DOCUMENT RESUME

ED 047 648 | 24 | HE 002 026

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TITLE	The Resource Requirements Prediction Model 1 (RRPM-1): An Overview.
INSTITUTION	Western Interstate Commission for Higher Education, Boulder, Colo.
SPONS AGENCY	Office of Education (DHEW), Washington, D.C. Bureau of Research.
REPORT NO	TR-16
BUREAU NO	BR-8-0708
PUB DATE	Jan 71
CONTRACT	OEC-0-8-980708-4533 (010)
NOTE	37p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	*Computer Oriented Programs, Costs, Decision Making, Educational Planning, *Higher Education, *Management Systems, Models, *Planning, *Resource Allocations
IDENTIFIERS	*Resource Requirements Prediction Model

ABSTRACT

This paper provides a brief overview of the conceptual approach used in the initial version of the WICHE Resource Requirements Prediction Model (RRPM-1). RRPM-1 is an institutional-oriented, computer-based model which simulates the cost of operating a college campus over a 3- to 10-year time frame. The model may be viewed as a management tool to assist higher education decisionmakers in understanding the long-range resource implications of planning decisions. This report presents information on (1) the role of RRPM, (2) design criteria, (3) model selection, (4) a generalized model, (5) The RRPM system and the dimensions of the RRPM-1 system, (6) computational flow, (7) projected unit costs, (8) projected degree-winner cost, (9) new construction costs, (10) the pilot test, and (11) future developments. A bibliography concludes the report. (AF)

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Technical Report 16

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Planning and Management Systems Division
Western Interstate Commission for Higher Education

WICHE

The Western Interstate Commission for Higher Education (WICHE) is a public agency through which the 13 western states work together

. . . to increase educational opportunities for westerners.

. . . to expand the supply of specialized manpower in the West.

. . . to help universities and colleges improve both their programs and their management.

. . . to inform the public about the needs of higher education.

The program of the WICHE Planning and Management Systems Division was proposed by state coordinating agencies and colleges and universities in the West to be under the aegis of the Western Interstate Commission for Higher Education. The Planning and Management Systems Division program proposes in summary:

To design, develop, and encourage the implementation of management information systems and data bases including common data elements in institutions and agencies of higher education that will:

- provide improved information to higher education administration at all levels.
- facilitate exchange of comparable data among institutions.
- facilitate reporting of comparable information at the state and national levels.

WICHE PLANNING & MANAGEMENT SYSTEMS PROGRAM

THE RESOURCE REQUIREMENTS PREDICTION MODEL (RRPM-1): AN OVERVIEW

By
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The WICHE Planning and Management Systems Program is supported by the U. S. Office of Education, National Center for Educational Research and Development, Division of Higher Education Research.

PLANNING AND MANAGEMENT SYSTEMS DIVISION
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January 1971

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ACKNOWLEDGMENT

The RRPM system has been developed as a result of the contributions of many individuals and institutions. We are particularly grateful to the original design group (see Appendix 1) and the current RRPM-1 Task Force (see Appendix 2) for their many fine contributions to the project. The initial design of RRPM-1 was developed by Mathematica of Princeton, New Jersey under the direction of Dr. Norman I. Agin and Mr. Roger L. Sisson. We are indebted to Dr. George B. Weathersby for his work in the original conceptualization and subsequent efforts in the development of RRPM-1.

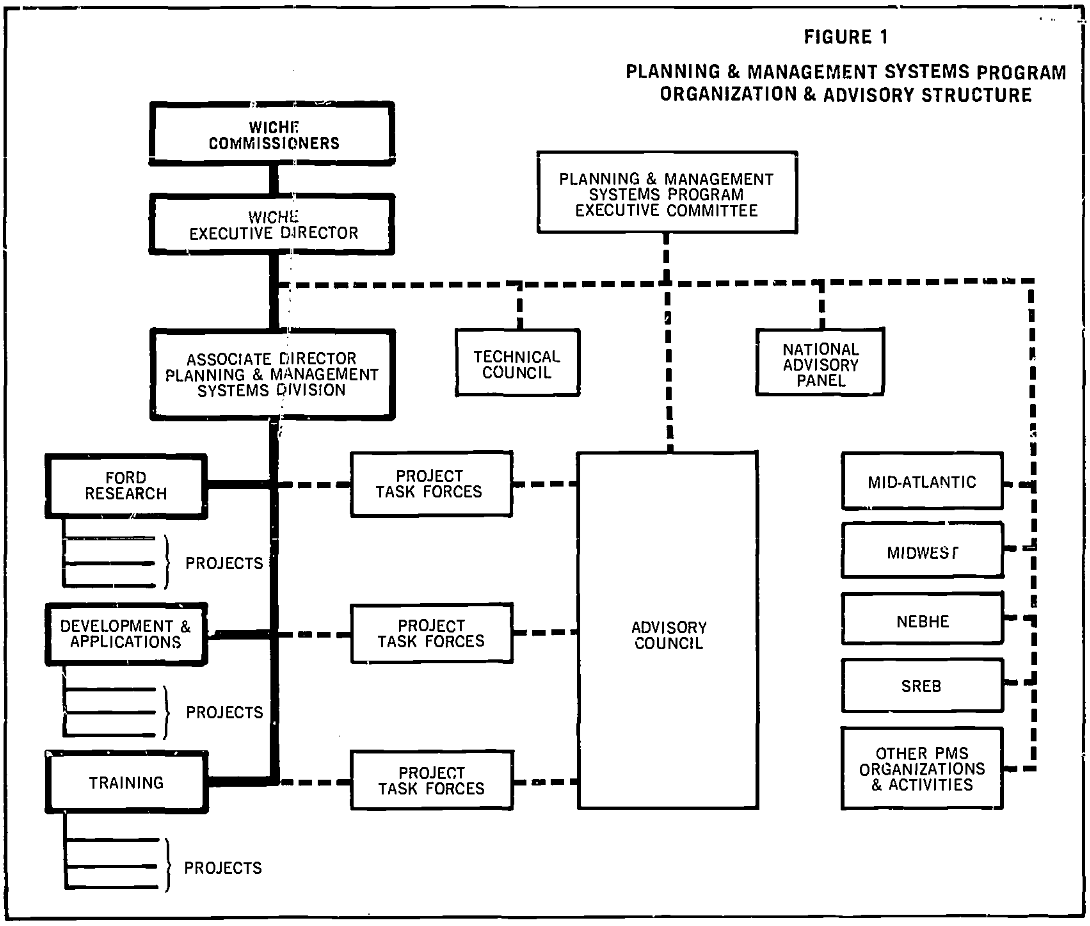
The prototype system (Version 1.2) currently under development was designed and programmed by Mr. James S. Martin of our staff. The revised Report Module was designed and programmed by Mr. Charles R. Thomas, PMS Program Associate for Information Systems.

RESOURCE REQUIREMENTS PREDICTION MODEL (RRPM-1): An Overview[1]

Introduction

This paper has been developed to provide a brief description of the conceptual approach used in the initial version of the WICHE Resource Requirements Prediction Model. This model is currently under development by the WICHE Planning and Management Systems staff and a number of cooperating institutions. The level of presentation is targeted at the non-technical user in an effort to provide advance information regarding the prototype model.[2] A detailed description of the computer routines and associated mathematics will be made available upon completion of design and testing of the prototype model.

The WICHE Planning and Management Systems (PMS) Program is a cooperative undertaking of over 500 institutions and agencies to develop new management technologies for higher education. The basic support for the program is provided by the U. S. Office of Education. The Resource Requirements Prediction Model is one of a number of projects within the Development and Applications unit of the program. Figure 1 is a chart of the PMS program organization and advisory structure.



[1]Based on a paper of the same title presented to the Eleventh American Meeting of the Institute of Management Sciences (TIMS), Los Angeles, California, October 1970.

[2]The description of the Resource Requirements Prediction Model is based on version 1.2 of the prototype model currently under development.

Background

The increasing student demand for higher education combined with rising operating costs has intensified the need for long-range planning in both public and private institutions. The imbalance that often exists between decision requirements and available information is becoming evident as educational resources grow increasingly scarce and the demand for services expands. In order to provide information which will aid in making decisions regarding long-range planning, it is apparent that the analytical tools for management science must play a larger role in the management of American colleges and universities.

For any single institution, the development of analytical models (particularly large-scale simulation models) is a difficult and costly task. Although a number of sophisticated cost simulation models for higher education have been developed and operated using experimental data for testing and research purposes, these models have not been widely implemented to operational levels in institutions of higher education for several practical reasons:

1. Existing demands on the institutional staff and the lack of sufficient resources for internal management applications prevent any serious attempt at such implementation.

2. Simulation models in higher education are not sufficiently proven at this time to warrant a level of confidence sufficient to persuade administrators to change their current methods of budgeting and planning. In fact, developers of analytical models would insist that such models may not be useful for current year applications until they have been operational within an institution for some time. Consequently, when analytical models are eventually implemented within an institution, such implementation will be parallel to the existing system. Only as models become fully operational will the old system be supplemented by the new system.

3. The various costs of implementation are such that many institutions question the value of implementing an unproven model. They prefer to wait for results from other institutions before launching into their own program.

For these and other reasons, the use of simulation models in higher education is not widely accepted. In an effort to overcome these problems, the participating institutions of the WICHE Planning and Management Systems (PMS) Program requested that the staff undertake the development of analytical models which will aid the decision-maker in higher education in evaluating current operations and in analyzing future resource allocations.

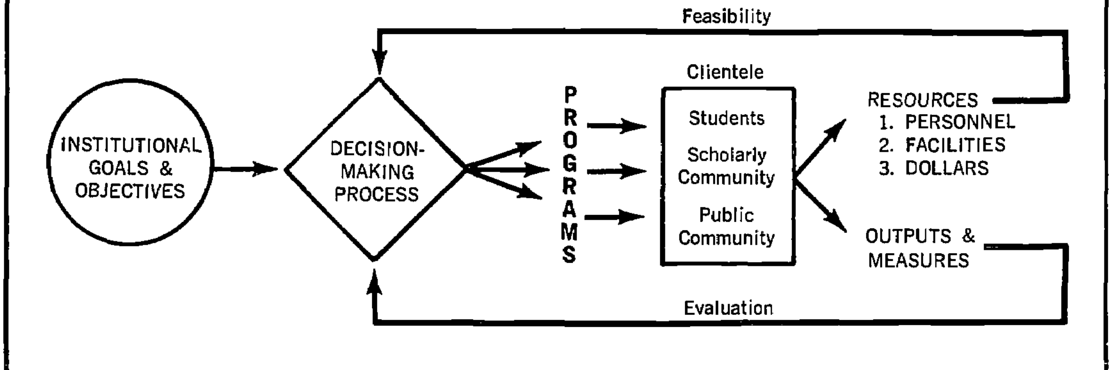
This paper provides a brief overview of the first of these models, the initial Resource Requirements Prediction Model, referred to as RRPM-1. RRPM-1 is an institutional-oriented, computer-based model which simulates the cost of operating a college campus over a three to ten year time frame. The model may be viewed as a management tool which will assist higher education decision-makers in understanding the long-range resource implications of planning decisions.

The Role of RRPM

The RRPM system is a long-range planning model designed to aid higher level management in rapidly determining the resource implications of alternative policy and planning changes. Figure 2 provides one way of viewing the planning cycle in higher education. This particular representation characterizes the planning cycle as a closed loop. The determination of where an institution starts or initiates the planning cycle depends in large part upon the nature of the institution.

In general, higher education programs are devised to serve the clientele of the institution: the students through instructional programs, the scholarly community through research programs, and the public community through public service programs. Associated with each set of program activities are the resources required to establish and operate the program, and the outputs and measures of contribution to the objectives of the program. Since higher education operates with scarce resources, the outputs of each program must be evaluated with regard to the resource requirements in terms of the feasibility of providing the resources. This requires trade-offs between both the number of programs and their scale of operation.

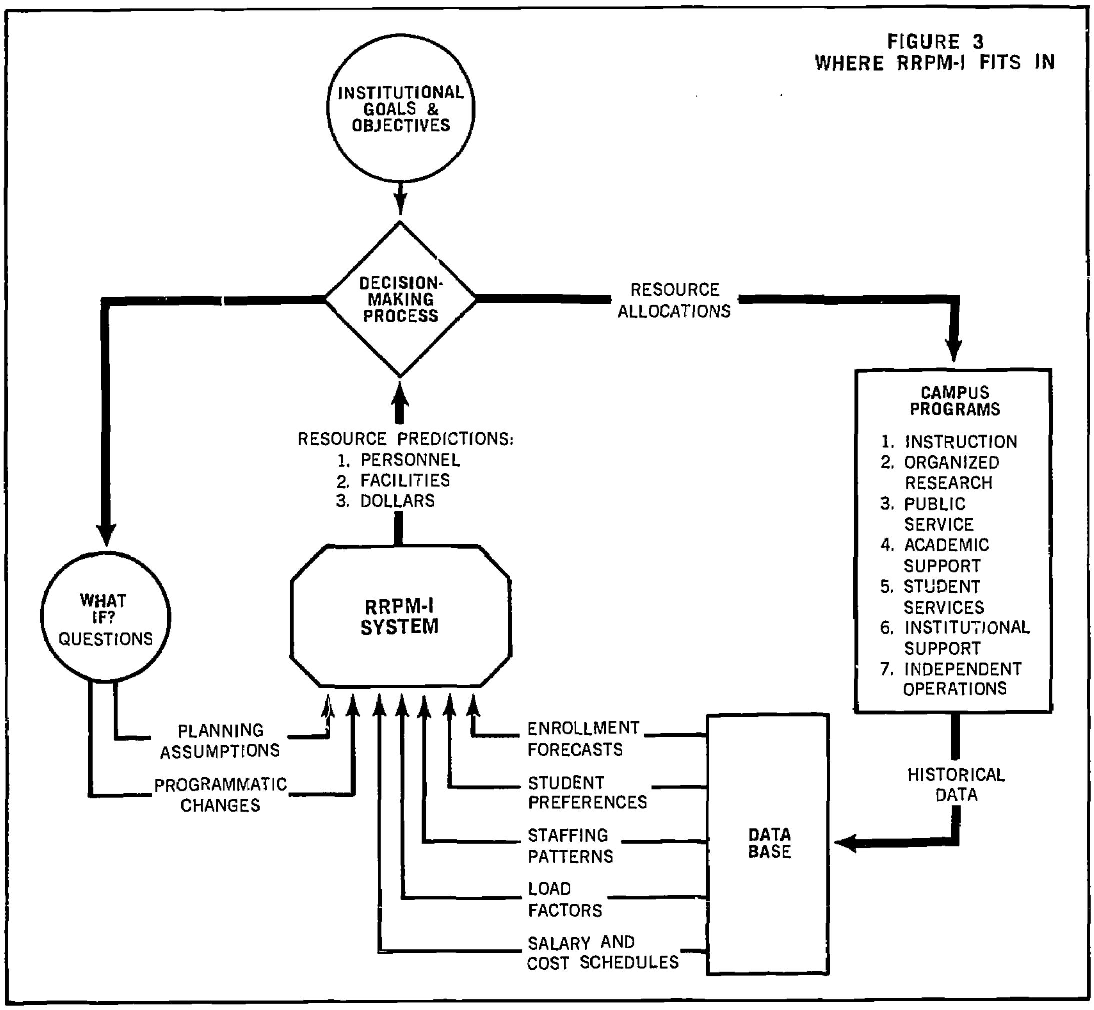
FIGURE 2
A REPRESENTATION OF THE PLANNING CYCLE



In a planning sense, this process is iterated until a set of programs are designed which collectively provide the maximum benefits in terms of the goals and objectives of the institution within the set of resources available. Given this particular view of the planning cycle, the RRPM system provides a mathematical conversion of program activity to resource requirements. The RRPM is designed to aid decision-making by providing quantitative estimates of the total set of resource requirements for the institution.

A more detailed view of where RRPM-1 fits in the planning and decision-making process is described in Figure 3. The institutional decision-making process determines the resource allocation to campus programs based on the institutional goals and objectives. The operations of each program provides historical data regarding the scale of activity and resource requirements of the various programs. 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 on student preferences, staff and facility loading factors, salary and various other cost schedules as inputs to the system.

FIGURE 3
WHERE RRPM-I FITS IN



The decision-maker, in attempting to balance the institution's programs against the resources available, asks a number of "what if?" questions. The "what if?" questions are reflected in terms of planning assumptions and programmatic changes which modify the historical data from the data base. The RRPM-1 system uses this data to compute resource predictions in terms of personnel, facilities, and dollars as an aid to the decision-making process.

Examples of the type of "what if?" questions which can be addressed in terms of resource implications using the RRPM-1 include the following:

1. What if a specific change is made in the mix of students either by degree program or by level or both?

2. What if a change is made in the instructional techniques; e.g., independent study versus classroom study, classroom activities versus laboratory activity? How does such a change influence the resource requirements over an extended time frame?

3. What if a specific new program is added, or a current program is dropped? What are the resource implications for the total institution resulting from these types of changes?

4. What if a change is made in the mix of faculty conducting an instructional activity; e.g., substituting, say, tenured faculty for graduate assistants?

5. What if a major change is made in the faculty's salary schedule?

6. What if a change is made in the average faculty load?

7. What if changes are made in the staffing ratios of support staff to faculty?

8. What if a change is made in the average section size, either across the board or in specific instructional programs? What implications will such a change have for both facility requirements and faculty resources?

9. What if programmatic changes are made in instruction, research, or public service programs? What additional administrative requirements result from such changes?

10. What if changes are made in the mix of the student body? What resource implications will such changes have on, say, library resources?

The resource implications of questions such as these and others may be answered in an aggregate manner through the use of the RRPM-1. Clearly, there are other subjective implications which reflect upon the quality and scope of operations. The state-of-the-art in modeling has not advanced sufficiently to deal in a quantitative manner with this aspect of planning and programmatic changes. However, the ability to rapidly compute the resource implications of alternative policies permits the examination of a larger set of alternatives and will, hopefully, lead to a more ordered and structured consideration of the subjective aspects of higher education.

The sections following provide a description of the developments leading up to the current version of the Resource Requirements Prediction Model and a brief overview of how the model operates.

Design Criteria

During the summer of 1969, the PMS staff, along with an advisory design group[3], reviewed a number of cost simulation models which had been designed for use in institutions of higher education.[4] The purpose of the review was to determine if it was possible to build upon previous work to develop a generalized simulation model. The review of the various simulation models proved helpful in specifying the design criteria for the initial version of the Resource Requirements Prediction Model, RRPM-1. These criteria were described in terms of:

a. Complexity of design
b. Data requirements
c. Machine core requirements

It was determined that the design of the initial version of the Resource Requirements Prediction Model, RRPM-1, should be a relatively straightforward approach in order that the model might be comprehended easily by executive level administrators of higher education. The model should be designed to assist decision-making for long-range planning at the campus level and would not be required to produce extemely detailed analysis such as specific course data.

Although detailed analysis is desirable, it was the opinion of the advisory design group that many of the WICHE PMS participating institutions were lacking the capability to provide the data necessary for such analysis. Further, there was some question as to the capability of the institutions to utilize (and analyze) detailed course information at this point in time. Thus, it was determined that the initial version of the model, RRPM-1, should be based on a scheme which minimizes the data required to drive the model.

A preliminary survey of computer capacity at participating institutions indicated that a majority of institutions participating in the PMS program would not have the capability of operating a large-scale simulation model which required an extensive detailed data base and a very large computer installation. Therefore, it was determined that RRPM-1 should be sufficiently small to fit on a majority of computer installations in operation at participating institutions.

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[3]The RRPM-1 advisory design group is listed in Appendix I.

[4]For a recent comprehensive review of such models see George B. Weathersby and Milton C. Weinstein "A Structural Comparison of Analytical Models for University Planning." Ford Research Program monograph paper p. 12, Office of the Vice President, Planning and Analysis, University of California, Berkeley, California, August 1970.

The final design criteria suggested by the design group was that the RRPM system be developed in a modular fashion (i.e., consisting of discrete units) in order to facilitate modification and the incorporation of improvements. The first version of the Resource Requirements Prediction Model, RRPM-1, would be concerned primarily with simulating the cost of the instructional function in higher education, later versions would deal with disaggregated data and detailed simulation of the research and public service functions.

Model Selection

Perhaps the best known generalized model available in 1969 was the CAMPUS V model developed at the University of Toronto by the Systems Research Group.[5] The WICHE PMS program has given extensive consideration to the design of the CAMPUS V routines into a RRPM system. The advisory design group also considered other higher education simulation models, including the Koenig model at Michigan State[6], Peat, Marwick & Mitchell's CAP:SC (Computer-Assisted Planning for Small Colleges)[7], and the Cost Simulation Model at the University of California[8].

In light of the design criteria for the initial version of the Resource Requirements Prediction Model: (a) a straight-forward conceptual approach, (b) minimum data requirements for executive-level planning decisions, and (c) the capability to operate on a medium-scale computer system; it was determined that RRPM-1 would be based upon Weathersby's conceptualization as utilized in the Cost Simulation Model at the University of California. The initial work on RRPM-1 was conducted by Mathematica of Princeton, New Jersey, under contract to WICHE.

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[5]"A WICHE Co-ordinated Project to Implement CAMPUS Integrated with the WICHE Data Elements in Four Representative Pilot Institutions," Systems Research Group, Toronto, Canada, October 1969.

[6]H. E. Koenig, M. G. Keeney, R. Zemach, A Systems Model for Management Planning and Resource Allocation in Institutions of Higher Education, Division of Engineering Research, Michigan State University, East Lansing, Michigan, September 30, 1968.

[7]"Computer-Assisted Planning for Small Colleges" Project Report - Phase I, Peat, Marwick, Mitchell & Co., Peat, Marwick, Livingston & Co. May 15, 1969.

[8]George Weathersby, "Development and Applications of a University Cost Simulation Model," An unpublished monograph, University of California, Berkeley, California, Office of Analytical Studies, June 15, 1967.

A Generalized Model

It is thought that the development of a single generalized model for use by many institutions can be undertaken at a relatively low unit cost. Previously, the development of generalized models has been restricted due to the numerous data systems in higher education and the need to tailor a model to the unique structure of each institution. The RRPM system is designed around the WICHE Program Classification Structure: Preliminary Edition[9] which will serve as the common language of information exchange for the WICHE Planning and Management Systems (PMS) Program. By utilizing the Program Classification Structure it is now possible to design a generalized model on the basis of a common format, since each participating institution will develop a set of transformation procedures to allow a crossover from institutional-oriented data (structured to fit the unique organization of the institution) to a common WICHE PMS format. It is anticipated that the use of these transformation or crossover procedures will eliminate many of the compatability problems usually associated with generalized models. The data output from each institution's transformation procedure will be in accordance with the Program Classification Structure format, thereby allowing the design of a generalized program which may be used by all participating institutions.

The RRPM System

The RRPM system is a set of generalized computer routines which may be used to simulate mathematically the resource requirements associated with operating an institution of higher education for a specified period of time. It is designed to be used as a long-range planning aid, estimating future resource requirements and relevant data for three to ten years beyond current data. The initial version, RRPM-1, is concerned primarily with estimating the resources necessary to support a given number of students subject to a set of constraints and decision parameters defined by the institution. Input to the model is based on an analysis of the institution's historical data as modified by the judgment of the institution's administrators.

Input requirements are structured to be compatible with the WICHE Data Element Dictionary[10] and the Program Classification Structure. Output from the model will generate various reports suitable for management analysis and comparison of alternative resource allocation decisions with provisions to accommodate institutional unique reporting requirements. The output is also compatible with the Program Classification Structure.

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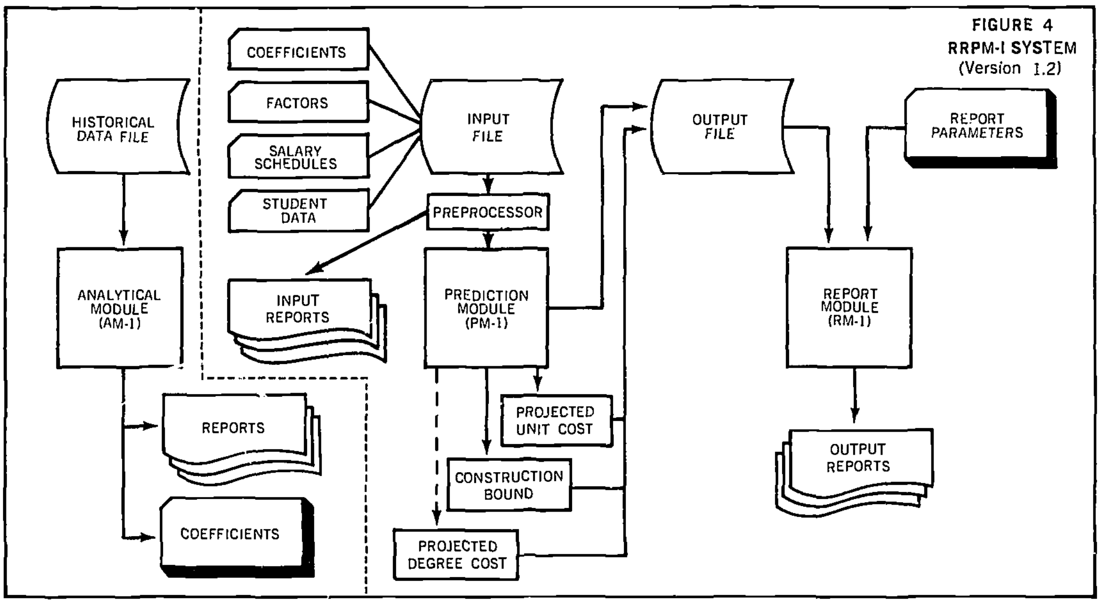
[9]Warren W. Gulko, Program Classification Structure: Preliminary Edition, Boulder, Colorado: Western Interstate Commission for Higher Education, June 1970.

[10]Charles R. Thomas, Data Element Dictionary: Students, Staff, Facilities, Course, Finance, First Editions. Boulder, Colorado: Western Interstate Commission for Higher Education, Febrary 1970.

Figure 4 is a diagram of the overall RRPM-1 system which demonstrates the basic modular approach used in RRPM. The Analytical Module (AM-1) is a FORTRAN regression package based on the ECON multiple regression routines with a Bayesian regression option. The AM-1 consists of a set of statistical routines designed to assist users in determining the coefficients for the estimation equations used in the Prediction Module (PM-1). Routines in the AM-1 may be used to analyze the institution's historical data file to determine the best form of the estimation equations to be used and the associated coefficients. An output deck of the coefficients to be used for the Prediction Module is produced by the AM-1 along with a set of reports to assist the user in the analysis of these coefficients.



AM-1 was developed by Steve Robinson of Mathematica, under contract to WICHE to provide a statistical package for institutions to use if similar routines are not available. However, it is likely that the institution's analyst will have access to a statistical package with which he is familiar and will prefer to use his own analytical module. For this reason, AM-1 is considered to be a distinct and separate portion of the RRPM-1 system.

The coefficients produced by the Analytical Module or similar statistical package[11] (suitably modified by the user) along with estimating factors, salary schedules, and various student data are collected in an input file which provides the necessary data to drive the Prediction Module (PM-1). The input file is passed through a COBOL Preprocessor which checks the data for validity, consistency, and completeness. The Preprocessor produces a set of input reports including diagnostics of the input file.

The PM-1 is a set of FORTRAN routines which estimate the resource requirements for each of the institutional activities as described by the Program Classification Structure. The resource requirements data is collected in a data

[11]Note that for some applications, the PM-1 may be operated by using subjectively derived coefficients.

output file along with information related to the projected unit cost of instruction, the estimated new construction data, and (optional) projected cost per degree-winner.

The Report Module (RM-1) is a COBOL program which reads data from the output file and produces the various reports as specified by the user through report parameters.

Dimensions of the RRPM-1 System

The standard dimensions of the RRPM-1 system fall into nine basic categories:

a. 30 Campus Activities (programs and sub-programs)
b. 33 Discipline Categories (HEGIS)
c. 3 Instruction Types
d. 5 Course Levels
e. 7 Student Levels
f. 80 Student Fields of Study (student major)
g. 6 Academic Staff Ranks
h. 4 Nonacademic Staff Ranks
i. 22 Space Types

The dimensions are set at what are deemed to be reasonable maximums for the purposes of the model. However, the limits may be modified for specific institutional applications. These various standard dimensions of the RRPM-1 are described briefly in the following paragraphs.

FIGURE 5
PROGRAM CLASSIFICATION STRUCTURE NOMENCLATURE

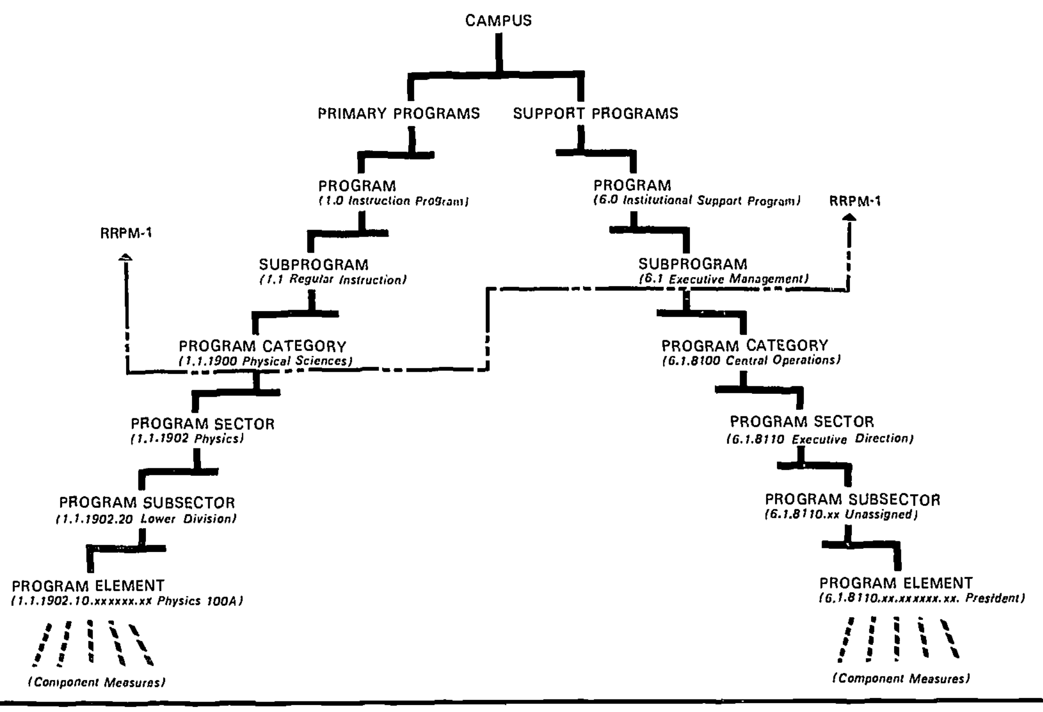


Figure 5 shows the various levels of data aggregation in the Program Classification Structure and the level of detail used in RRPM-1. The

FIGURE 6

RRPM-I STANDARD DIMENSIONS

CAMPUS ACTIVITIES: PRIMARY PROGRAMS

INSTRUCTION

1.1 REGULAR
 •DISCIPLINE CATEGORY
1.2 SPECIAL SESSION
 •DISCIPLINE CATEGORY
1.3 EXTENSION (for credit)
 •DISCIPLINE CATEGORY
1.4 EXPERIMENTAL
 •DISCIPLINE CATEGORY

ORGANIZED RESEARCH

2.1 INSTITUTES & RESEARCH CENTERS
 •DISCIPLINE CATEGORY
2.2 INDIVIDUAL OR PROJECT RESEARCH
 •DISCIPLINE CATEGORY

PUBLIC SERVICE

3.1 DEPARTMENTAL CONTINUING EDUCATION
 •DISCIPLINE CATEGORY
3.2 ORGANIZED EXTENSION CONTINUING EDUCATION
 •DISCIPLINE CATEGORY
3.3 ORGANIZED EXTENSION COMMUNITY SERVICE
 •DISCIPLINE CATEGORY
3.4 CAMPUS COMMUNITY SERVICE
 •DISCIPLINE CATEGORY
3.5 AGRICULTURE EXTENSION SERVICE
 •DISCIPLINE CATEGORY

FIGURE 7

RRPM-I STANDARD DIMENSIONS

CAMPUS ACTIVITIES: SUPPORT PROGRAMS

ACADEMIC SUPPORT

4.1 LIBRARIES
4.2 MUSEUMS & GALLERIES
4.3 AUDIO/VISUAL SERVICES
4.4 COMPUTING SUPPORT
4.5 ANCILLARY SUPPORT

STUDENT SERVICE

5.1 SOCIAL & CULTURAL DEVELOPMENT
5.2 SUPPLEMENTARY EDUCATIONAL SERVICE
5.3 COUNSELING & CAREER GUIDANCE
5.4 FINANCIAL AID
5.5 STUDENT SUPPORT

INSTITUTIONAL SUPPORT

6.1 EXECUTIVE MANAGEMENT
6.2 FINANCIAL OPERATIONS
6.3 GENERAL ADMINISTRATIVE SERVICES
6.4 LOGISTICAL SERVICES
6.5 PHYSICAL PLANT OPERATIONS
6.6 FACULTY & STAFF SERVICES
6.7 COMMUNITY RELATIONS

INDEPENDENT OPERATIONS

7.1 INSTITUTIONAL OPERATIONS
7.2 OUTSIDE AGENCIES

RRPM-1 provides data to the program category level for the primary programs (excluding 3.5, Agricultural Extension Service) and to the subprogram level for the support programs. The program category level for primary programs in the Program Classification Structure equates to the HEGIS discipline categories listed in Figure 8. The subprogram level for support programs is equivalent to the campus activities listed in Figure 7.

Figure 6 lists the campus activities or subprograms for the three primary programs of the Program Classification Structure[12] used in RRPM-1; i.e., the Instruction Program, Organized Research Program, and Public Service Program. The data is simulated at the discipline category level for the primary programs. Figure 7 lists the campus activities or subprograms within the model for the four support programs. Although thirty subprograms are indicated, very few institutions have significant activity in every one of these areas. Thus, it is anticipated that most institutions will wish to reduce the number of subprograms to that which is consistent with institutional operations.

FIGURE 8

RRPM-I STANDARD DIMENSIONS

DISCIPLINE CATEGORIES

HEGIS DISCIPLINES*

1. AGRICULTURE AND NATURAL RESOURCES
2. ARCHITECTURE AND ENVIRONMENTAL DESIGN
3. AREA STUDIES
4. BIOLOGICAL SCIENCES
5. BUSINESS AND MANAGEMENT
6. COMMUNICATIONS
7. COMPUTER AND INFORMATION SCIENCES
8. EDUCATION
9. ENGINEERING
10. FINE AND APPLIED ARTS
11. FOREIGN LANGUAGES
12. HEALTH PROFESSIONS
13. HOME ECONOMICS
14. LAW
15. LETTERS
16. LIBRARY SCIENCE
17. MATHEMATICS
18. MILITARY SCIENCES
19. PHYSICAL SCIENCES
20. PSYCHOLOGY
21. PUBLIC AFFAIRS AND SERVICES
22. SOCIAL SCIENCES
23. THEOLOGY
24. INTERDISCIPLINARY STUDIES
25. BUSINESS AND COMMERCE TECHNOLOGIES
26. DATA PROCESSING TECHNOLOGIES
27. HEALTH SERVICES AND PARAMEDICAL TECHNOLOGIES
28. MECHANICAL AND ENGINEERING TECHNOLOGIES
29. NATURAL SCIENCE TECHNOLOGIES
30. PUBLIC SERVICE RELATED TECHNOLOGIES

NON-HEGIS DISCIPLINES

31. PHYSICAL EDUCATION
32. UNDECLARED
33. OTHER

*The standard disciplines to be used in the Higher Education General Information Survey (HEGIS) will be published shortly by the National Center for Educational Statistics under the title, "A Taxonomy of Instructional Programs in Higher Education."

Figure 8 is a listing of the discipline categories used in the RRPM-1. The first thirty discipline categories correspond to the HEGIS discipline categories. The HEGIS disciplines are described in detail in the Program Classification Structure and will soon be published by the National Center for Educational Statistics. In addition, three non-HEGIS disciplines have been included within the RRPM-1 system to isolate physical education;

[12]It should be noted that the Program Classification Structure is presently undergoing extensive review and may be modified, requiring corresponding changes in RRPM-1.

to provide an additional category of "Other" to accommodate institutional unique situations, e.g., a graduate school; and to provide an undeclared category for those instances where field of study is aligned to the HEGIS disciplines. Discipline may be equated to academic department where appropriate in that the discipline represents course offerings in the instruction program.

Provision is made to use the above disciplines in all primary subprograms excluding 3.5, Agriculture Extension Service. However, it is unlikely that most institutions will require all 33 disciplines. Significant savings in terms of both computer memory and operating time will be realized by reducing the number of disciplines to something less than 33.

FIGURE 9

RRPM-I STANDARD DIMENSIONS

FIELDS OF STUDY (MAJORS)

DIMENSIONED FOR EIGHTY (80) POSSIBLE FIELDS OF STUDY AS SPECIFIED BY USER. IF NONE SPECIFIED, ASSUMED TO BE THE 33 DISCIPLINE CATEGORIES. IF USER SPECIFIED, CROSSOVER TO HEGIS DISCIPLINES OPTIONAL.

Field of study refers to the name of a student degree program or major. A careful distinction must be made between fields of study and discipline instruction programs. The discipline instruction program is concerned with the instruction activities in a specific field of knowledge, generally associated with course level; e.g., lower division psychology, upper division mathematics. The field of study (or degree program) is concerned with the instruction activities in which a student engages in the pursuit of a degree or certificate; i.e., the curricula mixes leading to the award of a specific degree. Field of study is generally associated with student level; e.g., a freshman history major, a senior in psychology.

The fields of study used in RRPM-1 are unspecified. Provision is made in the model to accommodate 80 fields of study as identified by the user. These may be mapped to the 33 standard discipline categories through a crossover vector which identifies each of the fields of study to a specific discipline category. If the user does not specify student fields of study, the fields of study are assumed to be equivalent to the 33 standard discipline categories used in the RRPM-1 system.

Figure 10 lists the course levels and student levels used in the RRPM-1 system. The course level describes the level of sophistication for instructional course offerings. The student level describes the progress of students in terms of recognized credits. The five course levels correspond to the Data Element Dictionary: Course[13] and the Program Classification Structure. The seven student levels used in RRPM-1 have been aggregated from the twelve student levels in the Data Element Dictionary: Students[14] to include both senior and fifth year undergraduates as one student level, master's and professional students in the Grad-I category, doctoral students and doctoral candidates in the Grad-II category, and to include all undergraduate specials, graduate specials and post-doctoral students in the special category.

Course levels and student levels are frequently confused. Care must be exercised to avoid mixing the two. It will be helpful to remember the distinction, e.g., sophomore students often take upper division courses.

FIGURE 10

RRPM-I STANDARD DIMENSIONS

COURSE LEVELS AND STUDENT LEVELS

COURSE LEVELS	STUDENT LEVELS
1. PREPARATORY	1. FRESHMAN
2. LOWER DIVISION	2. SOPHOMORE
3. UPPER DIVISION	3. JUNIOR
4. UPPER DIVISION/GRADUATE	4. SENIOR & 5th YEAR UNDERGRADUATE
5. GRADUATE	5. GRADUATE I (MASTER & FIRST PROFESSIONAL DEGREE)
	6. GRADUATE II (DOCTORAL STUDENTS)
	7. SPECIAL STUDENTS

A significant input requirement of the RRPM-1 system is the "Induced Course-Load Matrix" (ICLM) which describes the average distribution of credits across disciplines by course level for each student level in a given field of study; i.e., a column of the matrix describes the distribution of the average load placed on the instruction program by a typical student. Thus, the induced course-load matrix in the example shown in Figure 11 describes the average distribution of credits taken by Agriculture and Natural Resources majors in the various discipline offerings of the institution. The totals for each column represent the average student

[13]Charles R. Thomas, Data Element Dictionary: Course, First Edition, Boulder, Colorado: Western Interstate Commission for Higher Education, February 1970, Data Element No. 213, p. 31.

[14]Charles R. Thomas, Data Element Dictionary: Students, First Edition, Boulder, Colorado: Western Interstate Commission for Higher Education, February 1970, Data Element No. 101, p. 10.

load by student level for Agriculture and Natural Resources majors. For example Figure 11 indicates that a freshman (student level 1) majoring in Agriculture and Natural Resources will on the average take 6 units of lower division courses and 1 unit of upper division courses within the field of study. The average number of units per freshman student is 16.5 per term. Therefore, the typical student takes 9.5 units in other disciplines.

FIGURE 11

EXAMPLE OF AN INDUCED COURSE-LOAD MATRIX

Field of Study: AGRICULTURE AND NATURAL RESOURCES

(Average Credit Hours per Student for a Given Term)

DISCIPLINE by COURSE LEVEL	STUDENT LEVEL 1	2	3	4	5	6	7	OVERALL AVERAGE
AGRICULTURE AND NATURAL RESOURCES								
LOWER DIVISION	6.0	7.0	2.0	0.7	0.2	0.2	0.3	1.6
UPPER DIVISION	1.0	2.0	1.5	3.0	1.4	0.8	0.5	1.4
UPPER/GRADUTE	....	....	3.2	1.7	1.8	2.0	1.3	1.8
GRADUATE ONLY	....	....	....	0.2	0.6	1.0	0.4	0.7
OTHER	....	....	....	0.1	....	0.2	0.3	0.1
SUBTOTAL	7.0	9.0	6.7	5.7	4.0	4.2	2.8	5.6
ARCHITECTURE AND ENVIRONMENTAL DESIGN								
LOWER DIVISION	....	0.5	0.4	....	....	....	....	0.1
UPPER DIVISION	....	....	0.1	0.3	0.4	0.6	....	0.4
UPPER/GRADUATE	....	....	....	0.3	0.6	0.4	....	0.5
⋮		(Other Disciplines)						⋮
TOTAL	16.5	17.0	15.0	13.0	8.0	6.0	3.5	12.0

The ICLM is often considered to be stable for most applications. However, there is some question as to the stability of the ICLM at any one institution.[15] In order to use RRPM-1 as a planning tool, it is necessary that a school understand the dynamics of student preferences and the manner in which curriculum changes influence course loadings. This is perhaps best accomplished by undertaking a thorough analysis of the institution's ICLM to determine the extent of changes over time.

[15]e.g., see Frank I. Jewell, Alan P. Feddersen, Donald F. Lawson, and William D. O'Grady, The Feasibility of Analytical Models for Academic Planning: A Preliminary Analysis of Seven Quarters of Observations on the "Induced Course Load Matrix," The California State Colleges, Division of Information Systems, September 1970.

Instructional activities are dimensioned by three types of instruction as listed in Figure 12 for the purpose of discriminating between differential faculty loads and facility requirements for each instructional type. Classroom instruction refers to the normal recitation and lecture type of instruction that typically takes place in the classroom setting. Laboratory and demonstration instruction is considered to be instructional activities requiring special use facilities, e.g., laboratories. Other instruction is to accommodate those instructional activities which take place outside of the regular classroom; e.g., independent study, field work, etc.

FIGURE 12

RRPM-I STANDARD DIMENSIONS

INSTRUCTION TYPES

- CLASSROOM INSTRUCTION
- LABORATORY & DEMONSTRATION INSTRUCTION
- OTHER INSTRUCTION

Figure 13 lists the staff and faculty ranks used within the model in the two areas of academic and non-academic staff. The academic staff is divided between administrators with academic appointment (AdWAPs) and the five typical ranks of regular faculty personnel. Individuals falling into the category of administrators with academic appointment (AdWAP) vary with each institution but, generally, are such people as Deans, Vice Presidents, etc. Four ranks are provided for non-academic personnel: Professional/Management includes supervisors, administrators and professional personnel such as analysts, accountants, etc. Technical/Craft includes skilled trades. Clerical/Secretarial includes the various categories of office personnel. Unskilled/Semi-skilled includes the grounds and building maintenance and custodial personnel, kitchen help, etc.

FIGURE 13

RRPM-I STANDARD DIMENSIONS

STAFF & FACULTY RANKS

NON-ACADEMIC

1. PROFESSIONAL/MANAGEMENT
2. TECHNICAL/CRAFT
3. CLERICAL/SECRETARIAL
4. UNSKILLED/SEMI-SKILLED

ACADEMIC

1. ADMINISTRATOR WITH ACADEMIC APPOINTMENT (AdWAP)

FACULTY

1. PROFESSOR
2. ASSOCIATE PROFESSOR
3. ASSISTANT PROFESSOR
4. INSTRUCTOR/LECTURER/RESEARCH ASSOCIATE
5. GRADUATE ASSISTANTS

Listed in Figure 14 are the 22 various room/facility or space types used within the model. Each of the specific space types are defined in terms of the definitions and codes used by the Higher Education Facilities Classification and Inventory Procedures Manual[16]. Although 22 different space types are listed in Figure 14, it should be noted that most of these are linked exclusively with specific subprograms of the institution; e.g., space type number 18, Residential, which consists of HEFA room types 910 and 911, would appear only in the subprogram for student support. Library, Museum/Gallery, Audio Visual, etc. all fall within specific subprogram areas as contrasted to Classroom, which may fall within regular instruction, special session instruction, extension for credit, experimental instruction, departmental continuing education, and organized extension continuing education.

FIGURE 14

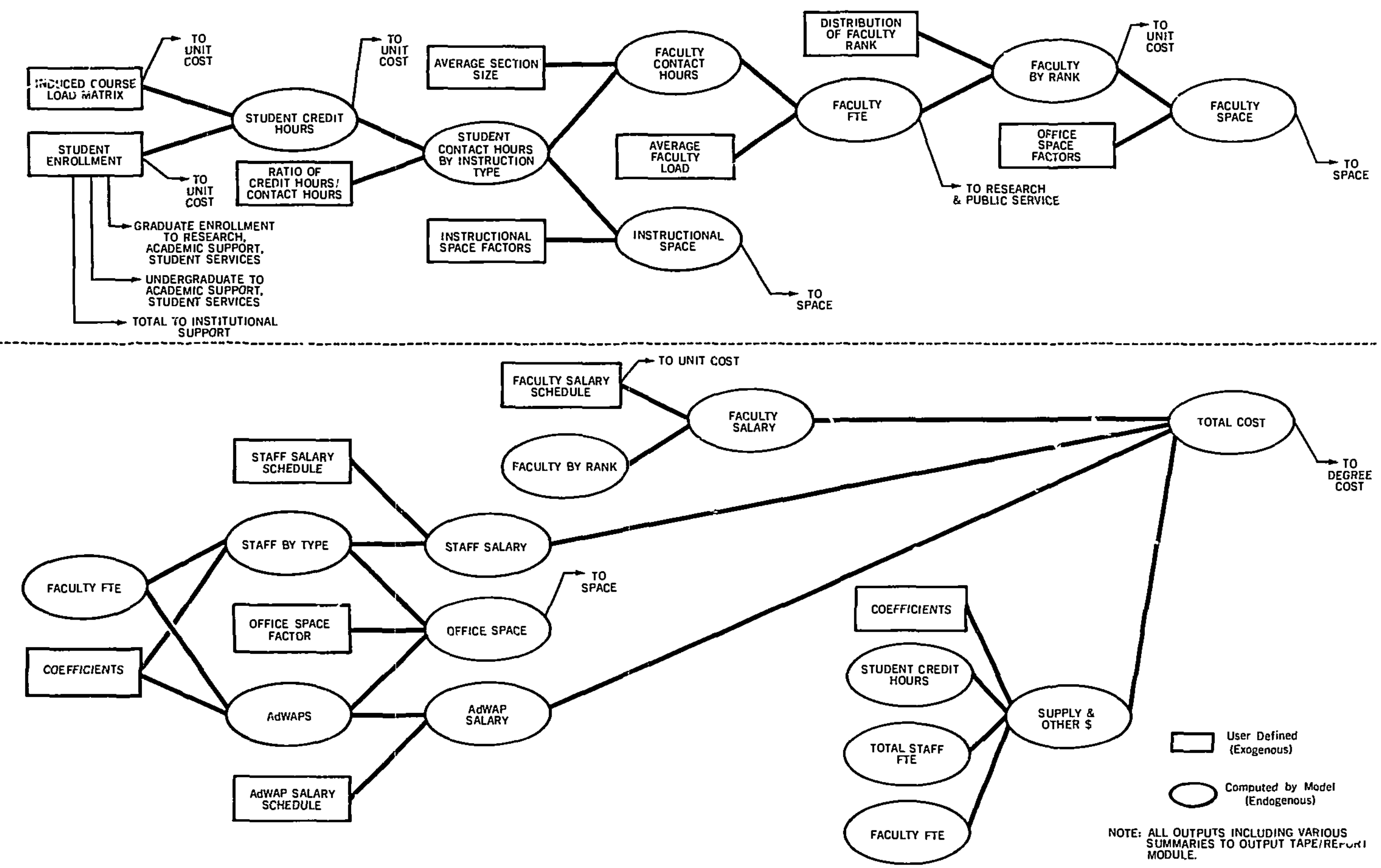
RRPM-I STANDARD DIMENSIONS

SPACE TYPES

1. CLASSROOM
2. CLASS LABORATORY
3. RESEARCH LABORATORY
4. OFFICE AND CONFERENCE
5. LIBRARY
6. MUSEUM/GALLERY
7. AUDIO/VISUAL
8. DATA PROCESSING/COMPUTER
9. ARMORY
10. CLINIC
11. DEMONSTRATION
12. FIELD SERVICE
13. ATHLETIC-PHYSICAL EDUCATION
14. ASSEMBLY
15. LOUNGE
16. MERCHANDISING
17. RECREATION
18. RESIDENTIAL
19. DINING
20. STUDENT HEALTH
21. MEDICAL CARE
22. PHYSICAL PLANT

[16] Higher Education Facilities Classification and Inventory Procedures Manual. Higher Education Studies Branch, National Center for Educational Statistics, U. S. Department of Health, Education, and Welfare, 1968.

FIGURE 15
INSTRUCTION FLOW
FOR EACH DISCIPLINE AND SUBPROGRAM



Computational Flow

Figure 15 describes the flow of the computations for determining the resource requirements for the instruction program. The square boxes in Figure 15 indicate user-supplied (exogenous) data, whereas the ellipses indicate data computed (endogenous) by the model. This distinction is used also in Figures 16, 17, and 18. For the instruction program, the induced course-load matrix and student enrollment are read in for each discipline category to compute student credit hours by discipline and course level. The ratio of credit hours to contact hours by type of instruction is read in and applied to the student credit hours in order to determine student contact hours by discipline, course level, and instruction type. The contact hours are combined with instructional space factors to determine instructional space requirements. The average section size by discipline, course level, and instruction type is compared with the contact hours in order to determine faculty contact hours. An average faculty load by discipline, course level, and instruction type is used with faculty contact hours to compute the faculty FTE (full-time equivalent) requirements by discipline, course level, and instruction type. A distribution of faculty ranks is applied to the total faculty FTE in order to determine faculty by rank and course level for each discipline category. Space factors are then applied in order to determine the faculty space requirements by discipline category.

The bottom half of Figure 15 describes the general flow used for determining the resource requirements in each of the subprograms. For the instruction program, faculty FTE is used as the independent variable in the estimation equations for estimating AdWAPs and nonacademic staff by type. In the Organized Research subprograms, graduate enrollment is included with the faculty FTE as independent variables. The calculations for the Public Service subprograms are based on faculty FTE and total costs (instruction plus research) by discipline category. Academic Support and Student Services use the graduate enrollment and undergraduate enrollment as separate independent variables. For the Institutional Support subprograms, total enrollment is included with the faculty FTE as independent variables.

User specified salary schedules[17] for the nonacademic staff by type and for administrators with academic appointment (AdWAPs) are used to compute the salary requirements. Office space factors are used with the FTE data to compute office space requirements. A faculty salary schedule is used with the faculty FTE by rank to compute faculty salary dollars. Student credit hours, total nonacademic staff FTE, and faculty FTE are used as independent variables along with the coefficients to estimate the supply and other dollars by discipline and subprogram. These are combined with the salary cost to determine total cost by discipline and subprogram.

---

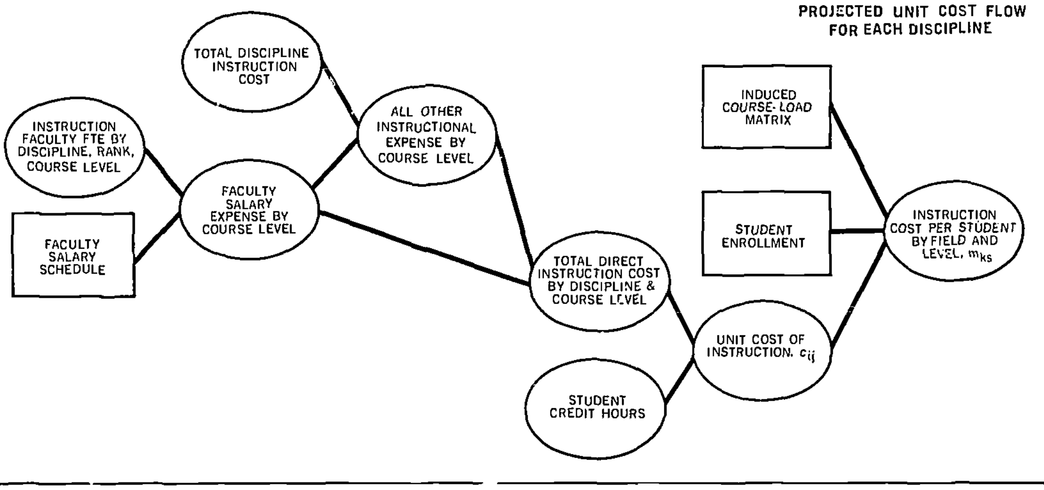
[17] Salary schedules are updated at the end of each simulation year by a user-defined inflation factor.

Projected Unit Costs

The projected unit costs of instruction by discipline and course level are computed in a subroutine which derives the direct instructional cost by course level for each discipline (Figure 16). Direct instructional costs for faculty are computed on the basis of course level using the faculty salary schedule and FTE by rank and course level. Other departmental costs attributable to instruction are derived by course level on the basis of the faculty salary expense. The total direct instructional cost by discipline and course level is divided by student credit hours (for each discipline and course level) to determine the projected cost per credit hour of instruction. The induced course-load matrix and student enrollment matrix is used along with the instruction unit cost to determine instructional cost per student by field of study and level of student.[18]

These projected unit costs will be helpful for institutional internal analysis of alternative policy decisions and comparison of relative program costs. However, such data is merely a short-hand representation of estimated future expenditures and is not intended to be used for comparison between institutions since the coefficients and variables used in deriving the forecasts may not be comparable.

FIGURE 16
PROJECTED UNIT COST FLOW FOR EACH DISCIPLINE



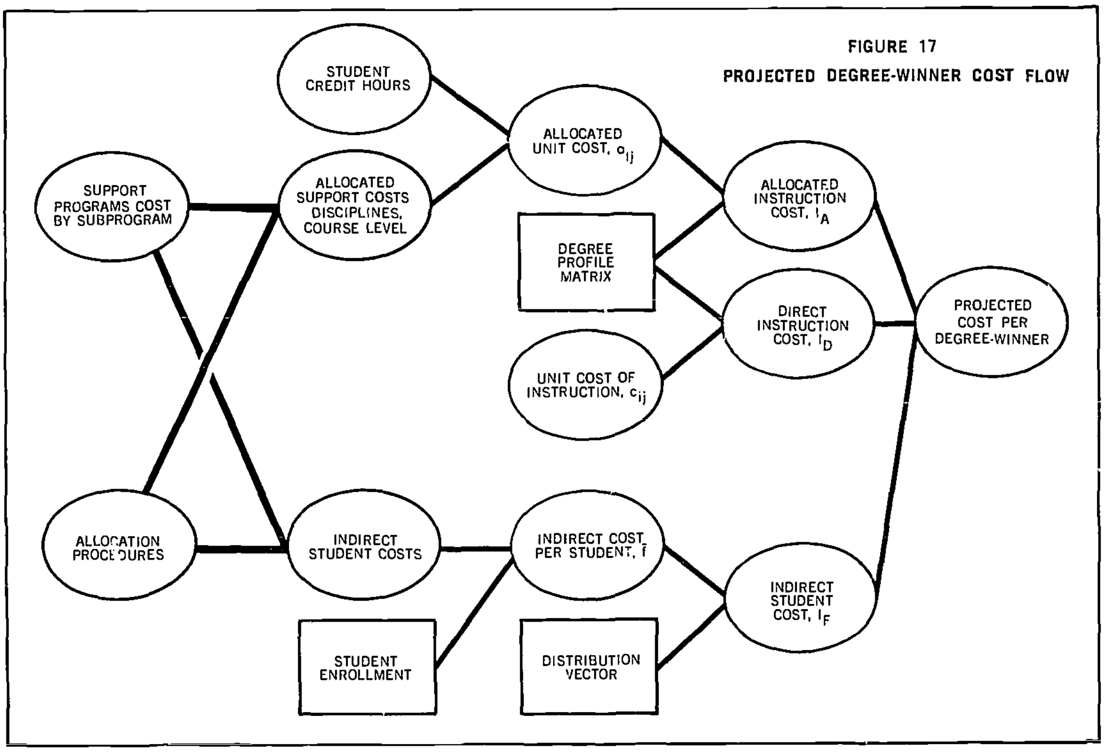
[18]For a more complete discussion of the unit costs, see, "UNIT COSTS OF INSTRUCTION: A Methodological Approach" a technical paper to be published shortly by the WICHE Planning and Management Systems Program.

Projected Degree-Winner Cost

The computation of the projected cost per degree-winner is an option that must be specified by student field of study and degree type, e.g., a B.A. in Psychology. Figure 17 describes the manner in which the projected cost per degree-winner is computed for a specified degree. The user provides a degree profile matrix which describes the distribution of credits over time for the typical degree-winner and a distribution vector which describes the proportion of a graduating class present in each of the years of the simulation time frame. Support costs by subprogram are brought in with a set of allocation procedures to determine the amount of support costs allocated to the instruction program by discipline category and course level. Indirect student cost which is not related to instructional activities (e.g., student services) is also derived through the allocation procedures. The allocated support costs are divided by student credit hours to determine allocated unit costs by discipline category and course level. The indirect student costs are divided by enrollment to determine indirect cost per student. The allocated unit cost is then applied to the degree profile matrix to determine the allocated instructional cost attributable to the degree. The projected unit cost of instruction by discipline and course level that was computed in the unit cost subroutine is applied to the degree profile matrix to determine the direct instructional cost attributable to the degree. The distribution vector is applied to the indirect cost per student to determine the indirect student cost. These three costs are then summed to the projected cost per degree-winner.

FIGURE 17

PROJECTED DEGREE-WINNER COST FLOW

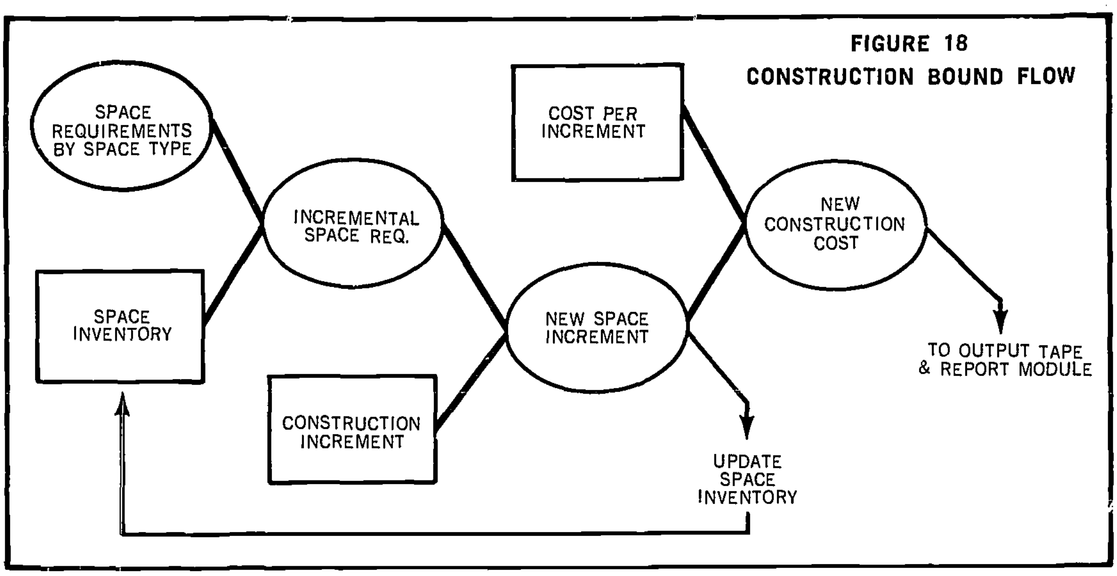


New Construction Costs

Figure 18 describes the flow within the construction bound subroutine to determine new space construction cost. The space requirements by space type are calculated by the space subroutines and compared to an initially preset space inventory to determine the incremental space requirements over and above current inventory. The incremental space requirement is compared to a construction increment which determines the new space increments to be constructed by space type. The construction increment permits space estimation to be made on the basis of a step function; i.e., one does not construct, say, new classrooms until the space requirements are sufficiently large to warrant a new building. Thus, RRPM-1 estimates new construction costs on the basis of space increments or blocks of space (i.e., a step function) rather than in a continuous fashion on a square footage basis.

The new space increment is applied to the space inventory to update the space inventory and is costed out on the basis of cost per increment to determine new construction costs. New construction cost computations are based on differential square footage costs by building type which are updated each year through a user-defined inflation factor.

FIGURE 18
CONSTRUCTION BOUND FLOW



Pilot Test

Figure 19 is a list of the institutions participating with WICHE in the development of the RRPM-1 system. The eight institutions listed at the top of Figure 19 are engaged in a series of pilot test activities with the prototype version of the RRPM-1 to determine its applicability to cost simulation in higher education, to debug the model, and to demonstrate its operational capabilities. Three other institutions, listed at the bottom of Figure 19 are participating in the design of the model and are represented on the Task Force[19]; however, they are not engaged in this phase of the pilot testing. The computer system used for RRPM-1 is indicated in parenthesis under each institution. In two cases, the computer facility is located at another institution: New Mexico State University and University of Oregon. At the present time, the prototype RRPM-1 (Version 1.2) is operating at the eight pilot test institutions for the purposes of test and validation.

FIGURE 19

RRPM-I PILOT TEST

PARTICIPATING INSTITUTIONS

1. CALIFORNIA STATE COLLEGES (CDC 3300)
2. NEW MEXICO JUNIOR COLLEGE (IBM 360/50: NMSU)
3. PORTLAND STATE UNIVERSITY (IBM 360/50: U of Oregon)
4. STANFORD UNIVERSITY (IBM 360/40, 256K)
5. STATE UNIVERSITY OF NEW YORK AT STONY BROOK (IBM 360/67)
6. UNIVERSITY OF CALIFORNIA AT LOS ANGELES (IBM 360/91)
7. UNIVERSITY OF UTAH (UNIVAC 1108)
8. WASHINGTON STATE UNIVERSITY (IBM 360/67)

OBSERVERS

STATE CENTER JUNIOR COLLEGE DISTRICT

UNIVERSITY OF COLORADO

UNIVERSITY OF ILLINOIS

[19]RRPM-1 Task Force members are listed in Appendix 2.

Future Developments

Figure 20 is a preliminary draft of the RRPM development and implementation plan. It briefly describes the activities anticipated for the RRPM project. In October 1970 the eight institutions listed in Figure 19 began the pre-implementation and pilot test of the RRPM-1. It is anticipated that by April 1971 we will have completed the development of the general RRPM-1 system. Between April and September of 1971 it is expected that special versions of RRPM-1 will be developed to orient the model specifically to community colleges and four-year state colleges. By January 1972 a private college version of the RRPM-1 will be developed. It is expected that the general system and the two special versions, along with appropriate documentation, will be released in the early fall of 1971, and that the private college version will be released shortly after January 1972.

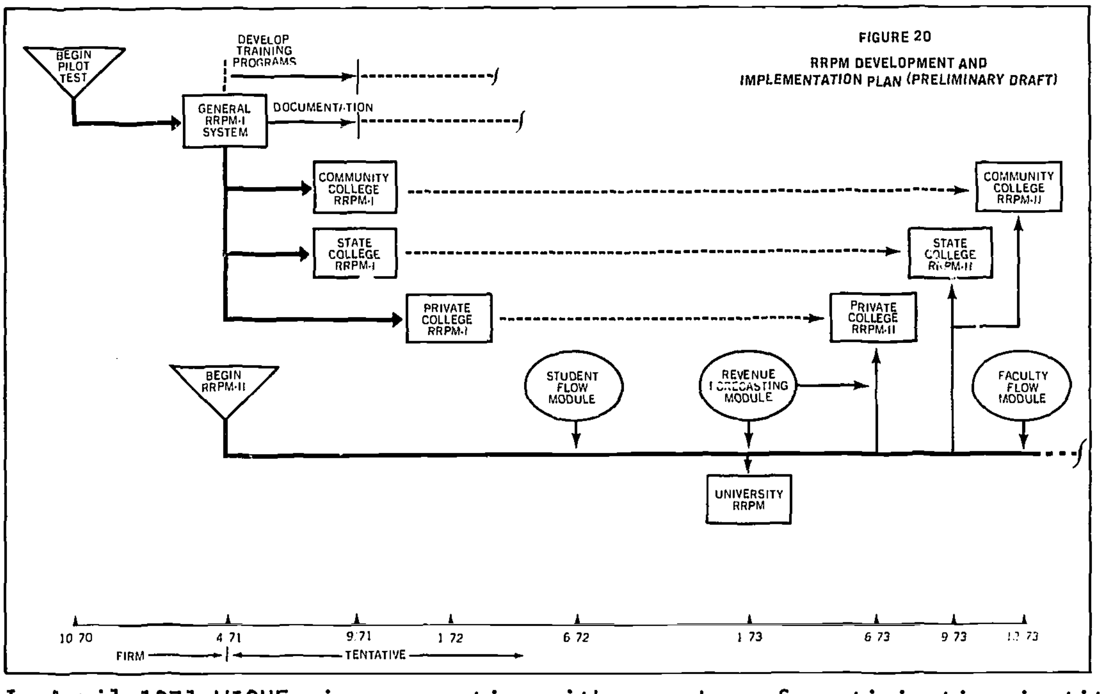


FIGURE 20
RRPM DEVELOPMENT AND IMPLEMENTATION PLAN (PRELIMINARY DRAFT)

In April 1971 WICHE, in cooperation with a number of participating institutions, will begin the development of RRPM-2. RRPM-2 will be a significantly expanded simulation model which will include far more detail than RRPM-1 and a more sophisticated simulation of the research and public service function. In addition it is anticipated that RRPM-2 will be designed to permit incorporating a student flow module, a faculty flow module, and a revenue forecasting module. Upon completion of the RRPM-2 design and pilot test, it is anticipated that special versions of this model will be made available for community colleges, state colleges, private colleges, and universities. Subsequent developments and additional features will be incorporated as they are developed.

In addition to the development of the RRPM-2, the PMS program has proposed to engage in the development of a national RRPM in cooperation with U.S.O.E.'s Office of Program Planning and Evaluation and other federal agencies. This model would provide a macro-simulation of national higher education. Also, a large-scale simulation model for use by state agencies is planned. The state system model will be designed to reflect the interinstitutional relationships of state programs and the associated resource requirements of state-level planning decisions as they relate to institutions of higher education.

APPENDIX 1

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APPENDIX 3

BIBLIOGRAPHY

Gulko, Warren, W. PROGRAM CLASSIFICATION STRUCTURE: Preliminary Edition. Boulder: Western Interstate Commission for Higher Education, June 1970.

Jewell, Frank, I., Feddersen, Alan, P., Lawson, Donald, F., and O'Grady, William, D. THE FEASIBILITY OF ANALYTICAL MODELS FOR ACADEMIC PLANNING: A PRELIMINARY ANALYSIS OF SEVEN QUARTERS OF OBSERVATIONS ON THE "INDUCED COURSE LOAD MATRIX." Los Angeles: The California State Colleges, Division of Information Systems, September 1970.

Koenig, H. E., Keeney, M. G., and Zemach, R. A SYSTEMS MODEL FOR MANAGEMENT, PLANNING, AND RESOURCE ALLOCATION IN INSTITUTIONS OF HIGHER EDUCATION. Lansing: Division of Engineering Research, Michigan State University, September 1968.

Osso, Nicholas A., Editor, and Roberts, Charles, T., Project Coordinator. HIGHER EDUCATION FACILITIES CLASSIFICATION AND INVENTORY PROCEDURES MANUAL. Washington, D. C.: Office of Education, United States Department of Health, Education and Welfare, 1968.

Peat, Marwick, Michell & Co. "Computer-Assisted Planning for Small Colleges." Project Report - Phase I. New York: Peat, Marwick, Livingston & Co., May 15, 1969.

Systems Research Group. "A WICHE Co-ordinated Project to Implement CAMPUS Integrated with the WICHE Data Elements in Four Representative Pilot Institutions." Toronto, Canada, October 1969.

Thomas, Charles, R. DATA ELEMENT DICTIONARY: STUDENTS, STAFF, FACILITIES, COURSE, FINANCE, First Editions. Boulder: Western Interstate Commission for Higher Education, February 1970.

Weathersby, George, B. "Development and Application of a University Cost Simulation Model." An unpublished monograph, University of California, Berkeley, California, Office of Analytical Studies, June 15, 1967.

Weathersby, George,B., and Weinstein, Milton, C. "A Structural Comparison of Analytical Models for University Planning." Ford Research Program Monograph. Office of the Vice President, Planning and Analysis, Berkeley: University of California, August 1970.

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