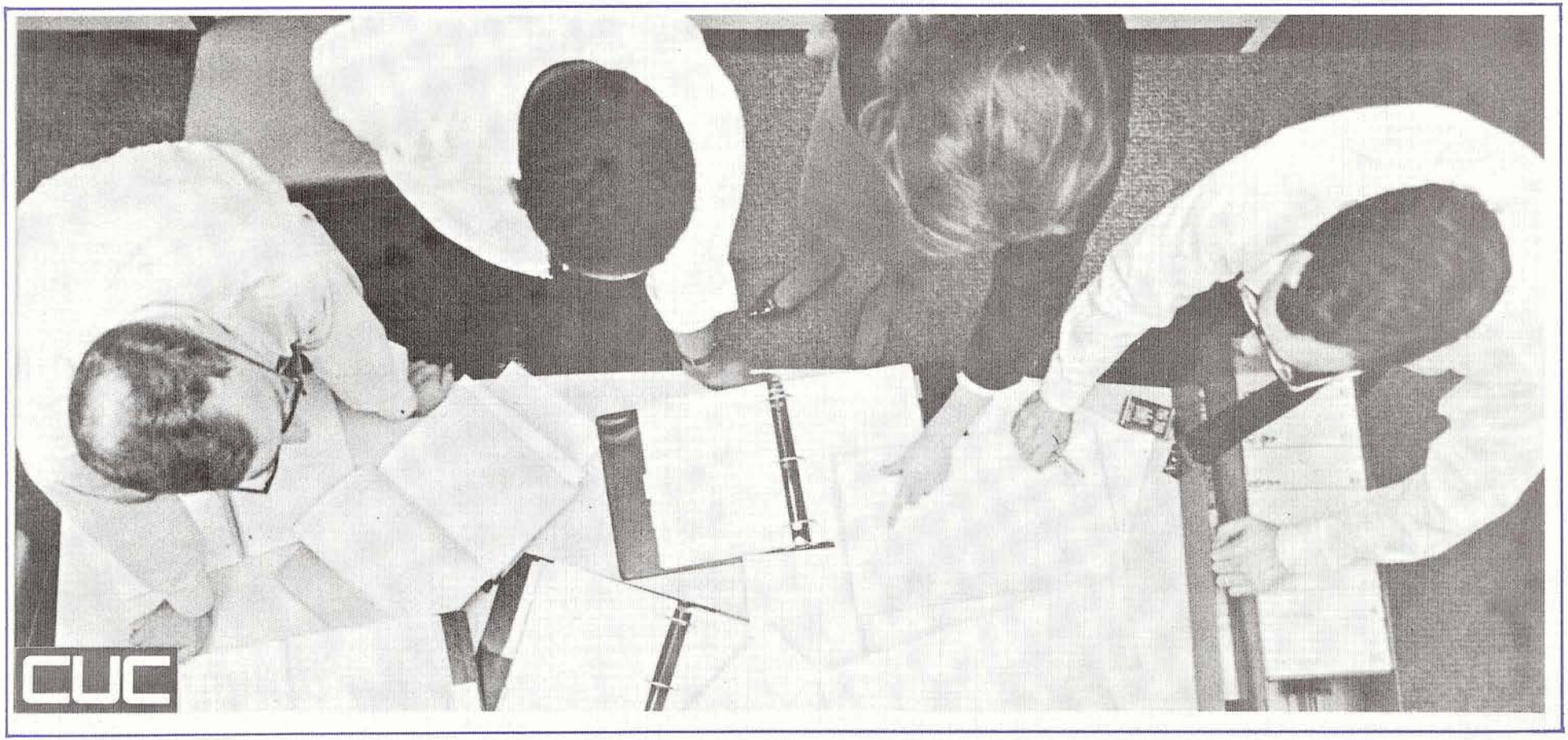
"PLANNING-PROGRAMMING-BUDGETING SYSTEM (PPBS) & DECISION MAKING"

By FRED A. GROSS



ABOUT the AUTHOR

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This article is concerned with describing the use of computer simulation and management science techniques to attain the objectives and structure the basic components of a Planning-Programming-Budgeting System (PPBS).

A PPBS can be defined as an information system which is supporting the planning, programming and budgeting functions through the provision of timely, usable information (data) to make better decisions on the allocation of resources among alternative strategies to attain desired accomplishments. PPBS is a tool which is intended to provide public administrators with the capability to determine the "best" strategy for acquisition and allocation of human, physical and financial resources necessary to render programs and services to the public sector.

The basic components of PPBS include:

1. A Program Structure, which consists of the programs and services of all organizations within a public agency required to attain desired accomplishments.

2. A Multi-Year Program and Financial Plan, which consists of the time-phased human, physical and financial resources required to render the programs and services contained in the Program Structure.

3. The Program Analysis, which provides for the systematic identification and analysis of the cost and benefits (or penalties) of alternative strategies to attain desired organizational accomplishments.

The problems facing public administrators in planning, programming and budgeting public sector programs and services can be succinctly summarized as the necessity to determine and cost effectively* remove deficiencies in projected public agency resources. Therefore, any rational approach to the problem must ultimately determine what kind and how many resources are needed, when they are needed, how much they will cost, and what effect deficiencies in resources will have on the ability to render program and services to the public. Specifically, planning, programming and budgeting in a public agency must come to grips with such problems as the type and numbers of personnel required; the type, number and design of facilities required; the requirements for special equipment and materials; and the requirements and total costs for a broad range of public programs and services offered either directly to individuals or to individuals through agencies and communities.

However, since deficiencies in public agency resources can be removed both by acquiring new resources and/or by better utilizing existing resources, a need exists to determine the cost and effectiveness of alternative strategies to eliminate deficiencies in public agency resources prior to incurring the cost and perhaps the disappointment of implementing the stategies.

The method recommended in this article to determine, test and evaluate alternative strategies requires the development of computer-based simulation models within the basic framework of a PPBS.

In order to fulfill these basic objectives, the planning, programming and budgeting simulation system (PPBS) has to answer the following fundamental questions: What is the "best" strategy for acquisition and allocation of resources, services and funds to render public agency programs? What human and physical resource categories are deficient for projected public services? How often do the deficiencies occur? When do the deficiencies occur? How long do the deficiencies last? What do these deficiencies do to the public agency's ability to render programs and services? What is the best way to remove the deficiencies? The reader will notice that implicit in all questions is not only "what kind" but "how many". Therefore, the PPBS is not only required to answer the question: Does the public agency need a person with the skill of a computer programmer? It also answers the question: How many computer programmers are needed?

The public agency's requirements and the objectives, therefore, of this computertized PPB simulation system are to:

1. Determine and simulate time-phased resource requirements in the public agency by resource category (personnel, equipment, facilities, etc.) caused by render-

** Cost effectiveness is defined as a quantitative measure of the effectiveness of a strategy for a specific cost.*

ing all the expected programs and services to communities and individuals.

2. Determine and simulate time-phased deficiencies in resources as a result of projected requirements and an inventory of existing resources.

3. Determine and simulate the cost and effectiveness of alternative strategies to eliminate deficiencies in public agency resources, analytically and cost/effectively, that is, before incurring the cost and perhaps the disappointment of implementing the strategies.

4. Provide for an experimental 'gaming' mode to measure the impact of budgetary requirements and program effectiveness due to deviations in projected population and community needs and growth characteristics, public sector programs, personnel and funding availability, and public agency policy.

5. Provide for a budgeting function which will receive the acceptance of the public agency's administrative staff through their participation in the design, development and operation of the PPBS.

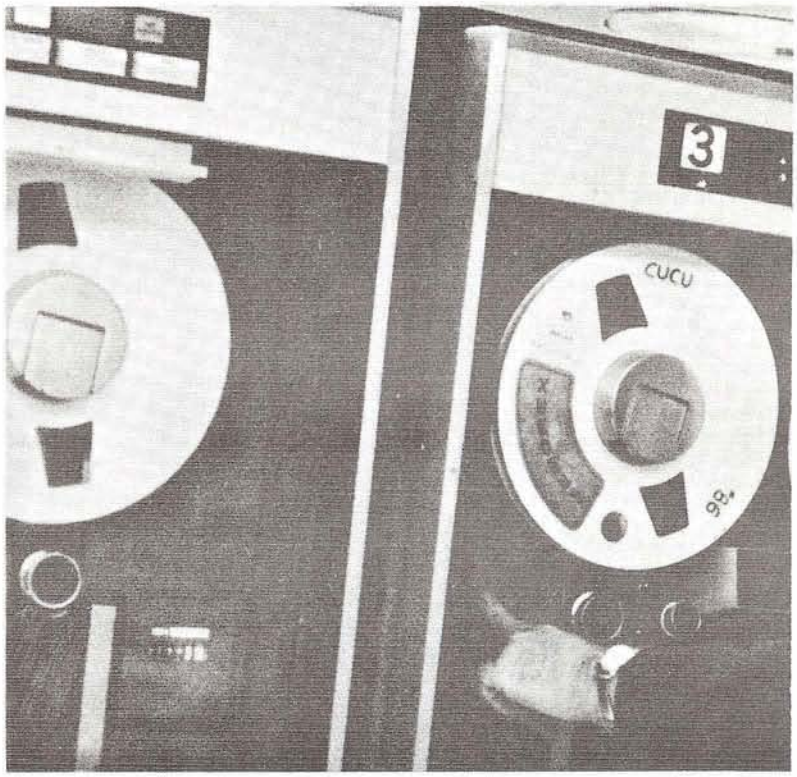
The overwhelming value of this simulation concept is that it is capable of clearly relating effects to causes. Therefore, the various public agencies will have the ability to test whether or not a planned change in causes leads to a desired change in effects and whether or not other desirable effects are produced. Essentially, this simulation system will become an operable representation of reality. In this case, the elements of reality are the public agency and all its resources; the programs and services provided by the public agency; the modus operandi of the public agency in the utilization of its resources to render programs and services to communities and individuals; and finally, the public sector itself--the population and communities---their number, needs and growth characteristics.

In order to develop the PPB simulation system, working computer models of the aforementioned elements of reality must be constructed. These models must reflect the properties of the elements of reality and the relationships between elements with a scope and level of detail required by the five objectives of the PPB simulation system discussed earlier. Therefore, in the simulation system under consideration, a description of the needs and growth characteristics of the public sector and programs and services provided by the public agency are represented in the Programs and Services Forecast Model; the human and physical resources of the public agency are represented in the Resources Inventory Model; and finally, the modus operandi and various effectiveness measures in the utilization of public agency resources to render programs and services to individuals and communities are represented in the Resource Service Model.

Inasmuch as this simulation system concept provides for a tool that can be used iteratively, (that is candidate strategies for the modification of reality can be modeled by making corresponding changes in the models referred to earlier), it is through this mode of operation that the objectives and requirements of the public agency and the PPB simulation system will be realized--that is through the determination and simulation of time-phased resource requirements, deficiencies, and the cost effectiveness of alternative strategies to eliminate deficiencies in the public agency resources. The definition and interrealtionships between these models, that is between these elements of reality, are contained in the following schematic representation. (Fig.1)

PROGRAMS & SERVICES FORECAST MODEL

Essentially, the Programs and Service Forecast Model forecasts by budget center or area the services and programs that will be required from that area during the next budget period. The forecast will be based upon trends, needs and characteristics of the public sector and the program and service requirements of the population during future time periods.



INPUT

- Target Population Needs and Growth Characteristics
- Forecast of Program Changes/Time Period
- Public Agency Policy on Program Provisions

OUTPUT

- Forecast of Programs and Services to Target Population
- Forecast of Level of Public Agency Support and
- Organizational Placement During Simulation Time Frame.

MODEL OPERATION

1. The model is initialized to reflect certain levels of Program and Service requirements; as defined by specific programs and services required by various groups or sub-agencies.

2. At the beginning of each simulated year the target population on forecast is up-dated.

3. The revised requirements distribution is dependent upon:

a. Forecast growth rates for each group, sub-agency and associated requirements.

b. Forecast service/requirements additions and/or deletions.

c. Public Agency policy.

4. The output of the Programs and Services Model per year is the basis for calculating budgetary allocations in the Resource Service Model.

RESOURCE INVENTORY MODEL

The Resource Inventory Model maintains a physical inventory of all the major human and physical resources available to the public agency. This inventory is updated and maintained during each time-phase of the simulation. As new resources are acquired, or existing resources are maintained,replaced, or depleted, the model reflects the budgetary and cost implications of these transactions and the appropriate records and inventory status are up-dated.

INPUT

- Inventory of Public Agency Major Item Resources
- Facilities
- Physical Plant
- Support Equipment
- Support Personnel
- Maintenance, Replacement and Additions Policy
- Cost characteristics associated with maintaing replacing, and adding inventory
- Purchase Dates & Expected life of the Resource items.

OUTPUT

Resources inventory status
Costs to maintain,replace and acquire Resources

MODEL OPERATION

1. At the simulated period the resource inventory model is initialized to reflect the status of all major resource items available.

2. The maintenance cost characteristics and expected life for each major item are an integral part of the model.

3. Prior to a simulated budgetary year each item in the inventory is examined, and the cost incurred to maintain it during that year is calculated.

4. The maintenance costs of "current" inventory are used as a direct input to the total budgetary requirements for that year.

5. As an item reaches the end of its expected life it is deleted from the inventory. It will be picked up again if there is a requirement for it in the next budgetary year.

6. The cost of each major item that may be required is stored in the model. Using these data the cost of the major item deficiencies can be calculated.

7. At the completion of each simulated year the inventory is up-dated to reflect the addition of new major resource items and the aging of existing items.

RESOURCE SERVICE MODEL

The Resource Service Model generates the resource requirements for each budgetary area or center based upon the modus operandi and various effectiveness measures of the public agency in the utilization of its resources to render programs and services. A comparative check with the Resource Inventory Model enables a Resource Deficiency listing to be generated. Based upon the resource deficiencies, inventory maintenance costs and operating costs, a budget listing for each budget area is produced. This budget is based upon certain levels of effectiveness, forecasts and translation coefficients (resource utilization factors). By manipulating these inputs various strategies can be examined and their effects analyzed prior to the implementation of any one strategy.

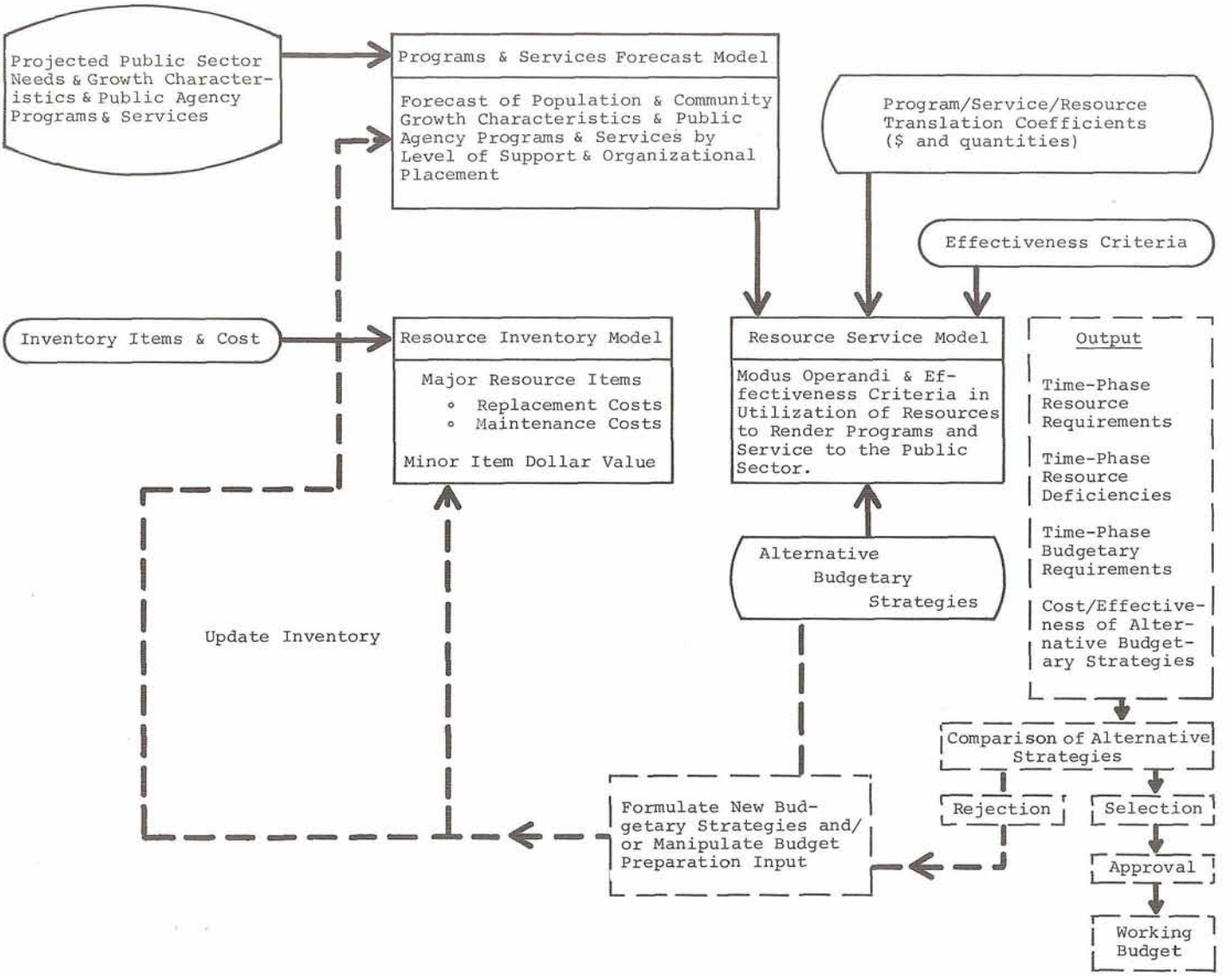


Fig. 1 - Model Interrelationships and Planning - Programming - Budgeting Simulation Operation

INPUT

The output from the Programs and Services Forecast model, i.e., the programs and services to be provided by the Public Agency during the simulated year.

Resource Inventory Model output, i.e., "current" resources available with the appropriate costs to maintain and replace the current inventory.

OUTPUT

Time-phased Resource Requirements
Time-phased Resource Deficiencies
Time-phased Budgetary Requirements

MODEL OPERATION

1. The programs and services to be provided for a particular simulated year are transmitted to this model from the forecast model.

2. Based upon the interrelationships and program requirements of the target population, the resource requirements for operating personnel, facilities, equipment, physical plant, etc. are determined for a particular effectiveness level and a certain time frame.

3. The resource requirements will be defined in terms of major and minor items. The major items will be individual items defined in quantities required. The minor will be of an inclusive type, such as office supplies and will be defined in dollar requirements.

4. By comparing the major item requirements, and major items available in inventory, resource deficiencies can be obtained.

5. By knowing the cost of each deficient item, the maintenance cost of the current inventory, and the minor item requirements cost, a budget can be generated.

6. In progressing to the next simulated year the inventory is up-dated to the extent that the deficiencies are regarded as procured and placed in inventory, along

with the appropriate purchase date, expected maintenance cost per year, and expected life.

7. On completion of the simulation the results of alternative strategies and corresponding budgets can be compared, and new strategies formulated in order to improve the effectiveness of the budgetary dollar.

DISCUSSION

The PPBS simulation model can be used for several purposes, such as:

1. Budget Generation Mode

The model can generate yearly budgets which are acceptable to all budget cost centers. At present, simulation models to generate municipal budgets exist, have been validated, and appear to be successful.* They produce savings in effort, time and money simply because the budget is automatically generated. There will be general agreement with a budget function of this nature because all concerned personnel would have been consulted, contributed to, and accepted the interrelationships and characteristics required to design the model.

2. Experimental "What if" Mode (Gaming)

Public administrators can use the model for experimental purposes to measure what impact deviations in projected population and community needs, programs, staff and funding availability, etc. will have on the budget. For example, the model will be capable of determining the budgetary effect of increasing the extent of services in a certain program area with a corresponding decrease in another program area.

The policymaker will have a tool by which he can see budgetary effects of his decisions prior to implementing the policies, and therefore have a predictive tool available to save time and provide supporting criteria and costs necessary for subsequent action.

3. Effectiveness Mode

Dependent upon the available data and effectiveness criteria, the model could be used to evaluate the effectiveness of various budgetary strategies. (Reference Fig. 2).

For example, assume a particular health agency objective of reducing the incidence of lung cancer by 10%. Strategy 1 would reduce the incidence of lung cancer by 9% and would involve a budgetary figure of $6,000,000. Now, with the total dollar budget maintained at $6,000,000 another strategy is formulated--which could be switching funds from lung cancer research to cigarette filter development and measuring the overall change in effectiveness. Successively, strategies 3, 4 and 5 would then be evaluated at a fixed budget level. Ultimately, it would be possible to generate a series of curves similar to Fig. 2, in which various strategies could be evaluated in terms of effectiveness and budgetary cost.

The advantage of including effectiveness criteria in the model consists of having the ability to evaluate the effects of budgetary trade-offs on the system; conduct sensitivity studies; and obtain an awareness of the cost/effective operating range.

* *J P Crecine, "A Computer Simulation Model of Municipal Budgeting" Management Science, Vol 13, No 11, July 1967*

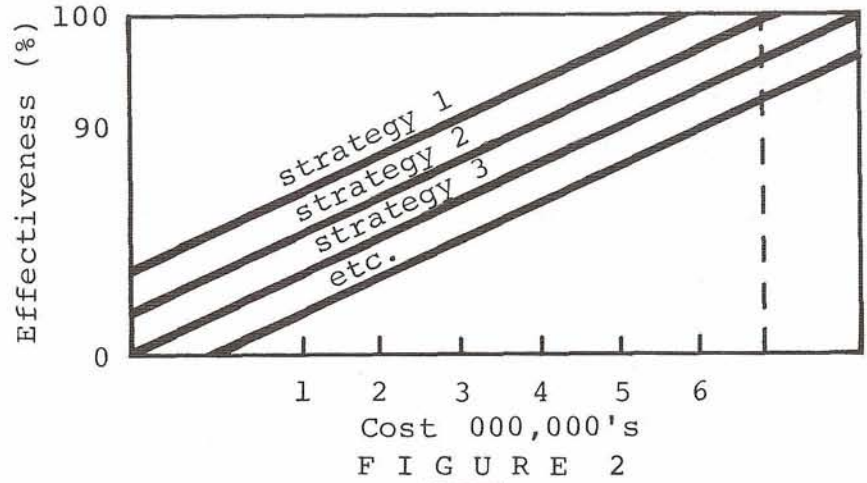


FIGURE 2

COMPUTER USAGE COMPANY, INC.
344 Main Street, Mount Kisco, N. Y. 10549