication Systems. (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. 17.

dynamics of educational institutions. As confidence is developed in comprehensive management information systems and simulation, not only a new basis for decision-making and planning will be formed, but a whole new basis for communication, i.e., relationships. It might be expected that the entire atmosphere for communication can be changed.

Communication is a two-way street, of course, and it may be that a new relationship and atmosphere will permit administrators to have more influence on instruction. Mayhew identified the breakdown of communication between faculty and administration as an important reason why it is difficult to change what goes on in the classroom.[157]

Perhaps it is carrying the logic too far, but there may be potential here also for bridging the rift between administration and students. Many of the elements in this relationship, or lack of it, are similar to those of the administration to faculty. This is particularly true as students are increasingly permitted, and taught, to participate in institutional decision-making and planning.

One aspect of this area has received some attention in systems related technology. The Organization Development component of the National Laboratory for Higher Education

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[157]Lewis B. Mayhew, Innovation in Collegiate Instruction; Strategies for Change (Atlanta: Southern Regional Education Board, 1967).

includes a process for assessment and development of institutional goals, objectives, plans, priorities, programs and resources. It features participation by, and communication among, all segments of the campus community.[158]

Centralization vs. Decentralization

Not unrelated to the concept of communication is the centralization/decentralization issue which is discussed at length in the industrial management literature and reveals some important parallels to educational institutions, i.e., the autonomy of faculty, students, departments and programs.

In a panel discussion on the subject, Churchman related the issue to hardware and software developments. He noted that the development of time sharing ". . . . makes decentralization capabilities greater."[159] He went on to add, however, that it would make no sense not to link the decentralized units sharing the computer and, "when we do, you'll have a much stronger centralization."[160]

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[158]Norman P. Uhl, Identifying Institutional Goals: Encouraging Convergence of Opinion Through the Delphi Technique (Durham, North Carolina: National Laboratory for Higher Education, 1971).

[159]C. West Churchman, "Information Retrieval and EDP in the Year 2000," Management 2000 (Hamilton, New York: American Foundation for Management Research, Inc., 1968), p. 83.

[160]Ibid.

Sollenberg commented after his research:

> Many of the people interviewed felt that developments in management control will reverse the trend toward decentralization and will introduce devices for consolidating control.[161]

Reim differentiated between " . . . the management of day-to-day operations and management in the sense of planning for the future."[162] He suggested that the day-to-day operation will be decentralized because, "No matter how much information a person has, the amount he can digest and use rationally is bound to be limited."[163] The long-range planning function will probably be centralized, however, in order to determine what the entire organization should be like in the future.[164]

Farmer summarized the issue and related it to higher education:

> Responsibility can be more effectively decentralized as it becomes possible to estimate performance and monitor the use of resources. Planning will receive more high-level attention as day-to-day decisions are delegated to appropriate levels. This may let higher education become more responsive to the needs and concerns of students,

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[161]Harold M. Sollenberg, Major Changes Caused by the Implementation of a Management Information System (New York: National Association of Accountants, 1968), p. 12.

[162]Norman P. Ream, "Information Retrieval and EDP in the Year 2000," Management 2000 (Hamilton, New York: American Foundation for Management Research, Inc., 1968), p. 83.

[163]Ibid, p. 84.

[164]Ibid, pp. 83-84.

> faculty and community, through both better planning and delegation of authority.[165]

Drucker commented on the issue and identified some related considerations:

> The more the individual in organization grows as a person, the more can the organization accomplish the insight underlying all our attention to manager development and advanced manager education today. But, conversely, the more the organization grows in seriousness and integrity, objectives and competence, the more scope is there for the individual to grow and develop as a person. This is a dynamic rather than a static relationship. It is determined by a future state and future purpose and focused on the growth and development of both.
>
> No organization comes close to having this vision today. We are confused, preach one thing and do another, guess, blunder, stultify. But even the most mismanaged of our new organization seeks for this concept and gropes for this vision. . . .[166]

State and National Systems

If the systems approach and its related techniques prove to be valuable in the administering, controlling, and planning of colleges and universities, it may also be applicable to state and federal level organizations. In

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[165] James Farmer, An Approach to Planning and Management Systems Information (Los Angeles: California State Colleges, Division of Analystic Studies, 1971), p. 6.

[166] Peter F. Drucker, Landmarks of Tomorrow (New York: Harper and Row, Publishers, 1959), p. 109.

fact it may be that the approach, and particularly some of the technology, will become increasingly valuable when applied to the larger and more complex operations.

A statement on the goals of WICHE Planning and Management Systems program included:

> These systems will be designed to benefit the entire range of higher education or organizations including public and private community colleges, four-year institutions and universities as well as local, state, regional and national agencies.[167]

The WICHE Guidelines for Program Development emphasized the need for "universality" in data collection not only for interinstitutional comparisons but also " . . . that they may be used for review purposes at echelons above the campus level."[168]

A WICHE program suited to state level use, which is already in operation, is the Student Flow Model. A WICHE description included the statement: "A state-level student flow model will aid in predicting the distribution of students to institutions within the state."[169] The Higher

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[167] Ben Lawrence, "The WICHE Planning and Management Systems Program: Its Nature, Scope, and Limitations." (Presented to the Federal Interagency Group on Higher Education Management Systems, January 12, 1971, p. A-1.

[168] Ibid, p. B-1.

[169] Ibid, p. 23.

Education Facilities Manual (HEFM) of the United States Office of Education is being revised to fit " . . . the facilities elements within the framework of the PCS"[170] (Program Classification Structure).

A project which will be undertaken at some undisclosed time in the future is the Statewide Planning Systems (SWPS):

> This project covers a wide scope of activities from development of tools which aid in establishing goals and objectives for higher education at the state level to development of procedures which will aid in investigating the sensitivity of institutional programming to programs at the state and national levels.
>
> Particular attention will be devoted to the integration of state and federal processes with those which occur within the institution.[171]

One WICHE project is solely for federal level use:

> Higher Education National Indicators Survey (HENIS) -- This project is intended to develop such things as lead lag indicators for income and expenditures for higher education (i.e. indicators which will function much as the consumer price index functions for the economy as a whole). The tools developed by such a project will be designed to aid decision-makers at the national level in testing the feasibility of pursuing certain programs (i.e., will it be economically feasible to undertake certain programs?).[172]

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[170] Ibid, p. 21.

[171] Ibid, p. 26.

[172] Ibid, p. 25.

The development of information systems at this level may have extensive implications for small, private colleges. As state and federal agencies move toward more specific attempts to economize in funds spent for public service (especially education) they will be concerned with reducing program duplication, output unit costs, cost/benefit analysis, etc. Distinctive institutional viewpoints as well as traditional programs and services of small private colleges may get lost in the shuffle. It may be that the best defense will be for small colleges to keep close to these developments and encourage model construction that will allow input of factors particularly relevant to smaller institutions. Otherwise real and implied controls, limitations, and exclusions could result in such areas as direct funding, loans and loan guarantees, student aid, and accreditation.

SUMMARY

Small colleges are facing an increasingly difficult era. Compounding the severe financial problems are inadequate planning and management processes and techniques, and insufficient data upon which to base decisions.

The systems approach, a new viewpoint and set of related techniques, may prove to be helpful. The approach is an attempt to apply general systems theory and related techniques to higher education administration and planning.

Three basic elements are essential to a syatems approach; (1) concern with relevant detail, (2) concern with relationships between elements and units of the system, and, (3) an overview of the system and suprasystem that includes a specification of goal and sequential steps toward that goal.

Systems related techniques for administration and planning include, PERT, CPM, PPBS, MIS, C/E, and simulation.

Sensitivity to psychological, social and political factors is essential in the use of the approach and these techniques.

Current use of these techniques is limited and full systems approaches are even more rare. Almost all use is now confined to universities and large colleges.

The systems approach appears to hold great potential for assisting colleges to make more efficient and effective resource allocation decisions, improve communication, increase participation in state and federal planning and programs, and generally make better use of more productive administrative theory and practice.

CHAPTER THREE

CATALOG OF SYSTEMS MODELS, PROGRAMS, AND SERVICES SUITABLE FOR SMALL COLLEGES

INTRODUCTION

In the second chapter a system was defined as a set of interrelated units and components with a common goal. It was also suggested that such a definition may be suitable to describe an institution of higher education.

A logical extension of this notion is that the best way to approach the study of a college, whether for descriptive or prescriptive purposes, is by assuming a systems model as the basic structure -- a "systems approach."

This approach provides the opportunity for the researcher or administrator to make use of a variety of resources including: the concepts and language of systems theory, insight from several disciplines on the functioning of systems, the use of new systems related tools and techniques, an approach which permits the synthesis of other theoretical and practical concepts, and a perspective which tends to precipitate new insight and understanding of the dynamics, structure and activity of colleges.

Various theorists, research groups, administrators, data processing technicians, and service agencies have

Figure 1

CATEGORIZED SYSTEMS MODELS, PROGRAMS, AND SERVICES, SUITABLE FOR USE IN SMALL COLLEGES

gement rmation ems	INFO/OASIS	Information Network for Operations/ Online Administrative Information System	Stanford University	Stanford, Calif.	Michael M. Roberts John W. Gwynn
ation	TOTAL	TOTAL-The Data Based Management System	Cincom Systems, Inc.	Cincinnati, Ohio	Michael J. Ehrensberger
	AIDS	Administrative Information Distribution System	Portland State University	Portland, Oregon	Arthur B. Kayser, Jr.
	MARK IV	MARK IV File Management System	Informatics, Inc.	Canoga Park, Calif.	S.R. Felderman
gement rmation ems	PMS/RRPM	Planning and Management Systems/ Resource Requirements Prediction Model	National Center for Higher Education Management Systems	Boulder, Colo.	Ben Lawrence
ning	CAMPUS	Comprehensive Analytical Methods for Planning in University Systems	Systems Research Group	Toronto, Canada	Richard W. Judy Jack B. Levine
	RAS	Resource Allocation Study	Princeton University	Princeton, N.J.	William G. Bowen
lation ems	CAP:SC	Computer Assisted Planning for Small Colleges	Peat, Marwich, Mitchell and Co.	New York, N.Y.	Charles A. Nelson
	HELP/ PLANTRAN	Higher Education Long-Range Planning/ Planning Translator	Midwest Research Institute	Kansas City, Mo.	Richard L. Salmon
	CEM	Cost Estimation Model	National Center for Higher Education Mgnt. Systems	Boulder, Colo.	Robert A. Huff
	TEMPLAN	Temple Planning System	Temple University	Philadelphia, Pa.	Fred W. Nicolai
	CSM/RIM	Cost Simulation Model/Reduced Input Model	University of Miami	Coral Gables, Fl.	Matt W. Steele
edural cesa) ls	PBA	Planning, Budgeting and Accounting	National Assn. of College and University Business Officers	Washington, D.C.	D.F. Finn
	C+UP	College and University Planning	American Foundation for Management Research	Hamilton, N.Y.	Robert G. Smith
re- ive lored) oach	AOS	Administrative and Organizational Systems	National Laboratory for Higher Education	Durham, N.C.	Everett H. Hopkins
	CAUSE	College and University Systems	College and University		

developed models and methods to make a systems approach operational. The diversity of their products represents, in part, their definition of "systems," the specific purpose or function they are trying to perform, their experience and professional orientation, the degree of comprehensiveness they are trying to achieve, the specific group or segment of the institution they are trying to serve, and the extent of the recources available to them for research and development.

The purpose of this chapter is to present a brief summary of each systems approach which has been identified as suitable for use in a small college.

It is not within the scope of this study to evaluate the effectiveness or efficiency of each approach. These models have been selected because they claim to be, appear to be, or have been demonstrated to be, suitable for use in small colleges.

The various approaches have been discovered through the literature, personal contacts, and referrals by professors, administrators, research and development personnel, and individuals in the Office of Education in Washington, D.C.

Many other systems have been examined in the process of the research but are not included here for a variety of reasons: (1) the design was exclusively suitable for universities; (2) the design was primarily for multicampus

institutions; (3) the design was for state-wide systems; (4) the design was primarily for universities and included no elements helpful to small colleges that were not available in other systems; (5) the design was suitable for use in only one unit of the total institutional system (students, alumni, financial, registration, etc.); or, (6) the approach was only an isolated technique related to a systems approach and available in more comprehensive models.

The categories into which the models, programs and services have been separated indicate an attempt to represent the types of approaches that are available. The sixteen models have been grouped into six categories (see Figure 1). It is hoped that this categorization will help to clarify general differences and major emphases, in addition to the specific differences covered in the individual descriptions.

The categories into which the systems have been separated are:

1. Management Information Systems for Operations

These approaches emphasize data collection, maintenance, and usage for daily transactions, execution, and control (cash balances, student grades, payroll records, alumni records, etc.).

2. Management Information Systems for Planning

The data in these approaches are organized and used to

satisfy a need for long-range planning and analysis of basic policies and goal achievement (cost of programs and activities, resource allocation and analytical data).

3. Simulation These approaches emphasize, or permit, computer simulation of the interrelationship of quantifiable factors according to various changes in factors, policies and environment, to create projections that can be used in the planning process.

4. Procedural (Process) Models These approaches represent an attempt to use PERT-like techniques to organize and structure the flow or process of decision-making and planning to include all interested parties at appropriate times, thereby assuring adequate input (hard data and psychological) and facilitating institutional development.

5. Comprehensive (Tailored) Approach The National Laboratory for Higher Education approach is the only program identified that attempted first to define the specific needs of the institution, and then use one or more of the several different models or tools (products) which it has developed.

6. Exchange Service The College and University Systems Exchange approach is a significant development and deserves listing. It claims to serve as a clearinghouse, a source of information, and a facilitator of systems applications.

A chart (Figure 2) has been prepared to summarize a comparison of the various functions performed by the models, programs, and services identified for use in small colleges. The chart is also intended to express the overlap of functions of the several approaches, even though they are categorized according to emphases.

FUNCTIONS PERFORMED BY SYSTEMS DESCRIBED IN THIS STUDY

Figure 2

Models, Programs and Services	Functions								
	Management Information System for Operations	Management Information System for Planning	Interinstitutional Comparisons	PPBS	C/B	Simulation	Goal Setting Techniques	PERT-like Processes	Information Service
INFO/OASIS	X								
TOTAL	X								
AIDS	X							X	
MARK IV	X								
PMS/NCHEMS		X	X	X	X	X			
CAMPUS		X	(X)	X	X	X		X	
RAS		X							
CAP:SC						X			
HELP/PLANTRAN						X			
CEM/NCHEMS						X			
TEMPLAN						X			
CSM/RIM						X			
PBA/NACUBO		X		X				X	
C+JP		X						X	
OAS/NLHE	X	X		X			X	X	
CAUSE									X

Information Network for Operations (INFO)

The INFO project which has been underway for several years at Stanford University has produced the design and partial implementation of a system entitled On-Line Administrative Information System (OASIS).

Sponsoring Agency and Funding The Director of INFO is Michael F. Roberts, and the Manager of the Advanced System Development Group is John W. Gwynn. Stanford University has sponsored the project and the Ford Foundation has been the primary source of funds. The address is: Project INFO, Encina Hall, Room 30, Stanford University, Stanford, California 94305.

Sources of Information A visit was made to the project office at Stanford (January 13, 1972) to interview Mr. Gwynn* and see the center of operations. Literature resources

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*When sources of information are referred to in this abbreviated form, the full name and title is listed in Appendix A along with the full name and location of the organization with which each is associated. Full bibliographic references to literature referred to can be found in the bibliography. The only exception to this is brief descriptive brochures supplied by vendors. This format is used in an attempt to make the catalog more readable to potential systems users and yet document the authenticity of the search.

included the OASIS Newsletter, the Project INFO: Progress Report (February, 1971), and the OASIS System Description. Data were also collected at the OASIS presentation at the System Forum in Denver (January 26-28, 1972).

Function OASIS is a management information system for data related to operation and execution. Dr. Gwynn reported that ultimately the model may incorporate a planning function, but at this point its purpose is to develop and use an integrated data base approach to daily operations.

It is intended to supply department and program directors, as well as top level administrators, with the data they need, compiled, analyzed and compared, in whatever form they desire. The system is built on the aggregate of files from various university offices and maintains access to every piece of information regardless of location.

Terminals are installed in various offices (student records, alumni records, personnel/payroll, and budget and finance) and can be operated by nontechnical personnel.

The system can produce reports that are "tailored" to the department or administrative requests. It also offers Generalized Services by means of: (1) "Query" (unanticipated questions regarding information on file) and, (2) Terminal Report Generation (reports may be requested at a terminal, viewed on the cathode ray tube (T.V.) and printed if desired).

Implementation The system requires at least a medium sized computer and rather high cost remote terminal units. It has been suggested that small college application would probably be feasible financially through the use of a regional consortium.

General Comments A special emphasis of the system is its rather elaborate and complex security provision which prevents unsanctioned and unintentional data base changes and prohibits access to confidential information by unauthorized personnel. Blocks at various levels and division can be removed only by using appropriate codes.

Dr. Gwynn claims that the system has been developed with the intention of also being used outside of Stanford and "localisms" have been avoided.

The newsletter and director emphasized that the Ford Foundation is interested in expanding the use of OASIS to other institutions. Some funds have been designated by Ford to assist in OASIS installation in other institutions, by providing information and some limited consultant service. The program is in the public domain and available to interested institutions on request.

Cost The specific cost of a small college installation is not available due to lack of experience, but some factors can be noted:

1. The type of terminal used can be rented for approximately $700 per month for each outlet desired;

2. Several additional people (including one or two technical people — programming and systems analysis) would be a minimal requirement for operation;

3. Ownership of, rental of, or access to a medium sized computer is necessary.

TOTAL

TOTAL is a proprietary computer software program which a college can use to compile, store, and retrieve information related to the operation of the institution.

Sponsoring Agency The program has been developed by, and can be purchased from, CINCOM Systems, 2181 Victory Parkway, Cincinnati, Ohio, 45206.

Sources of Information In addition to personal correspondence (February 17, 1972) and a telephone conversation (April, 1972) with CINCOM's Mr. Ehrensberger, college and university sales representative, several descriptive brochures were helpful. A technical article in DATAPRO (December, 1971) also provided information. Written and verbal presentations at the Systems Forum in Denver (January, 24-26, 1972) by Mr. Plourde regarding the use of TOTAL at Amherst College

were the primary sources of data related to implementation and cost.

Functions TOTAL is an integrated, data base management information system that is concerned primarily with daily operations, execution and control data. The data could be designed to be NCHEMS compatible (See PMS/RRPM) which would permit use of the NCHEMS planning program on the same data base.

The data base can integrate information from such diverse areas as students, alumni, gifts, accounting, personnel, and physical plant. A feature of the computer program is that every element in the data base can be related to any, or all other elements regardless of the source of original input. Administrators may, therefore, draw conclusions regarding interrelationships.

Department files can also be maintained and security preserved for traditional file usage. TOTAL permits the data to be network structured, however, rather than hierarchical. Data can be changed, structure altered, and new information linkages created as they appear to be helpful for analytical purposes.

The program interfaces with several computer languages and is vendor independent; i.e., can be operated on equipment produced by several different manufacturers.

Implementation CINCOM reports that eight or nine educational institutions (including Amherst, DePauw, and Bowling Green Colleges) are currently using the program in addition to almost 200 industrial and commercial users.

Start-up time will vary, depending on the organization and accessibility of data and the extent to which information is already computerized. Anywhere from a few days to nine months may be necessary to implement the system. Until CINCOM develops a report capability, additional time will also be needed to write a program for this purpose.

Cost The purchase price for the basic computer program is $22,500 to purchase, or $750 to rent monthly. Several technical people would probably be needed to operate the system, including analysts and programmers.

General Comments The TOTAL program, at this time, does not yet include an on-line capability (immediate, two-way interaction between computer and user). The developers suggest that it will be available soon. Reporting capabilities also are not yet built into the model, but must be developed independently; however, CINCOM claims to be working on this.

Administrative Information Distribution System (AIDS)

This management information system was developed and implemented at Portland State University, Portland, Oregon,

with assistance from the management consultant firm of Cresap, McCormick, and Paget. Arthur B. Kayser, Jr. was the Director of Systems Development at the time and is now with the University of Oregon, also at Portland.

Sources of Information The system was described and recommended to the author by Mr. Morrison of St. Anselm's College. The paper which Mr. Kayser presented at a seminar at St. Anselm's (August 5, 1969) was made available by Mr. Morrison and was the prime resource. Mr. Allison of Portland State University Systems Services was also helpful in a telephone conversation (March 22, 1972) in describing its use.

Purpose It was the intent of the approach to develop a system that would make use of three particular management principles:

1. Management by Exception - the purpose of AIDS is to establish good routine planning and operating procedures, which are only periodically reviewed, thereby releasing administrative time for extraordinary matters and long-range planning.

2. Management by Objective - the identification of objectives and periodic review of progress toward them.

3. Management by Perception - access by all levels of management to all relevant current and historical data.

The system was designed to be simple, manual, modular, and evolutionary.

Function AIDS is a management information system that is intended to provide data for planning, decision-making and control. Mr. Kayser pointed out that the data base is composed of information related to "critical information elements." It includes relevant data on students, finances, faculty, personnel, and facilities.

The Data Base Information System maintains and generates quantifiable information and generates reports.

The approach also includes a Management Communication System to facilitate direct and indirect communication of both quantifiable and nonquantifiable information to all management personnel.

The specified procedures encourage regular evaluation of the system by supplying each administrator with a form for evaluating effectiveness and recommending alterations.

The sequential steps to be followed in the development and implementation of AIDS are also outlined in Mr. Kayser's paper.

Implementation AIDS is a manual operation. It does not require a computerized data base, nor does it depend on electronic technology. Its developers claim that it can be quickly implemented and easily maintained and modified.

The system is modular. New segments can be developed and added later, or areas can be isolated for modification.

Mr. Kayser reports that manuals have been developed for each administrator who specifies his reporting responsibility and procedures.

It is also claimed that the system can be maintained and operated by clerical personnel. The suggestion is made that a secretary or clerk in each unit be assigned the responsibility for reporting and receiving information.

General Comments AIDS, in essence, as its name suggests, merely facilitates the distribution of useful information. Its value is that administrators are stimulated to determine what their specific information requirements are and to use the data in decision-making, planning and control. Administrators are, hopefully, encouraged to develop new management skills through the amount and quality of information available.

Cost No specific information has been reported but the developers claim that it can be quickly implemented, does not rely on expensive equipment or highly paid technical specialists and, therefore, can be implemented with a minimum expenditure of time, money, space, and personnel.

MARK IV File Management System

MARK IV is a general purpose software product (computer program or system), suitable for use in colleges and universities.

Sponsor It has been developed by, and is marketed and supported as a proprietary product of Informatics/Software Products Company, 21050 Vanowen Street, Canoga Park, California 91303. They also have sales offices in Los Angeles, Chicago, New York, Washington, D.C., and Switzerland.

Sources of Information Correspondence with the national sales manager of Informatics, Inc., Mr. Felderman (February 24, 1972), provided the basic data. Several descriptive brochures and a User's Digest were valuable resources for descriptions of the functions of the system and the organizations using it. The presentation by Mr. Marshall (University of Waterloo, Ontario) at the Systems Forum in Denver (January 26-28, 1972) was helpful in determining factors related to cost and implementation.

Functions Mr. Felderman describes the MARK IV system as facilitating file creation, file definition, file maintenance, file reading, scanning, and selection of data item extraction. The brochures claim that it computes and summarizes data, arranges and sorts outputs, formats reports

according to various specifications, and prints reports in many forms (standard computer paper, 3X5 cards, labels, etc., and on preprinted forms such as paychecks, invoices, journals, etc.).

The developers claim that education applications include student record files, central stores (inventory), alumni records, faculty file, payroll, accounts payable, project management, registration, class scheduling, and library.

It permits many of the usual processing tasks to be performed automatically. Common functions can be precoded and stored on the MARK IV library for recall when required.

Informatics claims that it is particularly well suited for ad hoc requests for data. Reports can be created directly from specifications, thus eliminating special programming.

The system is considered by its developers to be in evolution, and it was reported by Mr. Marshall that new features are planned. On-line capability, for immediate interaction between the user and the machine is supposed to be scheduled for availability by July, 1972. A feature for reducing computer time is also planned for release at that time.

Implementation The system is designed to operate on IBM System/360, or 370 and Univac Series 70 computers, under

either the standard Disk Operating System (DOS), Operating System (OS), or Tape-Disk Operating System (TDOS). Informatics support of MARK IV includes installation, training of personnel, technical consultation, and continuing maintenance.

Mr. Marshall reports substantial savings at Waterloo, in time and money, by using MARK IV in place of program writing for each new activity.

The developers claim that the system is simple enough to permit nontechnical personnel (such as administrators and secretaries) to learn about, and use, most of MARK IV's capabilities within a few hours. A few days of instruction permits experienced data processing personnel to utilize the system fully.

Reference, Operations, and Special Features manuals are available. A Monthly newsletter is also published to assist owners of MARK IV. A group of users ("The IV League") also meets twice yearly to compare experiences and share new uses. These meetings are open to nonuser observers on request.

General Comments The vendors report that there are currently 450 installations of MARK IV throughout the world of which about 20 are in larger colleges and universities, but apparently no small colleges are now using the system.

It should be noted that MARK IV is not a data based management information system such as AIDS or INFO/OASIS.

It is not a structure for data collection and maintenance, but a computer program for using, maintaining, and developing current data files. It appears to be best suited to institutions which already have a substantial data processing operation and desire improved access to, and analysis of, the information they have.

Cost Mr. Marshall reported that the price of the basic system is currently about $12,000 for educational institutions. Additional charges are made for on-site training ($1,250) and special operating features of the system.

As noted above, the system is best suited to an institution with an EDP department. This implies several technical and nontechnical people. MARK IV also requires a rather large computer, at least 32K. The cost factors inherent in these considerations must be taken into account.

National Center for Higher Education Management Systems (NCHEMS)

NCHEMS was formerly the Planning and Management Systems (PMS) Program of the Western Interstate Commission for Higher Education. The director is Dr. Ben Lawrence, Office Drawer P, Boulder, Colorado 80302. The center is concerned not only with institutional systems, but also with state and federal educational systems.

Sources of Information The very elaborate, detailed, and voluminous technical reports of NCHEMS were an important source of information. These include the Data Element Dictionaries, Program Classification Structure, The Resource Requirements Prediction Model I, Compatible Management Information Systems, and the Higher Education Facilities Planning and Management Manuals. Publications such as Why Planning, Programming, Budgeting Systems for Higher Education were also helpful as well as papers by NCHEMS staff, such as Dr. Lawrence's presentation to the Federal Interagency Group on Higher Education Management Systems (January 12, 1971).

In addition, the researcher participated in the first Task Force meeting of the Small College Demonstration Project (SCDP), in Boulder (June 8, 1971), and had several personal and telephone conversations with Dr. Minter, the Senior Staff Associate, that were extremely valuable in understanding the system and its use.

Funding The Office of Education of the Federal Department of Health, Education and Welfare has been the primary source of finances for research and development.

Functions The basis of the NCHEMS program is a comprehensive taxonomy of all data elements (Data Element

Dictionaries) related to cost analysis and planning in colleges and universities. These basic and detailed elements are organized by category (students, facilities, faculty, etc.) and by level (program, subprogram, program sector, etc.), by means of the Program Classification Structure (PCS).

An obvious result of this approach is the opportunity it provides for interinstitutional comparison of identical categories and elements. Cost comparisons can be made by program, course, major, degrees granted, etc. An approach of this sort is of obvious interest to state and federal agencies. The Higher Education General Information Survey (HEGIS), the Higher Education National Indicators Survey (HENIS), and the Statewide Planning and Management Systems (SWPMS) projects of NCHEMS reflect this interest. Important implications of these projects to small colleges were discussed in Chapter II.

Dr. Minter reports that the Small College Demonstration Project (SCDP) is still seeking funding. It will be an attempt to field test in small colleges, and adapt where necessary the NCHEMS approach, model, and technology that is now being used in larger institutions.

The specific products which are expected to be suitable to some extent at least, include:

1. Data Element Dictionaries (DED)

    a. Student Related Elements

    b. Staff Related Elements

    c. Facilities Related Elements

    d. Course Related Elements

    e. Finance Related Elements

2. Program Classification Structure (PCS) (probably will be truncated to suit the less complex small college environment)

3. Resource Requirements Prediction Model (RRPM)

4. Student Flow Model (SFM) (may have to be revised)

5. Faculty Activity Analysis (FAA) (may not be suitable)

6. Cost Finding Principles (CFP) (may not be fully suitable but will aid in identifying components)

7. Personnel Classification Manual (PCM)

8. Space Analysis Manual (SAM) (suitable, but perhaps not as valuable for small colleges).

The functions performed by the total system include:

1. Interinstitution comparisons through use of DED taxonomy and PCS;

2. Simulation through RRPM - evaluating current operations and ten year projections and testing the impli-

cation of short-range budget and policy decisions and changes in environment;

3. Predicting student enrollment - by department and major as well as totals (SFM);

4. Analysis of faculty activity with regard to various programs - specific allocation data (FAA);

5. Procedures for allocating all costs to specific programs (CFP);

6. Classification and analysis of space within the institution (SAM);

7. Compatability with future NCHEMS products such as the Input-Output Indicators (I-O) which will relate output measures to programs, activities, and cost.

Implementation Mr. Huff, Director of Training and Implementation, claims that the program requires access to a computer. This may be accomplished through a remote terminal, however. It was the consensus of the SCDP Task Force that the time necessary to collect the detailed data required and/or translate it into the NCHEMS taxonomy can be very extended and, therefore, the procedure becomes quite expensive.

General Comments A special emphasis of the NCHEMS approach is an excellent training program. Courses are suited

to personnel from various levels.

The SCDP Task Force emphasized that no school can consider the NCHEMS system unless it is prepared to meet the following minimum criteria:

1. A compatible data base and program structure;

2. A functioning information data base in at least accounting, payroll, student enrollment, and facilities;

3. Computer access.

Cost The actual cost of implementation and initial year of operation will, of course, vary with each institution depending on the state of the data base, new personnel needed to translate the data and supervise the program, etc. Estimates made by college representatives and NCHEMS staff ranged from approximately $20,000 to $40,000 for participation in the SCDP. It should be noted, however, that these institutions were selected because they already had technical personnel on campus, the necessary hardware (or, in one case, access to it), and a relatively sophisticated data system in operation in several areas. It may cost more than twice that which is estimated if these conditions must also be developed.

It should also be noted that their figure includes no charge for consultant's fees and training programs run by NCHEMS personnel, because the SCDP is actually a field test and a demonstration of the center.

Comprehensive Analytical Methods for Planning in University Systems (CAMPUS)

The CAMPUS model has gone through several stages of modification since its development in 1965. Of special interest to small colleges is the implementation of the CAMPUS/CONNECT system at Wheaton College in Norton, Massachusetts, and the Thomas More College installation for institutions having a computer.

Sources of Information Dr. Whithead, of the Political Science Department of Temple University, provided the first substantial data on the CAMPUS system. Correspondence with Drs. Judy and Levine (January 27, 1972 and February 16, 1972, respectively) at Toronto provided further information. Dr. Levine supplied several monographs and reports related to the use of the model, the descriptions of several installations, and a bibliography of SRG documents. Data related to implementation were also received from Dr. Caffrey of the SRG Washington office (November 2, 1971) through Dr. Voskuyl of the Council for the Advancement of Small Colleges.

The presentation at the Denver Systems Forum (January 26-28, 1972) on the CAMPUS installation at Wheaton College (Massachusetts) by Dean Kenworthy furnished firsthand data related to the use of the system in a small college. Mr. Carnell and Mr. Lombus of Thomas More College both shared

very helpful information over the telephone (April 21, 1972) on the CAMPUS implementation at their institution.

Personal conversation with Dr. Levine at the Denver Systems Forum also provided insight into the system and its use.

Sponsoring Agency and Principal Researchers The original model and application were developed by the Systems Research Group (SRG) in Toronto and the Institute for Quantitative Analysis of Social and Economic Policy at the University of Toronto. Their efforts represented one of the earliest attempts to design a computer based system for planning in institutions of higher education. Richard W. Judy and Jack B. Levine have been the principal developers. The CAMPUS program is currently being operated by the Systems Research Group, 252 Bloor Street West, Toronto 5, Ontario, Canada, which Jack Levine is now associated with.

Funding Seven different public agencies and private foundations have participated in the development process. In addition, the ESSO Education Foundation provided funds to SRG and Wheaton College (Massachusetts) to work together on the adaptation of the model to a small, private college.

Functions CAMPUS is an integrated, data based, planning system. The data are organized according to the NCHEMS Program Classification Structure which makes the system quite complex, and, of course, NCHEMS compatible.

The input includes data on programs, students, staff, space, equipment and finances.

Dean Kenworthy reported that one of the reasons CAMPUS was selected for use at Wheaton was that the approach includes procedures to be followed by administrators and faculty in order that input such as "approved decisions" and "approved future plans" can be incorporated into the model. One aspect of these procedures is the development and implementation of a program budget to assist in assessment of output and analysis of specific resources expended for each of the various activities and programs.

A computer simulation function is also incorporated into the system. It can be used to generate multiyear, annual, or semester (term) reports of past, current or future years. The reports can be either general or detailed. A feature of the CAMPUS simulation is that the mathematical relationship of the variables can be determined by the user.

Implementation The CAMPUS/CONNECT system at Wheaton is operated through a remote on-campus terminal to an IBM 360/67 computer at Brown University. Dean Kenworthy reported that it took about eighteen months to get the system operating at Wheaton. Shorter start-up periods may be expected in subsequent installations but the time will undoubtedly vary according to such things as the availability of data and/or the organization of existing data systems.

The program requires one full-time person to maintain the data base and operate the simulation model.

Mr. Carnell reported that the Thomas More installation took only about three months to get into operation. The difference in time was probably due to the availability of in-house technical personnel and the suitability of the college data base for application to the CAMPUS model. (See Chapter Four)

General Comments Reports on the Wheaton application have emphasized the stimulation of faculty and department head participation in decision-making. The procedural aspects of the system also specify that various types of decisions be routed through channels permitting participation of the people who should be involved.

Training and orientation programs, of short duration, are run on a small group basis to make participation as meaningful as possible.

Cost See Chapter IV.

Resource Allocation Study

This planning and operation system is not yet fully in operation, but it appears to be promising for small college use. A report is due in late spring or summer of 1972.

Sources of Information The existence of the system was first noted and general information describing it was derived from Dr. Casasco's work on Planning Techniques for University Management. An inquiry to Dr. William G. Bowen (a designer of the system and now Provost of Princeton) was referred to Dr. Davis, Assistant to the Provost for Resource Planning who was of great assistance over the telephone (February 8, 1972) and during a personal conversation in his office (March 15, 1972). The "Report of the Priorities Committee to the President" provided insight into the operation of the system.

Sponsor The system is being developed by the Administrative Data Processing Services Group at Princeton University, along with the Budget Director, and under the general direction of Provost William G. Bowen. The Ford Foundation has also participated in the project.

Functions The model is an information system suitable for general recordkeeping as well as for comparing consequences of alternative policy decisions.

Dr. Davis reported that the traditional budget process of listing current budget allocations next to budget requests is automated for rapid analysis and comparison. Scheduling of space and time is also considered, and

evaluation of teaching and teaching methods is included in the input according to the design outlined by Casasco.

Alternatives are considered and priorities determined by a Priorities Committee made up of faculty, students, administration, and nonfaculty staff. Through this process budget decisions are centralized on the basis of program priorities. Both long-range and annual budgets are planned.

General Comments Dr. Davis indicated that the program budget aspect of the system, and some other facets are still not fully developed.

The processes of budget development and priority establishment appear to contain elements particularly applicable to small colleges such as broad staff participation in resource allocations decisions, computer use dependent on facilities available, and modular implementation.

Implementation The program would probably require one full-time person as process coordinator, data collector and facilitator.

Computer use could vary with the complexity of the institution and the sophistication of its data base. It is conceivable that the model could be implemented without computer access.

A program of this type requires strong support by the chief administrator and other personnel traditionally responsible for budget development and control.

SIMULATION SYSTEMS

Computer Assisted Planning for Small Colleges (CAP:SC)

The model is entitled SEARCH, System for Evaluating Alternative Resource Commitments in Higher Education, but the project title and acronym CAP:SC are often used to identify this system approach to planning.

Sources of Information The initial contact with Peat, Marwick and Mitchell & Co. (PMM) was with Mr. Locacio (October 15, 1972) in the PMM office in New York. After study of the manual and related reports and monographs, another session was held in New York with Drs. Struve and Nelson of PMM (March 23, 1972). Dr. Voskuyl and Mr. Witter of the Council for the Advancement of Small Colleges also participated in this conference to discuss expanded small college use of the system.

The description of the use of CAP:SC at Franklin College by the Vice President for Academic Affairs, Dr. Richard M. Park at the Denver Systems Forum (January 26-28, 1972) provided data related to implementation. Mr. Dozier of Macalester College was also helpful (telephone conversation, March 29, 1972) in providing specific information on the application of CAP:SC at his college.

Developers and Sponsors George F. Keane and James N. Daniel, Jr., then of Peat, Marwick, Mitchell and Co., 345 Park Avenue, New York, New York, originally developed the model for an eight college consortium. Approximately one half of the development cost was provided by the Educational Facilities Laboratory, the ESSO Education Foundation, the Kettering Foundation and the Standard Oil of Indiana Foundation. The eight colleges shared the remaining cost.

Function The model as described in the manual, assumes that a college is an interactive system. It has as a base a mathematical simulation model that permits the use of the computer in exploring the results or implications of alternative policy decisions or changes in the environment. The statistics on students, programs, faculty, facilities, and finances for the current (or any) year are used as a basis from which to project statistics by yearly intervals for up to ten years. One or more of the variables, policies, and stated factors may be held constant, or changed, in order to simulate the effect on the projections created.

Drs. Struve and Nelson claim the model is flexible enough to permit use by schools of various sizes and characteristics. The amount of detail fed into the model can be varied according to the needs of the institution.

The manual specifies that projection reports can be designed to suit the interests of the people participating

in the planning process and can, of course, include projections for enrollment, programs, facilities, personnel, finances, etc.

Implementation The developers pointed out that the model has been designed primarily for use on large computers on a time sharing basis. It is intended to be used with rented, on-campus remote terminals. The purpose is to provide the capability of the large computer with the relatively low rental fee and convenience of a remote terminal. The program also can be run in a batch processing mode at a computer center, and the report is then carried to the college.

General Comments The vendors emphasize that an important aspect of this system is that SEARCH can be used directly by an administrator or planner without computer personnel acting in an intermediary capacity.

Those participating in the March 23, 1972 meeting, referred to above, concluded that it is possible that colleges that have participated in the CASC/NACUBO planning programs may find implementation of the program to be simplified (See Chapter IV).

Small College Use This is one of the few systems actually designed for small colleges and that has a history of use in smaller institutions.

Relative Cost The actual cost of implementation will vary according to the detail desired in the simulation and, more importantly, the availability of this data. The actual computer program is in the public domain and only the cost of reproduction can be charged for manuals. Consultant fees are charged by PMM for installing the program.

Hardware costs are low: (1) fees for actual time connected to the computer and charges by the second while running a simulation; (2) a monthly rental fee for the remote terminal; and, (3) a storage fee for the data held in the computer.

A more detailed study regarding implementation and cost is reported in Chapter IV.

Higher Education Long-Range Planning/Planning Translator (HELP/PLANTRAN)

The first segment of the name (HELP) is intended to indicate the type of program or service provided by this approach. The second segment (PLANTRAN) is the title given to the computer program which "translates" the raw data into reports that are useful for planning.

Developer and Sponsor The HELP/PLANTRAN system development was sponsored by the Midwest Research Institute, 425 Volker Boulevard, Kansas City, Missouri 64110. The

Economics and Management Science Division of MRI produced this approach at the request of the Kansas City Regional Council of Higher Education (KCRCHE). Mr. Salmon reports that it is now in operation in most of the fourteen KCRCHE schools, which range in size and complexity from the University of Missouri at Kansas City with thousands of students to the Kansas City Art Institute with only a few hundred students.

Sources of Information A personal visit was made to the Midwest Research Institute (June 9, 1971) to discuss small college use of the system with Mr. Salmon and to view the system in actual operation. Several descriptive brochures and the manual provided helpful material. The Sutterfield article in College and University Business (March, 1971) and some other journal articles also contained useful information for this report. Correspondence with Mr. Salmon (November 11, 1971) provided additional data regarding current small college use of the system.

Function The HELP/PLANTRAN program includes the methodology and consultant service to work with the administrators of an institution to determine the important elements involved in planning for their institution and the mathematical relationships between these components. These data are then fed into the computer. The product or report

is a computer printout of the logical consequences (for each year of a ten year period) of the assumptions, factors, and stated variables fed into the program. The composition and magnitude of any, or all, of the input data can, of course, be changed and the consequences will be simulated by the computer.

The developers emphasize the fact that there is no actual model in the HELP/PLANTRAN approach (it being only a technique and service for developing an institutional model), thus permitting maximum flexibility.

Mr. Salmon claims that the assumptions and variables have ranged in number, in various applications, from forty to over two hundred, and have included such items as tuition charges, number of students, faculty-student ratio, endowment income, salaries, space utilization, etc.

General Comments A unique facet of HELP/PLANTRAN is that it is not a model, but only a technique and service for developing and implementing a simulation model. The advantage of this approach is maximum flexibility which makes it more appealing to institutions with distinctively different structures, programs, and elements important to their planning. The weakness of this approach is that the elements and equations of the model are only as good as the consultants and administrators make them and do not necessarily reflect the sophistication of models produced by research and development centers.

Mr. Salmon pointed out that the actual administrative participation in model development does tend to produce greater confidence in its functions and products. This dynamic is highly valued by some observers.

Implementation The vendors claim that procedures related to initial implementation are quite brief. Assuming some availability of data from the current year of operation, the program could be running simulations within a few days. The simulations could then be run by administrators, in their offices, on remote terminal(s) without the intervention of technical personnel. MRI provides consultants to assist in the development of the model. Training sessions are available to orient personnel to the service.

Relative Cost The cost of the computer program and enough consultant time to get the simulations running is $7,500. The only other cost would be for remote terminal rental and time rented on a large central computer facility.

Cost Estimation Model (CEM)

This simulation system was originally designed by the National Center for Higher Education Management Systems (NCHEMS) as a computerized training version of their Resource Requirements Prediction Model (RRPM). (See description of full NCHEMS program elsewhere in this study.)

Dr. Robert A. Huff is Director of the Training and Implementation Unit of NCHEMS. The address is Post Office Drawer P, Boulder, Colorado 80302.

Sources of Information This model was first noted at the Systems Forum in Denver (January 26-28, 1972) where Colby Springer and David Benson of San Fernando Valley State College discussed its use at their institution. Personal conversation with Mr. Markovich (January 27, 1972) regarding the implementation of CEM at Azuza Pacific College was also helpful. Dr. Minter of NCHEMS provided information in a telephone conversation (February 9, 1972) and Dr. Young provided additional information in a letter (February 9, 1972).

Functions The NCHEMS people claim it is possible to use the model to organize and present data related to the management and planning functions of a college. The model can then be used as a simulation tool for planning. It is suitable for developing unit costs for instruction, creating five-year budget projections, testing the result of possible changes in enrollment upon other areas, determining the use of department resources by nonmajors, and simulating the consequences of alternative academic policies. They point out that questions that can be investigated include, admissions, policies, enrollment, restrictions, teaching loads, class size, and faculty rank distributions.

Implementation Dr. Young wrote that the CEM has been used extensively in the NCHEMS training seminars throughout the country during 1971. Many administrators who have become familiar with it have actually implemented it on their campuses to give assistance in the process of planning.

NCHEMS personnel have participated in various implementations. Dr. Young also claims that a small college application can be expected to take approximately four man-days from the beginning of data collection to the completion of validated test runs. This assumes a moderate sized data base that is not necessarily completely computer oriented.

Cost The system requires computer access. Computer time cost would probably be only a few hundred dollars. The only other cost is for data collection and organization and consultation fees if they prove to be necessary.

TEMPLAN

This system has been developed to assist the Temple University administration in planning and budget preparation.

Developer and Sponsor Dr. Fred L. Nicolai, Assistant Vice President for Administration at Temple University, Philadelphia, Pennsylvania 19122, developed the model in conjunction with some of the data processing specialists on campus and with programming consultant help from outside the university.

Sources of Information Two separate personal conversations with Dr. Nicolai (September 27, 1971, and March 24, 1972) provided the information for this report. The structure and operation of the model were discussed and the results of several computer simulations were reviewed.

Function The system is a relatively simple model suitable for simulating the annual incremental effect of trends and hypothesized ("what if") conditions and policies.

Dr. Nicolai reported that information needed for administrative decision-making was kept in various forms and at several centers on campus. This situation had developed through the years as the several departments and services collected and used information related to their activity. Four categories of data were drawn from these and are incorporated into the model: (1) enrollment; (2) faculty; (3) income; (4) expenditures. These categories are subdivided according to traditional budget categories.

Dr. Nicolai pointed out that the system can function in two ways. (1) It can project, for a given number of years, changes in any or all of the four categories according to current or simulated conditions (e.g., increase enrollment at 5 percent per year). (2) A goal condition (e.g., a balanced budget by increasing tuition) for some specific year in the future can be projected backward in an incremental manner to indicate the effect it will have on each category for each intervening year.

The model can be expanded by adding categories and/or subcategories.

General Comments Dr. Nicolai indicated that a special emphasis in the development of the system was to make it an analytical tool that could be used by people outside of central administration. The deans of the various colleges of the university were a focal point. By attempting to create a balance between simplicity and comprehensiveness, it is expected to be more broadly accepted.

It also appears to be well suited to an institution that does not have a sophisticated management information system in operation. A data base adequate for implementation probably could be developed from traditional reports with a minimum of time and effort.

Implementation The model requires access to a large computer. This could be achieved by means of a remote terminal on campus connected to a computer center. A reader-printer facility probably would be most useful. It permits testing of alternatives and then requesting a print of selected alternatives or combination(s) of alternatives.

According to Dr. Nicolai, the use of a computer generated histogram is also being developed to create reports that can be more easily understood and interpreted.

The system has not been implemented on a small college campus as of February, 1972, but it appears to be suitable

for this type of use and Dr. Nicolai reports that some thought has been given to application in other institutions.

Cost Simulation Model/Reduced Input Model (CSM/RIM)

The complex cost simulation model being developed at the University of Miami has a distinctive feature which they entitled Reduced Input Academic Model (RIM). Further information is available from Matt W. Steele, Associate Director, Institutional Research, University of Miami.

Sources of Information The system was originally identified in Casasco's Planning Techniques for University Management. Correspondence from Dr. Steele (January 17, 1972) and a paper by him presented to the Florida Statewide Invitational Conference on Institutional Research (June 24, 1971) provided the data for this report.

Function The ultimate purpose of the model is to describe the interrelationships between variables that determine income and expenditures. The intention is to develop the model to include data from the following areas:

Academic

Administration

Nonacademic Income Producing Areas

Capital Expenditures

Research

Maintenance

Dr. Steele reports that the only section that is currently operational is the academic area.

The designers wanted a comprehensive model paralleling the RRPM of NCHEMS/WICHE and CAMPUS of the Systems Research Group. They claim to have incorporated in the model such factors as total enrollment, attrition, admissions, enrollment by course, course crossover (courses outside major field), course level, faculty members and expense, teaching loads, support staff, and nonacademic expense. From such a base it is possible to project entire institutional budgets under a large number of simulated conditions.

According to Dr. Steele the enormous task of collecting and organizing data element input stimulated the developers to seek a shorter method. They found they could use as a data base the actual statistics of registration taken from course cards that contained such information as the student's major, course, department, etc. From this they were able to develop a student enrollment mix, or induced course load matrix, similar to NCHEMS and CAMPUS. A computer program was developed which could simulate changes in the data by altering the number of students in various levels of each program. This makes it possible to quickly determine what

effect any alteration in the number of students majoring in various departments will have on the actual number of course enrollments in each and every course in the institution.

Dr. Steele claims that several additional features are being developed. They include subroutines to generate:

1. Tuition income figures for any simulated head count;

2. Amount (in square feet) and type of space needed for instruction;

3. Personnel needs in faculty, staff, and nonacademic areas.

Implementation Contrary to expectations, Dr. Steele reports that the computer time for simulation runs has not been excessive (five minutes on an IBM 370-155).

The model is now being used at the University of Miami by their Commission on Academic Goals and by administrators who are using it to project enrollment by course for a number of possible student mixes.

The developers assert that the model and methodology are suitable for institutions of varying sizes and complexity.

It appears that the reduced input aspect of the system might be a significant feature of simulation model implementation for a small college.

General Comments Dr. Steele noted that a limitation of the RIM approach is that all projections are based on the

assumption that there will be no substantial change in course requirements for students in the various majors. They plan to develop a method, however, for changing the input data to reflect these changes, as well as program and course drops and adds.

Cost This approach might prove to be quite inexpensive if an institution has its registration data in a format compatible to the RIM approach.

Dr. Steele reported that the average computer cost to run a simulation, after the program was installed, was fifteen to twenty dollars.

PROCEDURAL (PROCESS) MODELS

Planning Budgeting and Accounting (NACUBO System)

This procedural process of planning and budget development and control was developed by Peat, Marwick, Mitchell and Co. under the direction of Howard University and Southern University and funded by the Ford Foundation.

The system is part of a manual developed to fulfill procedural needs identified in a 1967 study of predominantly Negro institutions. The National Association of College and University Business Officers (NACUBO) sponsored the 1967 study, and it was funded by the ESSO Education Foundation.

Rights to the system have been given to NACUBO to expedite its implementation.

Sources of Information The PBA Manual was the primary source for data related to the system's description and operation. Additional information about the system was provided through consultation with Mr. D.F. Finn, Executive Vice President of NACUBO (September 10, 1971). Specific information regarding implementation and cost was derived from the presentation at the Systems Forum in Denver (January 26-28, 1972) by Mr. Marvin Wrolstad regarding their experience with the system at Lawrence University. Mr. Dozier also provided material during a telephone conversation (March 29,

1972), about the use of the program at Macalester College. Papers presented by Sherwin Howard, Assistant to the President and James D. Dana, Professor of Economics both of Lawrence University, supplemented the data on implementation (CASC/EPDA Institute, August 4, 1971).

Function The primary function of this approach is that of providing a procedure, or flow system. The process is entitled Program Planning Cycle. According to the manual it includes a review of goals and objectives, college policies, considerations of alternative academic and support programs, and an analysis of the total long-range (five year) program and fiscal plan of the college. The process is repeated annually.

The manual specifies that a Planning Team manages the planning process. This team consists of the president (as chairman), his planning assistant (as secretary), the academic dean, dean of students, business manager, director of development and public relations, and others selected by the president (perhaps faculty and students).

A second committee, the Analytical Studies Group, performs a critical analysis of the total college program and plans. It is recommended by the manual that this group includes the planning assistant, a business office representative, four academic representatives (one of whom should be chairman), three representatives from support service programs, and ex-officio professional advisors as needed.

The third critical functionary in the process is the planning assistant. He is to be a staff member reporting directly to the president and handling detail work, coordinating the process, and preparing and distributing data and reports essential to the process. The president and his office staff could perform the function if a full-time planning assistant is not possible.

Appropriate forms for data collection and distribution are suggested, and illustrated charts of the process are provided in the manual.

The developers claim that the process will provide the following benefits:

1. A rational basis for annual budget preparation;
2. A rational basis for physical plant planning;
3. Identification of faculty and staff needs;
4. Provide planning data for use in development and fundraising activity;
5. Coordination of support services with academic departments.

Implementation Because this system is only a process, it does not require any special equipment or technical personnel.

NACUBO reports that over six hundred administrators, representing more than three hundred sixty institutions, have

participated in a series of workshops related to this system. The workshops have been presented by NACUBO and The Council for the Advancement of Small Colleges (CASC). (See Chapter IV for further material on implementation.)

General Comments This approach reflects a more traditional attitude regarding budget construction, decision-making, and general administrative procedures than most of the other systems reviewed in this chapter.

It is possible that this approach would be a good transition experience for many institutions. Before adopting a more sophisticated approach, an experience with the NACUBO system might pave the way by: (1) orienting faculty to the decision-making process and the reality of budgets; (2) helping administrators to accept faculty and staff input into decision-making; and, (3) planning and clarifying goals and objectives. The collection of data might also facilitate the use of a more comprehensive system at some later time — especially if compatability were considered at an early stage in the NACUBO implementation.

Cost The direct costs involved are salary and support for the planning assistant (if one is used), perhaps some salary for people on the analytical studies committee (if it meets for prolonged periods during the summer and includes less than twelve month personnel), and the cost of workshop attendance for orientation and training.

A considerable investment of administrative and staff time is necessary, which would result in some indirect costs.

College and University Planning/American Foundation for Management Research (C+UP/AFMR)

AFMR supported and funded a project to design a process for College and University Planning. The focus was on private, medium sized, liberal arts institutions. The primary researcher was Robert G. Smith, Executive Assistant to the President, Colgate University. Inquiries can be addressed to AFMR Management Learning Center, Hamilton, New York.

Sources of Information The system was first identified by James W. Morrison of St. Anselm's College (October 4, 1971) in the description of the system and recommendations for its use. A report on the development of the system by Mr. Smith (January 20, 1969) was the primary source of information.

Function According to Mr. Smith, the purpose of the process is to systematize and formalize the planning process of an institution. The variables and factors are organized and related in a structured frame of reference for organized planning. The primary responsibility for planning is placed on the president and a small team selected by him.

The process is subdivided into three phases:

1. Define underlying philosophy and purpose and

identify resources, assumptions, and data needed for decision-making;

2. Gather and organize quantitative data on the institution and its environment;

3. Identify differences ("gaps") between the direction of trends and stated objectives, modify objectives, analyze alternatives, design specific programs, activities and goals, and establish priorities and time schedules.

The first and third phases are conducted at the AFMR Center and are concentrated within a period of one week each. Mr. Smith estimates that the time needed for the second unit will vary from two to six months, depending on the availability and organization of the information needed.

A specific schedule is also suggested in the outline of the process for followthrough, review and approval of plans by committees, faculty, and board, and development of detailed subsystem planning.

Implementation It is recommended by the developers that the Planning Team be composed of seven or eight people (minimum five and maximum 12) and include the president (as chairman), vice presidents and deans, and one or more faculty members (possibly elected by the faculty).

Mr. Smith emphasizes that the library on general planning literature and specific planning approaches of many

schools is available at the AFMR Center. Some of the material is also available on slides for immediate use in the one week sessions at the center.

The developers feel that a consultant who is a professional planner and resource person is considered to be a critical condition to the process. From a neutral vantage point he can be expected to coordinate the activities of the process, supply special knowledge and skills, handle administrative details, and maintain continuity.

Mr. Smith points out that the process is intended to develop a systematic attitude toward planning in each of the participants. This should influence subsystem planning in the various areas or units of the college for which they have specific responsibility.

General Comments According to Mr. Smith, the process emphasizes a "from the top down" attitude toward institutional planning. The president and administration are the key figures, and in fact almost completely control the development of the overall plan. Faculty, staff, and student input and participation in the decision-making could probably be incorporated.

In general, this rather simple approach appears to be suited to institutions with an unsophisticated data base and a conservative attitude toward administration and planning.

Reports of the application of the approach to two institutions have been made (Colgate and Franklin and Marshall).

AFMR expects to develop a professional staff of consultants to assist in implementation on a fee basis.

Cost No specific costs were available.

COMPREHENSIVE (TAILORED) APPROACH

Administrative and Organizational Systems/National Laboratory for Higher Education (AOS/NLHE)

The Senior College Division of NLHE has directed its efforts toward the development of concepts and techniques related to rational management and planning in higher education. According to the leadership of NLHE, two distinctions of their approach are: (1) an interest in the smaller institutions; and, (2) an individualized approach which attempts to assist an institution to determine its specific areas of need and implement appropriate techniques.

Inquiries may be addressed to the National Laboratory for Higher Education, Senior College Division, Mutual Plaza, Durham, North Carolina 27701.

Sources of Information A presentation by Oscar Mink and Philip Winstead to members of CASC (October 29, 1971) in Washington, D.C., identified for the first time an outline of the full Administrative and Organization Systems (AOS) program. The position papers, role descriptions, and topical papers by the NLHE staff and consultants, provided additional information. Product description manuals and descriptive brochures were also helpful. A personal visit was made to the NLHE offices in Durham (February 24, 1972). At that time the

entire professional staff was interviewed individually regarding each of their particular product areas, and in group discussions regarding the functions and operation of the Laboratory. Interviews with the President, Everett Hopkins, and Acting Senior College Division Director, Harry Blanton, also provided important data. The preliminary edition of the comprehensive NLHE Product Descriptions (January, 1972) and the 1971 Annual Report were also very helpful.

Sponsor NLHE is an independent, nonprofit corporation formerly known as the Regional Education Laboratory for the Carolinas and Virginia. It operates under the direction of its own Board of Directors.

Funding The research and development activities are funded primarily by the Office of Education, Department of Health, Education and Welfare, Washington, D.C.

Functions The Laboratory has produced (or is in the process of developing) a variety of products to assist an institution in management and planning.

The "knowledge" products are conceptual statements, descriptions, and position papers documented from the literature. They cover such things as planning, identifying goals, curriculum development, and a position description for a planning officer in higher educational institutions (the educational development officer).

Specific techniques suitable for use in small colleges include:

1. Management Planning Guide, a procedural kit which includes a manual with forms and procedures for compiling and using data for planning and management. It is being pilot tested under the direction of Dr. Black during the summer of 1972.

2. Institutional Goals Package, a set of questionnaires, forms, item cards, and procedures for reaching consensus on institutional goals. Dr. Gordon describes it as the basis of a one day workshop of representatives from various segments of the college community brought together to identify the most important goals of the college.

3. Deriving Measurable Objectives, a manual that will enable a planning group to convert broad goals into specific objectives. It will be field tested during 1972.

4. Educational Development Officer Training Program, an in-service program for EDO's. According to Dr. Bell it is now being pilot tested at several institutions.

5. NLHE Information System, a generalized information storage and retrieval system for small-scale computers. There are two manuals (Logic Manual and User's Guide) and a set of keypunched computer cards. They claim it permits the administrator to order reports directly from a computer without assistance from a computer programmer.

Dr. Alcorn reports that the system is now in use in about two hundred colleges and covers admissions registration, fundraising, library and student records. It is designed to be used on an 8k, single-disc, IBM 1130 computer.

Dr. Blanton reports that other products, still in development, which may prove to be useful in small colleges include: Comparative Evaluation of Data Management Systems, Statistical Interface System, Institutional Fact Book, and the Institutional Research Survey.

Implementation Most of the techniques are still in the pilot field test stages and are not generally available for implementation. Some schools are needed as test sites, however, and if an administrator feels his institution needs, and is ready to use, a particular product, contact should be made with the Laboratory for further discussion.

One exception is the NLHE Information System which is available for the cost of reproduction and mailing.

They claim that seminars, workshops, training programs, and individual consultants are, or will be, available to aid in implementation of all products of the Laboratory.

General Comments The primary purpose of NLHE is research and development. According to Dr. Hobson, Product Development Coordinator, each product passes through six stages.

1. Conceptualization literature review, documentation of need, and writing of specifications

2. Pretesting on Laboratory staff and outside experts

3. Development of the product itself

4. Pilot testing

5. Field testing

6. Dissemination

Several of the products are in the final stages of development and testing during 1971-72, and may prove to be extremely useful to small colleges in the near future.

Relative Cost Because NLHE products have been developed with federal funds, they are public property. The only charge to institutions who desire to use the products is for materials necessary to convey or communicate the products, and fees for any consultation or training that the institution elects to purchase. For instance, Dr. Alcorn reports that the two manuals and keypunched cards of the NLHE Information System (see above) cost $25.00.

According to Dr. Mink, institutions that serve as test sites are charged no fees for materials or consultation.

EXCHANGE SERVICE

College and University Systems Exchange (CAUSE)

CAUSE intends to serve as a clearinghouse for information on related systems design and use, a catalyst for new developments in the field and a center for training programs and implementation services. The Executive Director is Charles R. Thomas, and the address is 737 Twenty-Ninth Street, Boulder, Colorado 80303.

Sources of Information CAUSE was first identified through the referral of Dr. John Minter of NCHEMS in a letter from Dr. Roger J. Voskuyl of CASC (August 5, 1971). Further information on CAUSE, and advice on this research, was secured through personal correspondence with Mr. Thomas (January 4, 1972) and in a personal conversation with him (Denver, January 27, 1972). Additional data on CAUSE were taken from several descriptive brochures, an organizational outline, and lists and descriptions of current and proposed services of the organizations.

Function The organization was formed as a professional association in 1962. The National Headquarters was opened on September 1, 1971, and Mr. Thomas reports that activity has centered on organization, planning, membership solicitation, a monthly newsletter, liaison with other organizations,

and cosponsorship of the National Forum on New Planning and Management Practices in Higher Education held in January, 1972.

An outline of CAUSE divisions and projects shows that a great deal of the CAUSE activity will be carried out in projects within six divisions:

1. Application Systems Exchange
2. Information Systems Development
3. Installation Management
4. Hardware and Systems Software
5. Professional Development
6. Small Computer Users

Each project division has a manager, and a team, appointed from the membership.

According to Mr. Thomas, proposed activities of CAUSE include:

1. Directories of systems personnel, hardware, applications in operation, etc.;
2. A library of systems, programs and documentation;
3. Monographs of exemplary systems will be distributed to the membership;
4. Educational seminars;
5. Development and publication of documentation standards;
6. Conference participation;

7. Liaison and participation with other systems organizations.

Membership The brochure claims that all interested institutions who will agree to provide information and/or documentation of developed systems are eligible. The annual membership fee is based on student enrollment and ranges from $100 for an institution under 2,000; to $1,000 for institutions over 20,000.

One official voting representative will be appointed by each institution but all mailings will be sent to three other individuals without charge. A member institution may send as many of its staff members as it desires to CAUSE activities.

General Comments Even though CAUSE is not actually a system, as such, it is included in this list because it is a significant development in the field and its service (the proposal for this research calls for identification of "services" as well as models) appears to be potentially valuable for small colleges. The membership fee structure should be an encouragement to small school participation. If more small institutions become involved, a greater proportion of the programs and services could probably be focused on their specific needs. In personal correspondence (January 4, 1972), Mr. Thomas expressed his opinion that

many of the so-called management problems of small colleges could probably be resolved, "by some basic efforts in . . . operational data systems."

CHAPTER FOUR

A DESCRIPTION OF SIGNIFICANT FACTORS RELATED TO THE IMPLEMENTATION OF SELECTED SYSTEMS MODELS, PROGRAMS, AND SERVICES

INTRODUCTION

The first and second chapters of this report attempted to define and describe systems theory, in general, and its present and potential usefulness in the study and administration of institutions of higher education. The third chapter surveyed some of the actual systems models, programs, and services that have been developed by those who have assumed a "systems approach." This chapter focuses on important factors related to the actual implementation of some of these systems on a small college campus.

Due to limited resources, it was impossible to study the details of implementation related to every system described in Chapter III. It was necessary, therefore, to select a representative sample.

This was done by developing nine criteria that were applied to the full list of systems outlined in Chapter III in order to select three models for more detailed study in regard to implementation.

The criteria were developed, initially, from a study of the literature and by noting important and recurring aspects of the systems being considered. These criteria were then reviewed by experts from the fields of systems research and development, administration, and educational research. The suggestions of these reviewers were incorporated by the investigator and his major advisor into the following criteria which were settled upon for use in selecting the three systems to be analyzed in this chapter:

1. representation from as many as possible of the six categories which were outlined in Chapter III. The categories divided the list of systems according to the primary function(s) or technique(s) they are intended to perform;

2. the degree to which the model, program, or service has been developed;

3. the extent to which it has actually been implemented and is now in operation in small colleges;

4. the designation of the system for small college use;

5. representation of important systems features and functions (other than those represented by the six categories, e.g., PBA, suprasystem interface);

6. the availability of information on implementation;

7. an attempt to represent both simple and complex models;

8. an attempt to represent systems designed by a research and development center, by an educational institution, and by a commercial organizaton;

9. an attempt to represent both expensive and inexpensive implementation;

Priority was given to the lower numbered criteria. Subjective decisions had to be made in the selective process so as to apply as many of the criteria as possible when considerations came into conflict.

Through application of the criteria, three systems were selected for more detailed study of significant factors related to their implementation on a small college campus. The systems chosen are: (1) CAMPUS (representing a management information system for planning); (2) CAP:SC (representing a simulation model); and, (3) the NACUBO Planning, Budgeting and Accounting System (representing a procedural model). The other specific reasons (criteria used) in selecting each are outlined in the section of this chapter that describes the details of implementation.

A model representative of the first category outlined in Chapter III (MIS for operations) was not included in the sample because of the limited suitability of design, the very high

costs involved in implementation, and very little use by institutions with resources and programs similar to those of small colleges. There is a need for a comprehensive MIS for operations for small college use, but no model appeared to be feasible for implementation.

The comprehensive approach of the National Laboratory for Higher Education (the fifth category on the chart) appeared to be designed, to a substantial degree, for use in small colleges. With the exception of one or two products, however, it has not yet had enough experience in the field to warrant special study related to implementation.

The exchange service offered by CAUSE (the final category) is still largely untried by small colleges. The selection of CAUSE as one of three systems for further study related to implementation would, therefore, probably not be the most valuable selection possible. An outline of the exchange services and membership fee structure is included in Chapter III.

Some factors related to implementation have been reported in Chapter III for every system listed. These include cost, personnel, and start-up time; factors which appeared relevant to the level of description undertaken in Chapter III. No systematic effort was made to authenticate the material in Chapter III by contacting users.

The selection of the three systems for special investigation related to implementation is not intended to indicate a preference (personal or professional) for the systems selected, or against those not selected. Individual institutions must assess their own needs and resources in order to select the "best" approach for themselves. Other criteria, such as the effectiveness of the system to do that which it claims, should be applied -- but are beyond the scope of this study. It should also be noted that some of the unselected systems that are still in the stages of development and testing seem to show great potential for small college use.

Information regarding the actual application of the selected models was collected from the designers, researchers, developers, and purveyors of these systems, from available literature and by direct contact with at least two small college users of each system.

A list of significant factors related to implementation was developed in the same manner as the list of criteria used in selecting the sample. Implementation factors considered important in the literature and reported by users and developers were listed and then reviewed by a panel of experts from systems research and development, administration, and educational research. The suggestions of the reviewers were then incorporated under the direction of the investigator's major advisor.

The significant factors related to implementation which will be considered in this chapter for each of the three selected systems include:

1. the cost of the model and electronic equipment needed for (a) start-up year, and (b) succeeding year(s). Comparison of rentals, purchase, remote terminals, time-sharing, etc., wherever possible. Specification of vendor and/or cost of adaptation to other equipment, if any;

2. cost of added personnel necessary for (a) start-up, and (b) operation;

3. cost of consultants for start-up and operation;

4. special space requirements for equipment and personnel;

5. availability of personnel capable of setting up and operating the system;

6. length of start-up period;

7. availability of literature relating to on-campus experience of the model, program, or service in small institutions;

8. flexibility of the program -- probable usefulness in unanticipated and unique problem areas;

9. comprehensiveness of the model;

10. simplicity of the model for comprehension and development of administrative confidence;

11. convenience of the system; physical and procedural availability to administrators and others, which is likely to affect the use of the system;

12. psychological cost, in terms of personal and professional risk and palatability of implicit change to administrators and others involved in implementation.

13. availability of training programs and/or materials for administrators and other users;

14. length of orientation or training programs for administrators and other users;

15. cost of training and orientation programs -- including travel if held off campus;

16. provision of system maintenance service -- and cost.

It might be profitable for a prospective systems user to note that information about the sixteen factors could be checked by anyone considering any other particular systems model.

The experts from systems research and development administration and educational research who were used to review the criteria for selecting a sample and the list of significant factors related to implementation, are listed in Appendix B.

CAMPUS

The Comprehensive Analytical Methods for Planning in University Systems (CAMPUS) program of the Systems Research Group (SRG) in Toronto was selected to represent the MIS for planning category (selection criterion #1) of systems suitable for small college use.

CAMPUS was selected because it is a comparatively highly developed (selection criterion #2) planning system. It has already gone through several revisions. In addition, a special version (CAMPUS/CONNECT) has been developed particularly for small colleges (selection criterion #4) and is now being used on a few small college campuses (selection criterion #3). This choice also represents a model with the suprasystem interface capability (selection criterion #5) (common data elements for interinstitutional comparisons) if the data base is organized as recommended in CAMPUS literature, according to NCHEMS Program Classification Structure. Furthermore, CAMPUS has the capability of a rather sophisticated program budget (selection criterion #5) and represents one of the more complex systems studied in the course of this research.

Inherent in the system is a process intended to bring together academic planners and financial officers. Academic personnel learn about the economic implications of their plans

and the finance people associate the expenditures with recognizable activities related to the objectives of the institution. Dean Kenworthy of Wheaton College (Massachusetts) reported in Denver (January 27, 1972) that this procedural feature of the system was one of the main reasons CAMPUS was selected for use at his institution.

In order to determine precise costs of specific programs and activities, the CAMPUS model must be fed descriptions of the college structure (departments, cost units, support facilities), statements about its academic programs (courses, students, and policies), and other factors that have a bearing on the use of space, staff, and other resources.

In addition to the basic MIS for planning, a computer simulation feature of the system can calculate future resource requirements (space, staff, and support facilities) and display them in reports and charts. Various alternative assumptions and conditions can be tested by asking the computer to simulate the effect they would have on the resources required. The reports can be either of a (1) general nature (programs and program categories), for assistance in broad comparisons and evaluation, or (2) specific and broken-down into the most basic elements for detailed analysis. The advantage of a simulation of this type is that it is built on the comprehensive data base of a total MIS for planning rather than a selected body of data accumulated just for the purpose of a simulation system. No

special compilation of data is necessary and greater confidence can be placed in the results.

Significant Factors Related to Implementation

Cost of Model and Equipment

The purchase, implementation, and running costs for the initial year at the first small college to use CAMPUS/CONNECT (Wheaton, Massachusetts) were reported by them to be rather high ($89,000) and took eighteen months to complete. Dr. Levin of SRG estimated that subsequent installations will cost between $12,500 and $75,000 and take from two to twelve months to implement (Denver, January 7, 1972). The lower cost estimate is based on the resolution of first installation-type problems encountered during the Wheaton implementation. The fee will vary according to the size and complexity of the institution, but perhaps more important is the amount of consultant time necessary to collect and organize the essential data about the institution.

In addition to covering the charge for the system itself, the fee includes the services of planning consultants to assist the college personnel to determine the type, level and format of the reports that are to be reproduced, and the critical factors, and their relationship, that make up the simulation model.

The size of the fee is stipulated in a contract prior to implementation. The responsibility of installing the

system on a computer is also assumed by the SRG consultants for this fee, as well as handling the training program for college personnel.

It is estimated by SRG that CAMPUS/CONNECT will cost a total of $20,000 to $30,000 per year to operate. The rental of a remote terminal, and fees for central computer time and data storage are included in this figure and are expected to range from $10,000 to $15,000.

Thomas More College has implemented the system CAMPUS VII on their own computer. This model of CAMPUS has been reduced in size and complexity to suit the small capacity of the IBM 1130 (16K). The computer was already owned by the college (purchased for $54,000) and is used for college instruction and research as well as for administrative purposes. A special arrangement was made with Thomas More, but Dr. Levin of SRG estimated (Denver, January 27, 1972) that the SRG fee for this application will range from $12,500 to $25,000 and will take from two to six months.

Mr. Carnell of Thomas More (April 21, 1972) reported that it took about three months to make the system fully operational. An initial visit of consultants for three to five days was necessary at first. Then once or twice a month one or two consultants from Toronto were at the college for a period of from one to two days. The comprehensive fee covered all consultant costs.

The annual total cost of a service policy for the computer and rental fees for related equipment (keypunch, sorter, etc.) is $25,000 to $30,000, according to Mr. Lombus of Thomas More. It must be kept in mind, of course, the electronic data processing facility at Thomas More is used for many other things in addition to running the CAMPUS system. No records were available on the amount of computer time used, but the schedule calls for a run every two weeks. Mr. Lomubs reported (August 8, 1972) however, that the pattern has been to run the system two or three times a week during peak planning and budget development periods and then sometimes it will sit idle for a few months.

Cost of Personnel

Local employment conditions, availability of personnel, supervisory and training skill and time available to direct the effort, and combination of the position with other responsibilities, all might have a bearing on the salary. For instance, the knowledgable, skilled and experienced Director of Institutional Research at Thomas More personally operates the less complex CAMPUS VII model at Thomas More, but his unreported salary may well be more than the high side of the estimate range ($15,000). On the other hand, only a portion of his time is spent in maintaining and operating the system after it is installed and only a percentage of his time should

be considered CAMPUS system cost -- although no such records were kept. Three people operate the computer facility; a director (part-time), a programmer, and a systems analyst (each full-time), but, of course, only a small percentage of their time should be considered a cost for operating the system.

The Wheaton implementation required one full-time system operator to handle the remote terminal on-campus and expedite the process. One full-time system operator may cost between $7,500 and $15,000.

There was also a substantial investment of time by staff from various levels in each department. Data must be collected and made compatible with the CAMPUS model, and a projection of information needs must be developed to structure the format of the reports. Careful records were not kept by Wheaton over the eighteen month period but a substantial amount of that time required the full-time service of other college personnel in coding the data elements, structuring the system and feeding it to the computer. It should be noted again, that the lengthy start-up time at Wheaton was largely a function of the problems related to the first implementation on a small college campus.

Thomas More College reported only one month of full-time work by one person (the Director of Institutional Research) to collect and code the data for the system. It was reported,

however, that this occurred immediately after a three year effort in general data collection by another staff member, which made the data collection for CAMPUS much easier.

Cost of Consultants -- See Cost of Model and Equipment

Space

The CAMPUS/CONNECT model would only require space for a remote terminal (which is the size of a large typewriter) and operator. Obviously the CAMPUS VII implementation requires more space for a computer and several support personnel.

Available Personnel

The CAMPUS/CONNECT operator can be a nontechnical person but must have at least the basic qualifications of intelligence, flexibility, and responsibility. The computer operators for the CAMPUS VII model are, of course, specialists. Personnel for these positions were difficult to find.

Length of Start-up Period -- See Cost of Model and Equipment

Availability of Literature

There is more literature related to CAMPUS than to most other systems. This may be because it has been in existence longer, but it is probably also a function of the skill, interest, and experience of the CAMPUS people in publication. There are manuals, descriptive monographs, a few journal articles, and papers that have been read at various conferences. Most of the

material has been produced by the SRG staff, and very little is related directly to small college use, although the principles are the same and the content is relevant. Interest is growing among small schools, however, and at least one journal article by a small college user is in preparation.

Flexibility, Comprehensiveness, Simplicity, and Convenience

The system is structured so as to stimulate consideration of a wide variety of factors related to institutional planning. Yet, the developers have worked at making it an extremely flexible model. Dr. Levin claims that the simulation capability is now approaching the state of being a "programming language" which would provide almost unlimited flexibility for adoption to specific institutional needs. Predetermined formulae and fixed assumptions are not used, but relationships are developed that satisfy the unique requirements of each institution.

CAMPUS is as comprehensive as any other system in its structure and detail, but also is organized in a very logical manner which makes it a relatively simple system to understand.

Both users report that the system is convenient and structured (processes, method, and means of input, and report capability) in such a manner as to make it conducive to use. The direct reports from people with such varied responsibility as Vice President for Financial Affairs (Mr. Carnell, Thomas

More College, April 21, 1972), Academic Dean (Dr. Walter Kenworthy, Wheaton College, Massachusetts, January 27, 1972), and Director of Institutional Research (Mr. Lombus, Thomas More College, August 4, 1972) were unanimously positive with regard to the convenience of the system. Mr. Lombus said it was always ready and Dr. Kenworthy, as mentioned previously, selected the model because of its suitability even for faculty use. The ready access of the remote terminal (or on-campus computer), the logical and understandable structure of the model, and the access to data for almost any analysis, all help to make the system convenient.

Some inconvenience related to the operation of the remote terminal seems to be typical, however. The investigator observed several instances, with various systems, and others have been reported. Usually the difficulty is only related to the initial connection with the central computer facility and not the garbled data communication that Wheaton experienced (See Psychological Cost). It is usually resolved in a few minutes. The Wheaton situation may be the result of antiquated telephone equipment in their locality.

Psychological Cost

Both users contacted reported that the process of data compilation and cross-reference translation of it was an important and profitable aspect of the system in and of itself.

It precipitated many new insights and better understanding of the institutions even before the data was electronically manipulated.

The Assistant Dean at Wheaton, Ms. Dresser, reported in a followup conversation (August 4, 1972) that the faculty had shown an interest in the planning budget aspects of the system but a chronic problem between the remote terminal at Wheaton College in Norton, Massachusetts, and the computer center at Brown University in Providence, Rhode Island, had caused a cessation of operation. Some data is still occasionally manipulated through the model by batch processing information on the CAMPUS computer facilities in Toronto. The faculty have apparently "lost interest" however, and any program to involve them would have to be started again from the beginning.

Perhaps an even more severe blow to the operation of the system at Wheaton, however, may be the resignation of the Dean to accept a position elsewhere. He was apparently the prime motivating factor in the implementation. Other administrators did not use the system except for occasional reports.

It is too early in the small college applications to tell yet but the potential for psychological cost may be higher on this type of system. Its relative complexity, program budget capability, and analytic function may be threatening to academic people. Faculty members, understandably, become quite

ego-involved in, and defensive about their disciplines, departments, curriculum, and courses. Quantitative indications of possible duplication and inefficiency based on program budgets and cost/benefit analysis may pose high risks for faculty. Mr. Lombus (August 4, 1972) when pressed, estimated that fifty percent of the faculty were indifferent to the system even though its operation had been explained to them, twenty percent were attracted to it (these were mostly economics and business specialists), twenty percent were interested, but a little anxious because they felt that they did not understand it, and ten percent strongly disliked it. Some of those who disliked it, however, have recognized its usefulness in pointing out high departmental costs and reduced student interest which has resulted in faculty cutbacks and reduced departmental budgets. Four faculty members are on a long-range planning committee at Thomas More and have begun to show an interest in using the model for planning purposes at the committee level (Mr. Lombus, August 4, 1972).

Some of this dynamic may also be true for administrators, but their activities are not so much the focus of the analysis. In addition, the administrators have had the opportunity to develop and structure the system during the planning and implementation stages, which makes the processes and functions more understandable and perhaps has permitted conscious and/or unconscious incorporation of administrative biases.

Availability of Training Materials and Length and Cost of Training Programs

Training programs and materials are available, and, as noted in "Cost of Model and Equipment," are provided without extra cost. SRG claims that their training program is flexible, and that the on-campus sessions can be adjusted in size, length, and depth according to the level and special interests of the participants. The usual format, however, is to conduct two or three one-day sessions with small groups.

Neither Thomas More nor Wheaton reflected this pattern -- but it is probably because each was the initial implementation of its type. Administrators and systems operators from each college had made trips to Toronto for general orientation and seminars on the system. There were also one-to-one sessions with administrators at the college that increased familiarization with the model. The pattern does reflect an SRG concern for training suited to appropriate level of responsibility and area(s) of interest. In addition, Mr. Lombus at Thomas More felt familiar enough after his experience with the model, to run his own session on the system for other colleges in his state.

Maintenance Service and Cost

SRG has a good reputation with regard to system maintenance. Both users reported good service from the CAMPUS consultants.

Thomas More people reported (April 21, 1972) that occasionally responses to general questions and developments were delayed for a week or two, but were always forthcoming. Mr. Lombus also reported that actual problems with system operation received priority attention from the sizable staff of professional consultants and backup people, and consultant help was always available within a few days. The other side of this excellent service is that there has recently been some discussion at SRG about charging a maintenance fee to users of the system to cover the cost of this service.

CAP:SC

The Computer Assisted Planning for Small Colleges (CAP:SC) project was sponsored by eight colleges and directed by Peat, Marwick, Mitchell and Co. (PMM). (Technically, the name of the model is SEARCH; System for Evaluating Alternative Resource Commitments in Higher Education, but it appears to be more popularly known by the project title of CAP:SC.) The small college orientation of the model is one of the prime reasons for its selection, as a representative of simulation systems (selection criterion #1), for more detailed study in this chapter. The design and factors related to implementation appear to be suited for small college use (selection criterion #4).

In addition, the development of the model has been complete for some time (selection criterion #2), and it has been in use on several campuses for two or more years (selection criterion #3).

Drs. Nelson and Struve of PMM (March 23, 1972) claim that the implementation procedures, initially, give attention to defining and clarifying institutional goals and objectives. The administrators are then assisted by professional consultants to determine information needs for long-range planning. Involved in this are the specific environmental factors, state and decision variables, and general parameters of the institution

(as outlined in the manual) which will be fed into the system. Usually some special effort must be made to collect and interpret the data needed to complete this step of implementation

The base from which the system operates is a report on the previous year's budget experience, that is compatible in structure to the SEARCH model.

All these data are stored on a computer at a service center.

The simulation system is operated through a telephone line, by means of a remote terminal on campus. Changes in the variables and their relationships can be tested through computer manipulation of the data in order to determine the effect created on other variables and the total institutional budget.

Significant Factors Related to Implementation

Cost of Model and Equipment

PMM claims that the total cost of implementation has varied from $10,000 to $20,000 for consultant fees, data collection and organization, implementation of the program, and training on-campus personnel to use the system. These costs do not include the time spent by in-house personnel in data collection, consultation and training or any charge for the model itself because it is in the public domain.

Franklin and Macalester Colleges were part of the original eight college development and implementation of the

model. Only aggregate costs were reported so specific figures on the cost to any one school are not available. PMM will give a specific cost estimate to any college interested in the program.

Equipment costs are consistently reported to be low. The only necessary equipment is a portable computer terminal (the size of a large portable typewriter). The monthly fee for this varies, depending primarily on the printing speed of the terminal and the method of financing. Macalester reported (August 4, 1972) a cost of $150 per month for rental of the terminal and Franklin reported (August 22, 1972) a cost of only $40 per month (and only $15 charged to the system) over a three year period to purchase a slower piece of equipment. Dr. Neugent (Franklin College) also estimated that the life of the terminal would probably only be about three years.

PMM claims that charges for use of the central computer facility include: (1) a monthly fee for data storage, and (2) fees for hookup and running time when the system is being used. These latter fees vary from as low as a personally observed $15.00 (for perhaps 30 minutes of hookup and running a few simulations at the New York office of PMM) to a report from Mr. Dozier of Macalester College for as much as $50.00 or $75.00 for a several hour session with a few complicated simulation runs.

The storage fees were estimated by PMM (March 23, 1972) to cost from $30.00 to $40.00 per month. This was confirmed in the report from Macalester (March 29, 1972) but Franklin reported a fee of $100 per month for storage (August 22, 1972). The high cost of data storage on the computer has caused them to have it stored on tape for $5.00 per month and set up on the central computer facility when they want to use it.

Macalester reported (March 29, 1972) as many as five or six simulation sessions per month in heavy use periods, and three to four month latent periods when the system is not used; Franklin indicated (August 22, 1972) a simular pattern.

PMM reported (March 23, 1972) that the system could be installed on an institution's own computer, if they already have one. (The time sharing application, described above would, of course, be much less expensive than installing a computer just for CAP:SC.) The actual computer program is available on 400 FORTRAN cards. Complete logic diagrams are also available. The charge for this material is limited to the cost of reproduction because the system is in the public domain.

Cost of Personnel

The on-campus personnel required for data collection was minimal for these two schools. Although no specific records had been kept at either institution, Mr. Dozier, of Macalester, estimated (August 4, 1972) that two people worked part-time on

data collection for the system for two or three weeks. Dr. Neugent, who was then the part-time Director of Institutional Research at Franklin, said (August 22, 1972) that he did not recall any special time or effort required of any on-campus personnel, other than his minimal activity of compiling the usual reports from the various college officers.

It may be significant to note at this point that one of the weaknesses noted by Dr. Neugent was that enough care probably was not taken at the time of data collection to make sure of common acceptance of the data in all departments and offices. If there is disagreement with the data base then, of course, all printouts of the system are suspect and the effectiveness of the model is tremendously reduced.

No technical on-campus personnel are required. Both users reported that the system can be operated by anyone who has been through the training sessions and has access to the remote terminal. Both users and PMM report that the tendency has been for one or two administrators to maintain an interest in the system (Macalester reported that currently, four people on campus are able to operate it) and therefore retain the relatively simple skills necessary to operate it. This is probably a function of the degree of interest that an administrator has in planning. In a practical sense,

however, this may be a result of the fact that the system is frequently used in an administrative or planning committee meeting and only one person on campus would have to be prepared to operate it.

Cost of Consultants

Consultants are provided by PMM for implementation at no extra charge. These consultants are also available for later services, through PMM, for altering the components or structure of the system, updating the data base, and retraining personnel. Dr. Nelson of PMM reports that three levels of consultants are available (consultant, manager, partner), and the assignment is dependent upon the depth and complexity of the problem. The fee, of course, varies with the level of personnel required.

Neither user found it necessary to use consultant services beyond the implementation period. Franklin made a special request for additional training and orientation of personnel (Neugent, August 22, 1972) with which PMM complied promptly, without charge.

Space

The space required is almost insignificant. The typewriter-sized equipment can be kept in or near any office in

which it may be used. Since no special full-time staff is necessary, extra office space is not required.

Availability of Personnel

No technical personnel are required.

Length of Start-up Period

Estimates and reports on the length of time required to implement the system vary from two or three weeks to several months. It will depend on the number of on-campus personnel concentrating on the implementation process, the amount of work contracted to be done by PMM personnel, and, of course, the availability of the appropriate data needed to operate the system.

Dr. Dozier of Macalester reported (March 29, 1972), that it took about two months to set up the model, but it could probably have been done in two or three weeks if a more concentrated effort was made. Dr. Neugent of Franklin (August 22, 1972) indicated that it took three or four months. Two PMM people visited the campus for a day to interview administrators individually to determine the data that would be needed. These data were then requested and sent to them in New York. They returned to campus at a later time to check the data and to run a one-day training session.

Availability of Literature

Very little literature is available on the development and use of the system. Hopefully, some user groups can also be formed as the number of implementations increase. Reports on actual usage are important for the development of broader use of CAMPUS where it has already been installed, as well as for the stimulation of interest and confidence in prospective users.

Flexibility, Comprehensiveness, Simplicity, and Convenience

This system appears to have arrived at a rather functional balance between structure and flexibility. There is enough structure to encourage the inclusion of various factors that have an important bearing on financial projection in a small college. PMM designed the program to permit the mathematical relationships between these factors to be varied, in most areas, according to the distinctive environment and structure of each institution. In addition, PMM claimed (March 23, 1972) that variables can be manually redefined to accommodate idiosyncrasies of a particular institutional or program structure without altering the computer program. Because the logic diagrams are available it is even possible, if necessary, to redesign the model to such an extent that the computer program must be changed. This, of course, would be fairly expensive

and would require technical personnel. Dr. Nelson claimed (March 23, 1972) that PMM can provide the personnel to do this on a per diem basis. (See also "Cost of Consultants.")

It is important that most, if not all, of the users of the data produced by the simulation model be familiar with its structure and some of its internal processes. This relates to the important consideration of confidence in the system. In order to develop this confidence, a balance is necessary between simplicity and comprehensiveness. If the model is too simple, every capable administrator and planner will recognize that the model does not take into account, in its simulation, some important factors. On the other hand, if the number of elements included and their interrelationship is too complex, no one, except perhaps the few who developed it, will have confidence in the data produced because they really cannot be certain what the output represents.

The SEARCH model is fairly complex. It is capable of hundreds of state and decision variables and dozens of environmental factors and parameters. However, they are grouped in such a manner as to produce understanding and confidence, after a brief orientation. Dr. Neugent emphasized (August 22, 1972) that the tape storage (used to reduce costs), requiring notification to the central computer agency a couple days or a week before a run, may reduce the convenience and use of the system.

Very little use of the system by nonadministrative personnel is reported. At Macalester, some faculty and student participation was part of the planning process, but the level of involvement is still only at the traditional budget development level. These nonadministrators have expressed some interest in the simulation model, and some use by them is quite possible in the near future. Franklin reported (August 22, 1972) a little more use by faculty but it was hindered by not having a planning process (such as NACUBO's PBA) established to provide a formal opportunity to use the model and for faculty to have a designated responsibility in the institutional planning process.

Of particular interest to small colleges, is PMM's contemplation of a special program for groups of institutions who are already using the NACUBO Planning, Budgeting and Accounting System. Drs. Nelson and Struve feel that reduced training programs may be possible due to general administrative familiarity with the principles of resource allocation. Furthermore, institutional planning data will probably be more readily available and suitable for use on CAP:SC. It is possible that the implementation fee might be reduced to as little as $5,000. This however, would probably require the participation of ten or more colleges simultaneously in training and implementation programs.

Psychological Cost

Since use is still somewhat limited, it is difficult to report with any firmness, but it appears that a simulation system of this type is perceived only slightly as a personal and/or professional risk. Any change of procedure, or introduction of a new technique is suspect to some degree. However, the SEARCH model is comparatively uncomplicated, and since everybody has access to the same data, the threat may be minimized. The report of both users (Macalester, March 29, 1972 and Franklin, August 22, 1972) contacted was that it was more ignored than feared.

Another factor related to its nonthreatening nature is the use of a rather traditional budget format as a base for simulation, which reduces mistrust. Budget breakdown, according to new divisions, tends to precipitate suspicion on behalf of individuals or departments that they will find their budget reduced, or at least the traditional basis for incremental increases lost. It should also be noted, however, that the system probably never reached its full potential impact on resource allocation decisions in either institution contacted, and personal attitudes toward it may change if it becomes a powerful factor in the decision-making process.

Dr. Neugent warned (August 22, 1971) that the individuals and committees using the system must be aware of the possibility

of negative reactions to the computer by other personnel on campus. He pointed out that a computer is not "magical" and cannot provide answers to questions not asked, nor replace the judgment of humans charged with leadership responsibility. He also felt that CAP:SC would prove more advantageous to an institution if at least one person on campus had a close working familiarity with computer language and operation.

Availability of Training Materials and Length and Cost of Training Programs

Basic training materials and programs are provided by PMM at no extra cost.

PMM claimed (March 23, 1972) that the training programs can be varied according to the interest and sophistication of the people involved. The length of the program is also flexible, therefore, but most run for two or three days and are geared to the president and those personnel immediately responsible to him. Franklin reported (August 22, 1972), however, that they had one-day training sessions and it is possible that a training program held over a longer period of time and geared to administrative level and interest might have been more profitable. (It should be remembered, however, that this was one of the earliest implementations of CAP:SC as part of the original eight college consortium.)

Administrators at Macalester (March 29, 1972) and Franklin (August 22, 1972) reported that upon completion of

the basic program, an adequate training and orientation program can be run by campus administrators for other college staff without involving PMM consultants. Dr. Neugent also ran a general orientation program for the Board of Trustees. Extra copies of the training and users manual can be purchased from PMM.

Maintenance Service and Cost

PMM has a staff that is available for maintenance, updating, and adjustment of the system if such service is necessary. Dr. Struve reported (March 23, 1972) that there is usually no charge for relatively minor assistance, but for lengthy consultation, fees will be based on contractual, or per diem, arrangements. The model was designed to permit most, if not all, maintenance functions to be performed by any administrator who is interested, has the time, and is motivated enough to do it.

PBA/NACUBO

The Planning, Budgeting and Accounting System of the National Association of College and University Business Officers (NACUBO) was the most widely distributed system identified during the course of this research. NACUBO reported that hundreds of administrators have attended the workshops sponsored by them and the Council for the Advancement of Small Colleges (CASC).

The system's low cost (selection criterion #9), its simplicity of concept (selection criterion #7), and the suitability of its design and procedure for small college use (selection criterion #4), appear to be responsible for its appeal to administrators as well as for its selection for a more detailed implementation study in this chapter. It also serves the purpose of representing a process system (selection criterion #1), a model in use on college campuses (selection criterion #3), capable of program budgeting (selection criterion #5) and inexpensive to operate (selection criterion #9).

The primary purpose of the system is that of improving the traditional process of budget development. This is done by establishing a process which permits the participation of the appropriate people, at the proper time, and with the necessary data for making recommendations and decisions

related to program and budget priorities. The entire process is called The Planning Cycle, and it is carefully and precisely presented through PERT-like flow charts in the comprehensive manual.

The procedures include the review and revision of goals and their approval by the Board of Trustees, evaluation of current activities and planning of suitable programs and supportive activities to achieve the goals and objectives, preparation of budgets, review and analysis of faculty, student, and administrative representatives, revisions as necessary, and final approval by the Board before the five year projection is published and the budget implemented for the coming year. This procedure is repeated annually for the purpose of budget preparation as well as for the updating of the five year projections.

Significant Factors Related to Implementation

Cost of Model and Equipment

Aside from costs related to reproduction of the manual ($10.00) there is no charge for the system itself. No special electronic data processing equipment is required.

Cost of Added Personnel

The greatest expense involved is that of hiring a planning assistant and providing him with adequate supportive

assistance. Estimates for this post range from a full-time position description with a full-time secretary-clerk to a less than half-time equivalency with no secretarial or clerical help. The range may reflect the size and/or complexity of the institution, as well as what is expected from the planning assistant, such as the level of his involvement in institutional research, evaluation of outputs and the psychological aspects of the planning process, skill and experience in institutional planning and general proficiency in the field. The salary for the planning assistant, therefore, might range from $3,000 or $4,000 a year for a part-time load, to as high as $20,000 a year for a full-time person who is experienced and skilled in the field. Mr. Wrolstad of Lawrence University reported (August 4, 1972) that the Assistant to the President, with a salary of $17,000, acted as planning assistant on his campus. There is also a secretary in the office with a salary of $5,500, but now that the system has been operating for several years they spend less than one-half of their time on the NACUBO planning process. Sherwin Howard, Assistant to the President at Lawrence, reported (August 4, 1971) that in the first year, seventy or eighty percent of his time was devoted to the system. Mr. Dozier of Macalester College reported (March 29, 1972) a $5,000-$6,000 salary figure for a one-quarter to one-third load for one person.

The manual suggests that the president's office could perform the functions of the planning assistant, but an attempt to save money in this area might very well prove to be a false economy. Neither Macalester nor Lawrence chose this route. A professionally skilled individual who is also adept in interpersonal relationships could be a key factor in the development of confidence in the system throughout the institution.

Some payment may be necessary to members of the Analytical Studies Group. For instance, faculty members under nine month contracts would have to be paid if they are involved for a month, or so, during the summer. Mr. Wrolstad reported (August 4, 1972) that Macalester faculty received $900 and students received $500 for participation in the ASG. The summer schedule of the ASG (recommended by the manual) may have other disadvantages; perhaps only those faculty unable to secure more lucrative positions during summer recess will be available for this responsibility. The suggestion was made by Mr. Dana (August 4, 1971) that the committee convene after Labor Day.

Another area of the cost is the training program. (For specifics See "Availability of Training Materials and the Length and Cost of Training Programs:")

Cost of Consultants

If the administrators conclude that some experienced people would facilitate the implementation of the system, a list of registered consultants is maintained at the NACUBO office in Washington, D.C. The usual fee is $100 to $125 per day, plus expenses. Mr. Dozier, an administrator at Macalester College which uses the system, as well as a registered NACUBO consultant, claimed (March 29, 1972) that an outside estimate of consultant help needed would probably be ten days to two weeks. These consultants might be helpful for training and orientation of personnel, assistance in data collection and organization, adaption of the system to distinctive aspects of the institution and, later, for trouble-shooting. Neither user contacted used an outside consultant. On the other hand, an administrator from each of these colleges has become a registered NACUBO consultant for the planning process which may indicate a particular interest and skill in the use of the system.

Space

The only special space requirements for the system are office facilities for the planning assistant and his secretarial support and adequate meeting room facilities for the Analytical Studies Group.

Available Personnel

The availability of people to fill the planning assistant position depends on the type and level of responsibility they will be expected to have. A clerk and expediter of information flow would be rather easy to find, but a researcher, evaluator, and initiator who is sensitive to the subtle, but frequently all important needs of individuals and groups might be difficult to find and hold. Salary will, of course, have to be commensurate with ability, experience, and responsibility.

Length of Start-up Period

It is difficult to compare the length of the start-up period of a procedural system like NACUBO's PBA with information or simulation systems. In a sense, the initial implementation is merely the decision, and commitment, to go ahead. Implementation might also be perceived, however, as a continual process of recycling through the planning process. The first time experience with each step of the process would require two years, as outlined in the manual. Macalester reported (March 29, 1972) the recommended two year start-up period, but Lawrence got a late start on the process in one year and was able to make up several months, shorten the process, and meet budget deadlines (reported August 4, 1972).

Availability of Literature

There is a limited amount of literature available on the system. A few workshop presentations have been transcribed by The Council for the Advancement of Small Colleges, and the manual is written in a language and manner suitable for non-technical personnel. Mr. Finn, Executive Vice President of NACUBO, confirmed (August 4, 1972) the apparent lack of literature on the system and could only suggest as a cause that financial officers generally do not have an interest in writing. The inexpensive workshops and accessibility of consultants makes extensive information readily available, however.

Flexibility, Comprehensiveness, Simplicity, and Convenience

Mr. Dozier claims that the system is flexible and adjustments can be made to resolve special concerns of individual institutions (March 29, 1972). Several of the recommended forms used for data collection and analysis have been criticized by users, but adjustments can be easily made. Some small college administrators who have considered the system felt it is too complex, but it appears that the process can also be altered to suit local conditions. The overall structure performs the essential function of stimulating consideration of vital factors, coordinating the planning process, disciplining a resource allocation approach, and improving communication regarding goals and objectives and the means of achieving them.

The manual, at first, gives the impression of being almost overwhelming in complexity, but in both principle, as well as practice, it is quite easily understood. The complexity of the system is not excessive. The levels and areas that are detailed are necessary to achieve the purpose of the system.

The first cycle through the system does require a great deal of effort on the part of many college personnel, however, and should not be undertaken without recognizing the commitment that is necessary.

Psychological Cost

Inherent in the process of the system is the involvement of nonadministrative personnel (primarily in the Analytical Studies Group) in resource allocation decisions. The amount, number, type, and level of staff involved can be varied according to the philosophy of the administration, but the system is conducive to broad representation in the planning process.

Dr. Dana, a faculty member at Lawrence University, which uses the system, reported, however, (August 4, 1971) that the members of the Analytical Studies Group evidenced some frustration because of the limitations of making recommendations while the administration and board retained decision-making

power. Mr. Wrolstad, Vice President for Finance at Lawrence, reported a year later (August 4, 1972) that there was still a mixed reaction from the faculty but the Analytical Studies Group would probably be continued because the "hard look" of the analytic process was essential. He pointed out that eight faculty stood for election for four vacancies on the committee and he felt this was a relatively healthy indication. Mr. Wrolstad said that the philosophy they were trying to foster was that the ASG is an adjunct to the president's office to help him make up the budget.

Mr. Dozier felt (August 4, 1972) that some of the faculty at Macalester felt threatened by the committee. Apparently several faculty were released last year for austerity reasons, and any new approach would be viewed with suspicion. Even the members of the committee evidenced some ambiguity. They showed reluctance to use some analytical data to assist them in priority determination. Mr. Dozier felt that the operation of the ASG at Macalester was somewhat negatively influenced by the political dynamics created by a new president who has been reticent at some points to accept the implicit philosophy of the system (i.e., faculty participation in decision-making). Mr. Dozier observed (August 4, 1972) that it takes a strong commitment and a real push to implement and maintain the system.

An interesting second (or perhaps third) phase of the ASG is that some of the personnel at Lawrence who have been supporting the system have begun to lose their enthusiasm. They have accepted the process and appreciated the opportunity to become informed and assist in the development of the budget, but now that they have spent a two-year effort getting the institution into the "black", they want to see the system used for the development of creative new programs and not just as an austerity tool (Wrolstad, August 4, 1972).

Availability of Training Materials and the Length and Cost of Training Programs

Both users reported that they found it profitable to attend the NACUBO or CASC workshops regarding the system. There has been at least one two-day workshop held in each of the last few years. The charge recently has been $125 for two people from one institution. They have felt that the system had a better chance of being implemented if more than one administrator returned to campus with training in the planning process. The room, board and travel costs related to these workshops will probably be the most expensive aspect of the training costs. Other campus personnel involved in the process can be easily oriented on campus. Additional copies of the manual are available at a cost of $10.00.

Maintenance Service and Cost

See "Cost of Consultants."

CHAPTER FIVE

CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

In this study a system has been defined as a set of interrelated elements working toward a common goal. An attempt has been made to apply the concept to the processes of administration and planning in institutions of higher education.

The research has focused on the identification and description of the functional applications of the systems concept (models, programs, and services) that appear to be suitable for use in small colleges. Special attention was also directed toward significant factors related to the implementation of a sample of these systems on college campuses.

As a logical extension of the research, this chapter attempts to draw general and specific conclusions, make several recommendations, suggest some areas for further research, and consider some implications.

Conclusions Regarding a Systems Approach to College Administration

Some generalizations regarding a systems approach can be drawn from the research. These general conclusions come from the review of the literature, the attempt to describe a

systems approach to college administration, the interaction with researchers and practitioners in the field while identifying models, the analysis of various systems models, and the study of factors related to systems implementation.

The systems approach to college administration and planning is, more than anything else, a way of thinking, a perspective, a viewpoint, a philosophy. It suggests that in order to understand an organization it is necessary to:

1. Identify the various units, or subsystems of the organization and their programs, activities, and functions;

2. Consider all of the relevant elements in detail and develop and maintain forms and procedures for doing this;

3. Clearly define goals and objectives (both unit and system), and ascertain the measurable movement toward them;

4. Maintain a sensitivity to the psychological, sociological and political dynamics in the organization which are relevant to its operation and achievement;

5. Analyze the processes that are used for control, management, resource allocation, evaluation, planning, and change;

6. Maintain an overview of the entire operation and a clear perspective of primary purpose, or goal, and the sequence of objectives that must be met in order to reach these overall goals.

From a financial standpoint, a systems approach is concerned with efficient and effective resource allocation based on information resulting from the approach described above. To achieve the goals and objectives of the institution, decisions regarding resource commitments should be made by taking into consideration the following:

1. what kind of resources are needed;
2. when and where are they needed;
3. what amounts are needed; and,
4. are they being used as efficiently as possible?

The models studied each deal with one or more of these questions.

The systems approach also attempts to evaluate alternative means of achieving unit and institutional goals and objectives. Costs, trade-offs of expected benefits or results, and consideration of all factors involved is necessary in this process. The simulation function focuses on this.

The state of the systems literature related to college administration and the art of systems models and techniques development, especially with regard to small colleges, is still a new field. The products that have been developed, on the whole, are still relatively untried, with the exception of some experimental and demonstration usage. A few are beyond this stage, but not yet tested by time, and their long-range effect on the institution is still uncertain.

The implementation of various systems related techniques defined in Chapter II are to a great extent fragmentary and specialized, and not actually "total system" oriented. More will be mentioned later about the need to tie some of the new developments together.

There has been an increase of interest in the development of systems for small college use, and some initial attempts at implementation have been made. The efforts of Peat, Marwick, Mitchell and Co., the National Center for Higher Education Management Systems at WICHE, and CAMPUS, illustrate this.

Conclusions Regarding Models

The categorization of the various systems models, programs, and services represents an attempt to reduce some of the confusion in understanding and terminology which exists in the field. Hopefully, it will be of assistance to prospective systems users by providing an outline of some of the kinds of functions performed by systems and by giving illustrations of specific models available.

MIS for Operations The information necessary for operational purposes is made up of data from such areas as budget control, cash balances, payroll, staff and student information, student grades, etc.

Many institutions have begun to make use of electronic data processing (EDP) in these areas and the term "systems"

is frequently associated only with these efforts. The term as used in this study, however, refers to a comprehensive information base that reflects the relevant relationships between the factors and areas involved.

As most users of EDP have noted, even with fragmented, nonsystems data bases, the cost of the hardware required to handle and manipulate complex data quickly and conveniently is quite high. In addition, the systems implementation probably will require expenditures for software (systems design and computer programs) and/or semitechnical or technical personnel to handle the program. Some cost justification is possible through personnel reduction (or reduced expansion of staff), but improved decision-making with associated indirect savings probably will have to be the primary reason for implementation.

No operational inexpensive MIS system for operations came to light in the process of this study. In the absence of a readymade model at a reasonable cost, smaller institutions will have to continue to gradually apply new segments of their information to EDP as it becomes necessary, and when they can afford it.

MIS for Planning The difference between an MIS for operations and an MIS for planning (See Chapter III) is not always made clear by vendors. In addition to specific functions performed (operations, as defined above, as compared to

planning), it is a matter of focus on purpose. The MIS for planning is designed for institutional research and analysis, cost/effectiveness study, general evaluation, resource allocation decisions, and long-range planning.

It may be suitable also for interinstitutional comparison, if NCHEMS data element definitions are used. The SWPS and HENIS projects of WICHE/NCHEMS (See Chapter II) seem to indicate that this may become standard for state and federal reports in the future.

As is indicated in Chapters III and IV, the cost will vary somewhat according to the model selected, but the primary expense is incurred by data collection and translation into definitions compatible to the elements and organization of the model selected.

Simulation Models These computer simulation programs permit study of the complex interrelationships of various factors that are important in institutional planning. Actually, these simulation models do no more than could be done with paper and pencil -- if enough time and personnel were available. The convenience of quick answers to "what if" type of questions is considered to be quite valuable by some planning groups.

The more structured models (e.g., RRPM, See Chapter III) also serve the purpose of alerting institutional planners to

important factors that might otherwise be forgotten. This sophisticated planning tool is merely a logical and electronic extension of an MIS for planning.

As with the MIS for planning it is not necessary to have expensive electronic equipment on campus. Access by remote terminal (e.g., CAP:SC and HELP/PLANTRAN, See Chapter III), or by physical transportation of large batches of data to time-sharing centers or service agencies is helpful in keeping the cost within the resource limits of most small colleges.

Procedural (Process) Models These applications of a systems approach (e.g., NACUBO/PBA and NLHE's Management and Planning Guide, See Chapter III) are probably a good starting place for most small colleges. The concept of a systematized planning cycle, program budgets, development and use of goals and objectives, participation of various segments of the college community in planning, establishment of evaluation procedures, and commitment to the principle of rational resource allocation are but a few of the benefits to be derived.

As the need for data collection and manipulation becomes greater and more complex, other systems techniques can be implemented.

Comprehensive Model As more of its products become available, the National Laboratory for Higher Education (NLHE) may be able to perform a valuable service. Institutions that

want a unified consultant and implementation service from a single organization may wish to select this approach.

Exchange Service The CAUSE program appears to be geared, at this point, to experienced systems users and developers. It has a great potential for the dissemination of systems information as well as the stimulation of new developments in the field.

Conclusions Regarding Implementation

The cost of implementing most of the systems reviewed in this study may be high for a small college with a limited budget. On the other hand, there are systems that can be afforded by almost any institution (e.g., NACUBO/PBA and some NLHE products, See Chapters III and IV) and some concepts and techniques of expensive models may be applicable in modified form at low cost (e.g., NCHEMS and CAMPUS, See Chapters III and IV).

Actual implementation costs tend to be higher than the estimates of the research and development centers and purveyors. This is especially true in initial presentations and general descriptions of management information systems. In addition to original purchase costs (if any are involved) and advertised direct and indirect costs, prospective users

should look for such things as: (1) "extra features" of the system which can be purchased at additional cost but might be essential to a functional implementation in a particular situation (especially with commercial systems, See Chapter III); (2) additional consultant fees necessary, or at least advisable, for adapting the system, organizing and collecting data, training personnel, updating the data base, maintaining the system, etc.; (3) additional on-campus personnel required; (4) equipment costs that include not only the obvious hardware, but also related technical and supportive machinery including desks, chairs, file cabinets, typewriters, calculators, etc.; (5) time spent by current full-time personnel at all levels which will "cost" in other work not done or additional personnel required at some later time as responsibilities expand; (6) space and special environmental conditions necessary for personnel and equipment; (7) travel and food costs related to orientation and training, examining other systems and implementations, and attending user's seminars and workshops. Other factors related to implementation (See Chapter IV) should also be considered.

It does not appear to be possible to develop a general guide for implementation costs based on a percentage of the total college budget for a year. The same system, implemented at similar costs could conceivably be suitable for small

colleges whose budgets vary from less than a million dollars to as much as eight or ten million. It is also possible, perhaps even likely, that the data available at a larger and more experienced institution might be found in a form more suited to system application than that of a smaller, undeveloped school. The result would be that implementation costs related to data collection and organization might be higher for the college with the smaller budget. Obviously, the type of systems functions and models selected will also affect the cost.

It appears, therefore, that estimates of implementation costs will have to be determined for each institution by being sensitive to some of the cost considerations outlined above (in this chapter) and in Chapter IV, and adding them to the announced costs.

Recommendations

The research as reported in Chapters III and IV, did not indicate that there is any one "perfect" system for small colleges. Each institution must analyze its own needs and then select a system which appears to be suited in design, purpose, and cost to its needs, resources, and level of development.

There are, however, some generalizations that can be made regarding certain models that may be particularly helpful at given points in an institution's development. For instance,

the use of a simulation model might be especially profitable for an institution facing a "crossroad" decision relating to one or more major policy changes. A planning group may want to project what effect such things as program changes, major capital expenditures, budget cuts, policy changes, and redefinition of procedures will have upon budget and other areas of the institution.

An institution interested in drawing together its faculty, students, and constituency, and in creating a goal consensus, might consider using the Institutional Goals Inventory package being tested by NLHE.

Another college may feel that its goals are clear and programs well planned, but that it has a need for better operational and control information. Such an institution would probably benefit from a study of existing MIS for operations models and either select one, or parts of several, or design its own.

Still another college may feel that its primary need is a better process for planning. It may want to select a process model, a data based model useful for cost/effectiveness analysis, a program budget system, or a program such as NCHEMS or CAMPUS which combines several of these functions.

The careful use of each of these products, especially when suited to an institutional need, might be expected to

assist in the creation of a more stable institution, greater openness to controlled change, an improvement in resource allocation decisions and the development of a general sense of confidence and feeling of security on the campus.

Another method of implementing a systems approach that may be particularly suitable to small colleges is the application of the concept, and some of the techniques, without the use of complex models and electronic data processing. For instance, a planning model could be created by determining the important factors related to analysis and planning and determining the relationships between them. The data base would then be hand collected, recorded, and organized. Projections could be created by paper and pencil computations and the use of desk calculators. The new electronic calculators are particularly well suited to this function.

As more detail, speed, and model complexity are desired and the approach proves to be cost effective, electronic implementation can be executed. The evolutionary approach may be best for colleges with limited funds and no pressing need for crossroad decisions (immediate plant needs, or major program and policy changes). Another advantage of this approach is that the administration, or director of institutional research, has the opportunity to assess commitment to

rational planning procedures and the concept of planned change. Both direct and indirect results can be assessed prior to substantial commitment of time, personnel, and funds to a full-blown application.

It probably would be advisable, however, to select a comprehensive model, such as NCHEMS/PMS or CAMPUS to be the goal of the evolutionary implementation. This overall structure could supply suggestions for factors to be manipulated manually, assist in the design of subsystems, and assure compatibility of early activity with later efforts. Some of the psychological considerations could also be identified, tested, and/or anticipated. These might include motivation to use the system, resistance to change, impact on faculty-student-administration communication, and general acceptance.

The general complexity of the field and the excessive claims of some vendors seem to suggest that a consultant be used for system selection unless a college's need for a particular type of system is very clear and they have the resources to implement the most comprehensive model of that type available. The average administrator, director of research, director of EDP, planning assistant, or educational development officer is not likely to have the sophistication to evaluate and assess the suitability to his institution of

an increasingly complex variety of systems models, programs, and services. An outside consultant, with an objective perspective, may be able to assist in the determination of specific institutional needs that can be satisfied by systems functions, the selection of the most suitable and economical model, the adaptation of the design (if necessary) to the specific institutional needs, the planning of related processes and procedures, the overseeing of implementation, and the training and orientation of personnel.

In light of the findings reported in Chapter III, it appears that a few recommendations might be in order for research and development centers.

Federally funded, foundation supported and university subsidized research and development centers have produced a wide variety of systems models, programs, and services. Some of these systems, or facets of them, appear to be suitable for use in small colleges.

One of the greatest needs, however, is that of field testing these products on small college campuses. The small schools, with limited resources, will probably be unable to risk the time, personnel, and funds necessary to "try" a sophisticated systems approach to college administration and planning. It will probably be necessary for them to feel that enough testing and on-campus use has taken place to give reasonable assurance that most of the snags have been removed,

and that the system has proven itself in terms of productivity, before their administrators recommend substantial commitments for systems implementation.

Aside from adaptation, general refinement, and field testing of the models available, one of the next most pressing needs of small colleges is the development of a viable design for a management information system for operations. This would satisfy the urgent need for organized, adequate, accurate, and quickly available information related to budget control, cash balances, student information, grades, alumni data, etc.

As noted in Chapter III, no MIS for operations was identified that would be suitable for most small colleges. There are some weaknesses in design, but the primary inhibiting factor is the cost of hardware, software, and implementation. If, however, a total structure is created that will permit an evolutionary implementation, most small schools could at least begin the process of installation. Obviously, the approach would have to be modular. This would permit implementation in priority areas and assure compatibility with later developments. It should also be paper, pencil, and desk calculator functional so that modules could be implemented without electronic data processing, if necessary.

Another effort of research and development which would appear to be of great help to small colleges is an overall

structure or design for an institution which incorporates all of the types of planning and management techniques available and suitable. A comprehensive, modular design of this type would have to be flexible enough to permit adaptation to individual institutional needs and to allow for the incorporation of new systems functions as they are developed. As with the evolutionary approach to an MIS for operations above, the design for a comprehensive system would provide a blueprint for segmented development. This will reduce fragmentation of effort and incompatibility of functions implemented at different times, in various departments, by different people and for different purposes. Depending on the environment and priorities, the institution could begin by implementing whatever function of the total design appeared to be most needed (such as MIS for operations, MIS for planning, simulation, or program budget) and then move to other areas as resources permitted.

A general impression received during the process of the research was that research and development centers and systems purveyors probably should be more careful to avoid excessive claims regarding the usefulness of their systems. Frequently, it is not as much what is said as what is not said. Prospective users are not, on the whole, very sophisticated in differentiating between various types and functions of systems, and yet only a few descriptions point out the weaknesses and

limitations of the system or explain that other desirable functions, performed by other products also called systems, are not performed by the particular model being described. In a relatively complicated field such as this, at this early stage of general development and use, and at a time when terminology is still, in large measure, in a state of flux, such efforts are necessary for clarification and fair representation if prospective users are not to be misled.

Excessive claims of vendors could impede the development of valuable tools and techniques. True systems theory, and a systems approach, is sobering and humbling as the user becomes increasingly aware of the ever expanding array of important factors involved in the system and its environment, their complex relationships, and the ever changing nature of the phenomena.

In a broader sense, a more difficult task of clarification and improved communication will also have to be undertaken soon, i.e., a more careful use of general systems theory terminology in educational systems application. One problem is that the discipline of general systems theory is not yet well enough established to give leadership in this effort. However, a greater problem appears to be the tendency of model designers (library, admissions, etc.) to use the term "system" for any segment of activity without considering the total system.

Implications

This section of the chapter is an attempt to express some ideas that appear to the writer to be implications of the review of the literature and findings contained in this report. In addition, some of the ideas are based on general impressions received by the researcher in the process of almost two years of study in the field and goes beyond the material reported in earlier chapters.

Effects of a Systems Approach During the process of the research, several apparent results or potential byproducts of systems implementation were reported or claimed in the literature, reported or anticipated by researchers and practitioners, and observed by this writer. Most of the eighteen items go beyond the scope of the findings reported in Chapters III and IV. Many of these practical, observable effects may occur even if the particular system implementation is not as successful as had been hoped. Many are "Hawthorne effect" phenomena, but others are more direct benefits of a systems approach:

1. Identifies and clarifies institutional goals and objectives;

2. Encourages focus of programs and activities on goals and objectives because of pressure to become analytical;

3. Enhances general communication through the committee work and general interaction between various segments of the

college community that is inherent to most systems;

4. Improves feeling of participation in decision-making which tends to upgrade morale and productivity;

5. Provides, through the planning group, a funnel for innovative ideas from all areas of the institution;

6. Increases probability of identifying potential problems and blind spots before they become excessively disruptive;

7. Maintains or increases institutional development and general viability;

8. Encourages consideration of long-range goals;

9. Encourages an attitude of planning in all areas and levels of the institution;

10. Encourages the development of new techniques of data collection, measurement, and analysis;

11. Increases program efficiency and effectiveness;

12. Creates constituency confidence in the operations and procedures of the institution;

13. Precipitates evaluation, even if a particular plan or model is not especially successful;

14. Decreases the reactionary tendency of decision-making during crisis periods;

15. Increases sensitivity to the importance of social, psychological, and political factors in educational and managerial policy and procedures;

16. Produces personnel satisfaction and confidence by conveying the feeling "we know where we're going or at least we're systematically trying to find out;"

17. Encourages the development of an organizational structure that parallels current operation;

18. Encourages the development of organizational and managerial theory and practice.

College Interest Colleges have shown an interest in these new management techniques. In 1972, over fifty small institutions wrote proposals requesting participation in a Title III project of systems implementation. The project was sponsored by The Council for the Advancement of Small Colleges, and the number of responses represented almost one half of the member institutions.

In the same year, almost 1,000 college and university administrators attended a three day forum on systems models which was held in Denver, Colorado.

Funding Private foundations have been supporting the development of small college techniques for several years (e.g., CAP:SC and NACUBO/PBA) and now the federal government is beginning to show an increased interest in this support (E.G., NCHEMS/SCDP and Title III, "Developing Institutions" Project).

In order for some of the more sophisticated approaches to be tested on small college campuses, it will probably be necessary for the federal government to expand the subsidy of implementation costs. Funds may also be available to individual colleges, or consortia, from foundations and private donors who have an appreciation for the use of planning and information systems in business and industry.

Perhaps the responsibility is beyond the duties of research and development centers, but they probably could be of substantial help to individual small colleges and consortia in raising funds for systems implementation. Sources might be federal, private foundations, and/or industry. The stature and stability of the research and development center, testimonials from other clients, and skill in presentation could all be used to increase the likelihood of grants.

Continued Developments in the Field Another general observation is the continuation of the development of the field, including the development of new techniques and the evolution of existing systems. The perfect model has not been developed and probably will not be. As organizations and their environment change in regard to structure, purpose, and program, the management tools must be altered to suit new needs. Therefore, the flexibility of any system and the development and testing of new models is very important.

The Preparation of Administrators There appears to be an increasing need for specialists in this field. New positions are opening in research and development centers, as Directors of Institutional Research, Planning Assistants, and Educational Development Officers on campuses, as teachers in departments of educational administration with a speciality in these new management sciences, in commercial firms which are developing, selling, and installing new models, and as consultants to research and development centers, colleges, and consortia.

In addition to the preparation of specialists, it may be increasingly profitable for all administrators to understand, in a general way, the systems approach and be cognizant of the related techniques that are available.

Departments of educational administration may find it desirable to develop courses and programs in these areas so that prospective administrators are at least familiar with the field and prepared to stimulate and encourage the use of new systems related management tools, if not adopt and implement a comprehensive systems approach themselves.

In-service, or continuing education programs, may also be helpful to incumbent administrators. Many higher education executives, of small colleges in particular, have had no training in administrative theory and practice. A study of the systems approach permits and encourages consideration of general

administrative theory and management practice as well as information about specific tools and techniques which would be a good basis for an in-service program.

The Need for Systems in Small Colleges A final impression is that without systematic planning procedures and rational decision-making, based on adequate data organized in a functional manner, small colleges are probably not going to be able to resolve the complex problems of the seventies. Without a clear purpose and efficient programs designed to achieve their goals and objectives, they are likely to continue to drift into the mold of larger institutions in whose patterns they may not be able to perform as well. There is substantial support for the opinion that small institutions have a place in American higher education, but they will have to find and maintain that place by self-analysis, sensitivity to their environment and constituency, altering institutional purposes and programs, where necessary, and systematically planning so as to match their activity with the resources available.

Suggestions for Additional Research

Within the systems approach one of the greatest needs is that of identifying, describing, measuring, and comparing "outcomes." The question of what is desirable and what is "quality education" according to the purpose of any one

particular college will probably have to be developed and implemented by the institution itself. It is likely that a college could be helped and encouraged in these efforts, however, if suggestions could be made. Perhaps the alternatives available could be catalogued, or at least illustrations presented of what constitutes an institutional purpose, or how to discover it, how to develop goals and objectives, how to develop programs and activities to achieve these goals and objectives, and suggest methods for measuring and evaluating the results. It is impossible to evaluate and adjust the processes of a system if you cannot evaluate its products. Current means of measuring output, i.e., number of courses taught, number of students, and degrees granted, are inadequate. Some identification and testing of ways to measure behavioral change resulting from exposure to college programs is necessary.

The relationship of a college system to its environment is another facet of the systems approach which needs research. Is it possible to develop or identify measures of the environment which will assist in predicting available resources, demands on the institution, requests for services, and potential competition and/or duplication of services?

A study of subsystem models may prove to be valuable. In the process of the research for this report, many special purpose models were noted. Their purposes and functions included:

library services, alumni information, student personnel information, accounting, physical plant planning and maintenance. A survey which catalogs and categorizes these models would be not only of assistance to potential users who have a priority need for their specialized functions, but could also be of value as components of a still-to-be-developed comprehensive system.

An important factor in the application of a systems approach is a master plan for an MIS for operations and a comprehensive MIS (just as institutions have a physical plant master plan so that new buildings fit in at the correct time and place) so as to avoid continued fragmentation of the data base. This approach, of course, requires an overall design that will accommodate modular implementation, be available at a reasonable cost (to the small college), and be suitable to moderately priced hardware. Such a model was not discovered during the research.

There is an apparent need for research into suitable methods for applying cost analysis methods to the use of systems models, programs, and services themselves. After the initial excitement of development and testing is over, the hard, cold question must be asked, "what benefits do we receive from using this system?" Cost/benefit techniques should be developed and applied to assist administrators in making this assessment.

Study is also needed on the actual effects of a systems approach, and the use of systems related techniques on a campus. How does it affect communication, planning procedures, decision-making, efficiency, goal clarification, morale, staff involvement, and outcomes? It may also be valuable to relate the findings of a study of this type to planning and management theory.

Amalgamation and Catalysis

An impression received during the process of the study is that perhaps the greatest single value inherent in the application of systems theory in educational administration in general, and to small private colleges in particular, does not lie in any one theoretical concept or sophisticated new technology. If a systems approach can permit and encourage the synthesis and generalization of various theoretical concepts that result in their having a greater impact on administrative behavior, it will have performed a valuable service.

Systems theory shows signs of being just such a theoretical framework for such varied concepts as process, change, planning, individual and group dynamics, communication, efficiency, effectiveness, productivity, accountability, responsibility, and democracy. Through common systems language, theoretical concepts from other disciplines can also be more easily related. Such heterogeneous (or at least previously considered to be so)

areas as economics, psychology, social psychology, engineering, curriculum theory, architectural and urban planning, educational measurement, finance, learning theory, information sciences, library science, and mathematics gain broader understanding and application from each other.

In addition to the potential for theoretical blending, this study has emphasized the coordination and combination of practical technologies and procedures in a systems approach to college administration. Instead of technical and specialist elites working on their projects in relative isolation, their efforts are integrated into and influenced by the overall goal of the institution and the efforts of other units of the organization.

Not only does a systems approach encourage a synthesis of existing activity and thought, but it tends to precipitate additional effort supportive to the system. Acting as a catalyst in the environment, and between existing units and components, it encourages change and innovation without being a tangential influence or producing excessively disruptive byproducts.

At the same time, a systems approach is flexible and sensitive to uniquely human elements. No model will ever be conceptually comprehensive enough, and sophisticated enough in function, to take into account all factors and dynamics.

Creative people can, and must, exercise judgment, identify new alternatives, create new systems and components, interact with the system, determine goals and objectives, and control the ethos of the system. In the systems approach resides an apparent potential for the individual, particularly the administrator, to discover his place and function in the system, and to find release from mundane and tedious procedures. He is stimulated to contribute his uniquely human and professional input in a manner that can increase the efficiency and effectiveness of the ever changing system of which he is a part.

The systems approach, its related technology, and its synthesis with the process of administration and planning is not only a stimulating and challenging theoretical exercise but it gives every indication of being a valuable conceptual and practical framework for attitudes and procedures that are essential to the optimization of the efforts of institutions of higher education. Even if this approach does not live up to the high expectation of its advocates, its implementation is likely to foster healthy communication and research, perhaps becoming the stepping stone to an even better approach.

APPENDIX A

The following people were especially helpful in carrying out this study. They supplied encouragement, information, advice and technical know-how by letter, telephone, and in personal interviews. Their commitment of time, energy, skill, experience and wisdom were invaluable.

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