A Hierarchical Goal-Programming Approach to Reverse Resource Allocation in Institutions of Higher Learning

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As universities react to severe financial pressures, there is a danger that too much emphasis will be placed on ‘balancing the budget’ at the expense of the academic goals of the institution. Therefore, the overall objective of this paper is to design and implement a model for reducing the operating budgets of the academic units of a university, while reflecting the diverse goals of the academic community. It recognizes that faculty, department chairmen and deans should share the responsibility of ‘reverse’ resource allocations or budget reductions. The model utilizes a goal-programming approach to reflect the multiple-phased model to allow for some degree of decentralization of decision making.

The model is applied to a small private university. The solution to the model reveals the distribution of budget reductions among the schools and within the departments. A survey of potential users reveals a definite preference for the model results over the actual budget procedure.

Key words: goal programming, higher education

INTRODUCTION

We are entering an age of austerity. The federal government has embarked on programmes to reduce, rather than increase, benefits for many persons. This environment of resource limitations permeates almost all organizations. Colleges and universities are not immune to these financial pressures.

Some major factors contributing to the financial woes of institutions of higher learning are enrolment shifts from humanities to business, reassessment of the value of a college education, enrolment declines and rapidly rising costs. Added to these is the switching of priorities to more expedient social problems. Both the federal and state governments have cut back their support to academia. Research grants have been reduced or eliminated by both foundations and private industry.

As the universities react to severe financial pressures, there is the danger that too much emphasis will be placed on ‘balancing the budget’ at the expense of the academic goals of the institution. The crucial issue in the administration of higher education is not just financial efficiency. The operational policy must be based on the combined philosophies of many diverse groups within the academic community. The very purpose, concept and function of the administrators, faculty and students must be embodied in budgeting decisions.

The effective and efficient operation of colleges and universities is complicated by the large measure of independence usually experienced by each school and department. In addition, faculty members are granted a great deal of independence in designing their own courses of instruction. This academic freedom must not be thwarted unless the university wishes to stifle academic professionalism, high-quality education and the specialized talents of its faculty.

The goals of a university are partially determined by these specialized talents. The problem of individual, departmental and school self-determination as opposed to the institutional purposes and authority must be addressed and resolved in establishing the overall operational budget of the university.

The overall objective of this paper is to design and implement a model for reducing the operating budgets of the academic units of a university. The model must reflect the diverse goals, with their respective priorities, of the academic community, while recognizing that a university is an economic system in which the subsystems must maintain a degree of autonomy. Faculty, departments and
colleges within the university should share the responsibility of ‘reverse resource allocation’ or budget cutbacks.

In line with this philosophy, the model developed will:

1. utilize a goal-programming (G.P.) approach to reflect the multiple, competitive goals of the university community;
2. employ a zero–one (0–1) solution process to reflect the indivisibility of the budget packages; and
3. allow for some degree of decentralization of decision making with respect to budgetary matters.

In recent years, goal programming has become recognized as an important mathematical approach to academic research. Lee and Clayton1 presented a G.P. model of university budget planning which determined the optimal size, type, rank and salary of faculty with a college. Schroeder2 provided a G.P. model for long-range budget planning and resource allocation. It focuses mainly on the division of the payroll budget among faculty, staff and graduate assistants. Mixed-integer G.P. was employed by Keown et al.3 to reflect the unique characteristics of university capital budgeting problems. The results of their model indicated which capital budgeting projects should be accepted.

This study differs from the existing models in that it addresses the problem of budget reductions rather than expansions. It is larger in scope, encompassing every department, division and school of the university. It is not dependent upon the preference structure of one decision maker, but incorporates input from administrators at all levels of the academic hierarchy.

A GOAL-PROGRAMMING MODEL

The model developed here is concerned with establishing optimal portfolios of budget-cut packages for each school in a university, and optimal packages of budget-cut items for each department within the schools. The results will be optimal in terms of establishing reverse resource allocations which cause the least amount of adverse impact on the effectiveness of the university.

The model is tested on a private co-educational university offering undergraduate programmes in natural sciences, social sciences, humanities, business and education. The undergraduate population is approx. 2400 students. A comparison is made between the actual percentage allocations of the university’s academic budget under existing budgetary practice and the percentage allocations resulting from the model when a 10% reduction in the operating budget is required.

Overview of the model

The academic sphere of the university is characterized by three administrative levels: academic vice-president, deans of schools or divisions and chairmen of departments. The model will allow the decision maker at each level to select the portfolio of budget cutbacks which has the least negative impact on his multiple objectives.

The budget process is sequential in nature. Goals of the university are first determined at the highest level by the academic vice-president. These goals are generally quite broad in nature, rather than very detailed. These goals are then decomposed into the goals of the deans of the schools. This decomposition results in the formulation of subgoals, which contribute to the goals of the higher level. A dean may add one or more additional local goals which are not of particular concern to the vice-president. Finally, the same process is repeated by chairmen at the department level.

After the goals are established at the lowest organizational level, the information flow is reversed. Each department sets up its own G.P. model in which the zero–one (0–1) decision variables correspond to budget-cut alternatives. The model is solved for several possible budget-level cuts, usually between three and five in number. Corresponding to the budget levels, optimal sets of budget-cut alternatives, called portfolios, are communicated upward to the dean of the school.

Each dean then uses the goal-programming approach on the set of mutually exclusive portfolios received from his departments, along with any budget-cut options he may wish to add. The