

DOCUMENT RESUME

ED 083 890

HE 004 595

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TITLE Simulation Models in Higher Education.
INSTITUTION Educational Facilities Labs., Inc., New York, N.Y.;
Society for Coll. and Univ. Planning, New York,
N.Y.
PUB DATE Jun 73
NOTE 4p.
JOURNAL CIT Planning for Higher Education; v2 n3:5/5 p1-4 Jun
1973
EDRS PRICE MF-\$0.65 HC-\$3.29
DESCRIPTORS Conference Reports; Cost Effectiveness; *Costs;
Educational Administration; *Educational Finance;
*Higher Education; Management Games; *Resource
Allocations; *Simulation

ABSTRACT

This paper, adapted from a Society for College and University Planning conference, discusses cost simulation models in higher education. Emphasis is placed on the art of management, mini-models vs. maxi-models, the useful model, the reporting problem, anatomy of failure, information vs. action, and words of caution.
(MJM)

ED 083890

planning *for higher education*

Vol. 2, No. 3: 5/5 June 1973



Simulation Models in Higher Education

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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Cost simulation models offer an important new tool for colleges and universities struggling with new demands for greater efficiency and accountability and new requirements for reporting to both state and federal governments. But there are a number of approaches to modeling, a variety of models available to planners, and not a little confusion in the minds of administrators contemplating their use. In an effort to clear up some of that confusion, SCUP held a conference — "Let's End the Confusion About Simulation Models!: A Candid Discussion of Their Place in Higher Education" — March 28-30 in Washington, D.C. The following article is adapted from the conference proceedings.

The new depression in higher education finance, according to John D. Millett, vice president and director, Management Division, Academy for Educational Development, has forced colleges and universities to develop "a structure and a process for resource reallocation within the institution" and, at the same time, "placed immense new demands upon data collection and data analysis within each institution."

"Resource reallocation," Millett told the more than 150 conferees at Washington's Mayflower Hotel, "means an in-depth analysis of the objectives, costs and income attached to the various programs of the particular institution. Upon the basis of this careful analysis, decisions had to be made about what goals and what technology to adopt consistent with the available income of the institution . . . Resource reallocation is not possible without extensive information to guide decision-making."

The institutional response to these new and pressing demands has been to turn to sophisticated "management information systems" (MIS), defined for the conferees by Bernard S. Sheehan, director, Office of Institutional Research, University of Calgary:

"MIS is a general term which usually refers to that set of methods, procedures, definitions, standards, and systems for the preparation and integration of data to satisfy the institution's needs for management control

and utilization information. Normally, this includes, for example, reports of program costs, instructional loads, and space use."

And, usually as a part of the overall MIS approach, some institutions have turned to the use of simulation models. The purpose of modeling, which may be carried out manually but usually is computerized, is, according to Sheehan, "to reduce complex institutional problems and situations to simpler proportions and compressed time frames so that the human skills of decision-makers can be brought to bear most effectively."

THE ART OF MANAGEMENT

At the same time, he added, modeling "cultivates the art of management by forcing explicit and analytical consideration of important internal institutional relations and alternative policies as well as strengths and weaknesses of institutional data bases and management information systems." Because traditional university administration is by consensus and involves large numbers of "competing, equal, and vocal interests," Sheehan noted, the modeling technique is even more appropriate in universities than in business, where relatively small numbers of people make management decisions.

"Modeling," he added, "is one of the tools of the systems approach to university management."

Another perspective was offered by Walter J. Ken-

AE 004 595



worthy, program manager, Exxon Education Foundation, who pointed out that "cost simulation models can serve only one purpose: to enhance the ability of the institution to achieve its stated objectives."

"A model," he added, "is a management information system and its function is to improve management. It must provide information in sufficient depth, breadth, and flexibility not only to satisfy the institution's managers but to increase their effectiveness. It must modify their behavior so that they push more of their decisions downward in the hierarchy, so that they explore all options open to them in a given situation rather than evaluate single proposals, so that they make their decisions on a smooth annual cycle rather than when stimulated by major and minor crises, and, most important, so that basing all decisions upon full information becomes such an ingrained habit that all who decide policies or procedures refuse to act without full information."

WORDS OF CAUTION

Modeling, it became apparent as the conference progressed, is no panacea, a fact driven home by the opening speaker, Frank J. Schultz, SCUP Mid-Atlantic Representative and vice chancellor of budget and planning, City University of New York:

"My main message: be cautious about using simulation and other mathematical techniques. Don't be enamoured but also don't reject them."

He suggested two basic techniques for institutions contemplating the use of models: careful selection of modeling applications in terms of their feasibility and their benefit to the institution and a proper approach — "the key is to have the right people."

Schultz added that he would avoid mathematical techniques and modeling in management decision-making under certain circumstances:

- "Where the size of the project and, therefore, the development effort are excessive. If a model takes three years to develop, either you have a system not worth modeling or a model not worth using.

- "Where unpredictable external variables have a major impact on the system to be modeled.

- "Where the system includes the behavior of a limited number of individuals as major influences, such as hierarchal organizations. You can *consider* modeling human behavior when you are dealing with the aggregate behavior of a large number of people, such as in modeling traffic patterns."

MINI-MODELS VS. MAXI-MODELS

In Schultz's view — and those of many of the conference

speakers — attempts to model an entire college or university simply are not practical. When such attempts are suggested, he noted, "I cringe and change the subject." Given that outlook, when does it make sense to consider using mathematical techniques? The answer, according to Schultz, is to employ them to aid in "specific decision-making on specific kinds of problems, such as projecting student populations by various characteristics, determining alternative plans for budgetary allocations, facilities planning, and personnel replacement planning for large organizations."

In other words, at least at this stage of their development and sophistication, the "mini-model," dealing with a discrete and readily definable problem, makes more sense than the "maxi-model," attempts at the highly complex modeling of a total institution. And Schultz spelled out additional requirements for the successful application of modeling techniques:

- "A relatively closed system that is defineable. You must be able to comprehend the system on a rational basis and translate it into mathematical algorithms.

- "Where masses of data and/or many alternatives are possible and worth exploring.

- "Where there is the availability of accurate historical data.

- And "where there is a reasonable balance between development costs and value to the decision-makers."

Schultz urged that administrators and planners develop their own sense of judgement in deciding when modeling techniques are applicable. "Don't," he warned, "put yourself at the mercy of the technicians." Finally, Schultz concluded, "do it first class. A second-class effort does not give second-class results. It is much worse than that."

THE USEFUL MODEL

The purpose of an analytical model, according to Thomas R. Mason, director of special studies, University of Colorado, "is to reduce masses of complex data into coherent information by means of a logical structure that represents a real-world situation." Accordingly, Mason noted, if a model is to prove useful to those engaged in the processes of decision-making or policy formation, it must have certain characteristics:

- *Believability*. "The model must be capable of validation against what is known about the system it is supposed to represent or model."

- *Relevancy*. "If the elements in the model that are selected to represent reality do not bear on the decision problem faced by the user, the outputs produced by the model obviously will have little use."

- *Flexibility*. "If the model is to maintain its

usefulness over time, it must be capable of being easily redefined or restructured to fit changing requirements of the user in a fickle world of changing issues. The thousands of dollars that may be invested in the design of a sophisticated analytical model are hardly worth it if the model can represent only a transient crisis. Another form of flexibility can be achieved by the use of very simple 'mini-models' that intentionally deal with a narrow problem. Large-scale system models must be written in generalized structural form capable of frequent adaptation."

• *Communicability of content.* "If the user cannot participate directly in the manipulation of the model, at least through an effective translator, he is less likely to believe it, see its relevance to his problems, or participate in its adaptation to his changing needs. If input, processing, and outputs of the model are the sole possession of the computer-systems man to whom the model is an end to itself, the non-technical user will quickly lose interest in its potential utility."

To meet the last criterion, Mason urged the development of an intermediate role — that of "policy analyst" — between the model and its technical support personnel and the "many potential actors in the institution's policy-formation process."

THE REPORTING PROBLEM

Still another criterion was suggested by William B. Adrian, special assistant to the chancellor, University of Denver. State legislatures and coordinating commissions, he pointed out, are requiring increasingly detailed information from state colleges and universities under the "rationale of accountability" and "it is likely that federal agencies will require increasingly detailed reports" from both public and private institutions. This, he suggested, made it advisable for institutions selecting a modeling system to anticipate the possible future modes of external reporting requirements and evaluate alternative models in the light of their ability to adapt to those requirements.

Modeling applications have not been without their pitfalls, suggesting that institutions exercise great care in selecting and applying modeling systems. The potential problems, as developed at the conference, include a lack of total institutional commitment to planning, an inadequate data base, failure to provide adequate technical support, an absence of effective machinery for communication, and failure to include the costs of data maintenance in budgets.

An example of failure in a modeling project was offered at the conference by Robert P. Hopmann, dean of administration at Concordia Teachers College in River Forest, Illinois. Concordia was one of eight small colleges (the others were Franklin College, Indiana; Loyola College, Baltimore; McAllister College, St. Paul; Mount Aloysius Junior College, Cresson, Pennsylvania; College, Kansas City, Missouri; St. Mary's College, na, Minnesota, and Sanford University, Birming-

ham, Alabama) that participated in the Computer-Assisted Planning for Small Colleges project (CAP:SC).

The project, according to Hopmann, began under "auspicious circumstances," was carried out "with thoroughness and enthusiasm," produced a valid end product in a workable modeling system, but failed because of a "lack of implementation, follow-up, and continuing benefit."

ANATOMY OF A FAILURE

The failure, Hopmann speculated, may have been partly due to the model (SEARCH, for System for Evaluating Alternative Resource Commitments in Higher Education) itself. It may, he noted, have been too complex in terms of information gathering and use but not complex enough in terms of the "fine-tuned responses which may have been expected by some."

But the most significant problem proved to be that of the personnel turnover common to small colleges and a resulting lack of continuity in coordination and effective interaction with the project consultant.

And, Hopmann added, the real failure "probably was in the failure to meet the objective of training key personnel in institutional planning... The CAP:SC project was not a failure. Utilization of what was learned and of the tool developed was a failure. It does not appear that the colleges have found a better solution. It appears more likely that the planning problem simply is being avoided: It is much more fun to talk about planning than to do it."

In addition to SEARCH, the conference included detailed discussion of a series of modeling systems in use on the campuses, all reflecting the alphabet-soup appellations common to planning and computer jargon. They included applications of CAMPUS at the University of Colorado, WICHE/RRPM at Portland State University (Oregon), and HELP/PLANTRAN at the University of Denver. In addition, there were discussions of the relative merits of purchasing, borrowing, or building the institution's own modeling system. The discussions were complex and, in some cases, highly technical and space does not permit a full description of them in this article. However, many of the speakers employed prepared texts and those available are listed in an appendix to this article.

INFORMATION VS. ACTION

Models and other mathematical techniques offer a useful tool as higher education struggles to reallocate its resources. "The new management in higher education," commented keynote speaker Millett, "is a management which can muster the needed analytical information for intelligent, persuasive resource reallocation.

"But there is one final and obvious observation to make about resource reallocation. Information is not a substitute for action. Information can assist the decision-making process. Information cannot and does not replace decision-makers. There are some who wish it

were otherwise. But the buck still stops at some point in the decision-making process. Those who cannot stand the heat generated at that particular point had better abandon the kitchen."

James J. Morisseau

APPENDIX

The following papers from SCUP Spring Conference 2 are listed in order of delivery.

Schultz, Frank J., *Introductory Address.*

Millet, John D., *Resource Reallocation: Information Needs and Limitations.*

Mason, Thomas R., *The Purpose of Analytical Models: The Perspective of the Model User.*

Sheehan, Bernard S., *The Purpose of Analytical Models*

from the Perspective of a Data Provider.

Corrallo, Sal B., *Federal Planning and Evaluation Activities and Institutional Cost Simulation Models.*

Kenworthy, Walter J., *The Implementation Decision: To Buy.*

Stock, Gary C., *The Problems Involved with Borrowing a Simulation Model.*

Andrew, Gary M., *CAMPUS at Colorado.* (Includes bibliography.)

Evans, W. Keith, *Implementation and RRPM: Machines, Models, and People.* (Includes bibliography.)

Adrian, William B., *Uses of PLANTRAN at the University of Denver.*

Hopmann, Robert P., *The SEARCH Model.*