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ABSTRACT

Following the keynote address on the importance of planning and the changing style of management in colleges and universities, various prepared papers developed the meeting theme of using technology in college and university planning. William Massey described the development and use of a computer model for strategic planning at Stanford. Edmund Cranch reviewed the long-range implementation of the planning process with reference to Cornell's experience. The design and use of a support Administration Information System for planning and control at the University of Pennsylvania provided another case report. Planning for computer and television technologies provided the focus for several presentations. After an overview of the obstacles to innovations with instructional technology by Franklin Patterson of the University of Massachusetts, Bruce Lusignan gave a brief description of the Public Service Satellite Consortium and Robert Scott from MIT discussed planning for the expense of information processing systems. (KB)

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Defining the Future

PLANNING WITH AND FOR TECHNOLOGY IN HIGHER EDUCATION

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PREFACE

As academic institutions encounter financial stress, the role of planning in colleges and universities becomes more and more important. Resource allocation, the appropriate use of people and other ways to achieve excellence, become the focus of institutional administration. Discussion of the planning process on three levels, strategic, tactical, and operational and the use of technology in planning were the emphases of the Spring 1975 EDUCOM Conference.

Following an initial address on the importance of planning and the changing style of management in colleges and universities by keynoter Richard M. Cyert, various prepared papers developed the themes of using technology in planning at the strategic, tactical, and operational levels. Presentations on planning for technology (computing and television) rounded out the program and workshops provided an opportunity to explore specific examples.

These papers in edited form have been collected and printed in this proceedings. Further information on applications discussed in the papers in this volume can be obtained directly from the author of each presentation. Names and addresses of all conference participants including the speakers are listed in Appendix A.

On behalf of all conferees, I sincerely thank the Conference Chairman and Program Committee for developing such an excellent program. Richard Van Horn, Vice President for Business Affairs, Carnegie-Mellon University, served as chairman of the Conference and was assisted by: James Emery, Executive Director, Planning Council on Computing in Education and Research EDUCOM; Kenneth King, Dean for Computer Systems, Board of Higher Education, CUNY; and Fred Rogers, Head, Planning and Analysis, Carnegie-Mellon University. The plans and expectations of the Program Committee were ably fulfilled by the speakers and the workshop leaders, to each of whom I would like to extend special appreciation.

Henry Chauncey
EDUCOM President

INTRODUCTION

"Traditionally universities have not been managed at all . . . We must now operate in a more deliberate way to utilize most effectively the resources at our command." These words from keynoter Richard M. Cyert set the tone for a thorough discussion of the planning process in colleges and universities and the relevance of technology to that process in 1975. Although many administrators might argue today against any kind of planning because of uncertainties facing each college and university, one must recognize that an institution has to be prepared to act effectively over a wide range of possible events.

Papers presented at the EDUCOM Spring 1975 Conference, which have been edited and collected in this volume, address issues related to planning with and for technology in Higher Education. Following the keynote by Richard M. Cyert, William Massy, Stanford University, describes the developmnent and use of a computer based model at Stanford University for strategic planning. Edmund T. Cranch, Cornell University, reviews implementation of the planning process, at the long range or strategic level, with particular emphasis on recent experience at Cornell University. In a strategic planning exercise at Cornell, data bases covering current experience at the institution were employed to generate alternative projections for the future.

Planning for television and computer resources is a special application of the planning process. Following an overview of this process by Franklin Patterson, Boyden Professor, University of Massachusetts, Bruce Lusignan, Stanford University, describes the Public Service Satellite Consortium which is a recently developed cooperative group of users or potential users of satellite communications. Robert Scott, Director of

Information Processing Services, M.I.T., outlines, in a later presentation, the factors to consider in planning for computer use in colleges and universities at the various levels of planning.

Specific examples of planning in individual institutions highlighted the workshops held throughout the conference. Summaries of each workshop have been made and sent directly to conference participants. For further information on these informal discussions, readers are referred to workshop leaders listed in Appendix B. A complete listing of all conferees names and addresses appear in Appendix A.

Traditional functioning of colleges and universities as highly decentralized organizations was possible and often productive during a period of fast growth and adequate resources. During the 1970's however, when resources are decreasing and enrollments declining, institutions must develop methods of planning at all levels in order to survive and develop as centers of excellence. This volume gives some perspective on using technology to enhance an institution's planning and budgeting process and to effectively pursue institutional goals.

Richard Van Horn
Conference Chairman

CHAPTER 1

by RICHARD M. CYERT

A Style of Managing a University

As academic institutions encounter financial stress, they develop more interest in their own management. Looking closer into the subject, they recognize that there are really far fewer management differences between business firms and academic institutions than have been presumed. One of the areas that business firms have emphasized but academic institutions have ignored is planning. In the halcyon days of the '60s, when colleges and universities turned many students away, nobody needed to plan and nobody did; one interesting example is the amount of construction undertaken on both private and public campuses without sufficient planning. These buildings were designed only for the next day instead of for next week or next year, and now, as growth tapers off and even turns down, colleges begin to find themselves with excess capacity.

Many administrators and faculty members will argue today against any kind of planning because of the uncertainties facing an institution, primarily uncertainties in enrollment and operating funds. A planner must first recognize that since uncertainties will always exist, he needs to put the organization in such a position that it can act effectively over a range of possible events. More specifically, planning consists of setting some goals, devising some strategies to reach those goals, and developing organizational processes to implement those strategies.

Setting Goals

The first step in planning must be the setting of goals, which is obviously not a simple matter. There are always constraints on the goals. In most business firms, as James March and I argued some years ago, the goals tend to be set by a bargaining process among the coalition running the organization. To some extent this is also true in academic institutions. But if a university has two Nobel Prize winners in a certain discipline, it is unlikely that one of its long-range goals will be to abandon that field, regardless of how well or badly the department fits into the rest of the institution. Other constraints will come from the financial resources and the people already in the organization.

If the goals are to be made explicit, which is the condition for their being useful, somebody must start the process of determining them, and this should be the chief executive. Unless the chief executive is committed to planning, and unless he is prepared to follow the plan, all of the planning activity will be mere facade. The executive's statement of the goals should be discussed in detail and refined by the coalition managing the organization (which will differ in makeup depending upon the executive's style). It is also useful to have inputs in the refining process from the other major constituents of the university — trustees, faculty, students, and alumni. The completed goal statement will be hierarchical, and the different levels of goals will have different degrees of specificity and will relate to different organizational units. A totally developed goal system will become the basis for a broad and detailed set of plans.(4)

Devising Strategies

The next step in the planning process is the development of a set of strategies that will link the organization to the achievement of the goals. The implicit assumption in this second process is that the planners are already aware of the university's resources. They are basically trying to find strategies that will map these resources into the goal structure. The result will again be a hierarchy of strategies that will relate the overall goals of the organization to those of the subun ·s. Strategies may range from a tuition, scale, and program portfolio at the aggregate level to fields of emphasis in particular departments at the more micro level of planning.

Developing Organizational Processes

The next step in the process is to devise the means by which these strategies can be implemented. Each micro or budget unit must develop specific plans with the necessary personnel, program, and financial values for a five-year period. The plan for the first year should become the budget for that year and should be revised annually, with each current year's plan becoming the subsequent year's budget. More accurately, these plans should be regarded as the unit's budget requests since financial constraints may not allow the organization to fund the request fully. These plans should become the basis for the total program and financial planning for operating the university over a five-year period. The capital budget must be added to the operating plans for the five-year period to derive the total financial requirements. Of course, the total plan at the micro unit will include the number of faculty members needed and the estimated number of students who will enroll.

This kind of planning should utilize the academic and business departments. The overall framework in which the planning is done may be determined centrally, but a great deal of the work has to be done at the individual departmental level. This carries with it some potential difficulties if the organization is unable to carry through on the plans. There is a danger of disillusionment and frustration at the departmental level if no results are evident after the amount of effort required in the planning, but such a risk is necessary.

Exploring Variables

At this point one of the best uses to which the planning data can be put is to attempt a series of computer simulations or analyses exploring changes in the different variables. NCHEMS has developed several approaches to the process.(7) Models such as CAMPUS or DECADE offer alternatives.(3) And Massy and his colleagues have developed several financial planning models for use at Stanford. The key point here is the need for a mechanism to explore alternatives in the context of a multiyear plan and the need for a framework within which to collect and organize planning data.

One of the secrets of managing the planning process is to remain flexible and not force the organization to follow rigidly a specified plan that is clearly obsolete Frequently, an academic unit will see a series of paths it might wish to follow. After a while it will be known if the present path is productive; if it is not, the unit may wish to move to another area. It is possible by means of the basic data provided by the computer to make assumptions about possible paths depending upon the degree of success of the particular one being followed.(2) In all of these planning procedures it is crucial to have appropriate programs on the computer, ranging from pure data storage for retrieval to analysis to simulation. Modern planning has developed along with computer capacity, and it is now virtually impossible to do a sophisticated job of planning without the help of a computer.

Monitoring Performance

The next step in the planning process is to develop measures to monitor performance. These are the basis for determining an organization's progress in achieving its objectives. They may signal a change in resource allocation because of the success or failure of plans. Such measures are difficult to develop and generally have not been handled well in academic organizations. The measure should be an index number in which all the variables of performance for which the dean, for example, is responsible are included. These should be weighted in some system acceptable to all administrators involved. Thus, a system might include: number of bachelor's degrees awarded; number of Ph.D. degrees awarded, perhaps on a per-faculty-member basis; some measurement of research output; some indication of budget performance; and an indication of the general rating or ranking of the school in relation to competitors.

The difficulty lies in defining the quality of performance, or more specifically, in measuring the quality of education and research. Research quality is, perhaps, easier to measure than that of education because of the high correlation between quantity and quality of publications.(5) Quality of research in this context would be measured by the quality of the journals in which the research results are published. Other, more sophisticated measures would be desirable. Citations in other articles and books might serve as a measure of quality, but they are expensive and time-consuming to ascertain.

The measurement of quality in education is more difficult, however. The quality of the teaching is often measured by student questionnaires, but that system is fraught with great danger.(8) The best approach is to measure the actual outcome of the teaching process.(1) The problem of timing is obviously important in such measurements. In professional schools, for example, the best standard might be success in the chosen profession five, ten, or twenty years after graduation, measured by such criteria as salary or organizational role. Short-range measures involve testing and must deal with all the attendant problems of that field. Nevertheless, some form of outcome measure is necessary in an evaluation index.

Complementary Plans

Until now we have been discussing only a broad type of planning. This might be called development of the strategy and structure of the organization, and in some sense it might be viewed as the organization's major plan. A series of complementary plans must also be developed. For example, the management of cash requires a planning process of at least one fiscal year in duration, in which the receipts and disbursements of cash are analyzed and forecast on a monthly basis. The cash-flow plan enables an organization to invest its cash in short-term securities in an effective manner and keeps it from developing serious problems in its cash account. Similar examples are a faculty tenure plan and personnel flow plans for retirement, promotion, etc.

The University's Endowment

Another area of importance in planning relates to the endowment of a university. The optimal way to plan is to start with a set of expected expenditures from an endowment income over a period of about ten years. If it is going to be meaningful this expenditure plan must, of course, be tied to the other planning process of the organization. (2) This pattern of expenditures should be put into a simulation model that involves the current portfolio of the endowment and makes some assumptions based on historical fact about the stock market and the bond market (if both exist in the portfolio). (6) Out of a simulation of this type, in which the goal for the five- or ten-year period is specified in terms of a desired value for the endowment at the end of the period, the simulation model can determine the degree of risk that should be taken in the portfolio. This degree of risk becomes a factor for the managers of the organization's endowment in setting an investment policy.

The basic plan for the endowment should include a method of evaluating the performance of the endowment manager, such as getting information about the performance of those who are managing portfolios similar to the university's. Too often the tendency has been simply to turn the endowment over to the manager, trusting in the outcome without measuring performance.

Radical Alternatives

The planning process itself tends to be a somewhat conservative operation. The tendency is to plan along the lines that already exist in the organization. There is usually pressure to complete the plans quickly, and this pressure tends to eliminate attention to an item like organizational structure. Also, under these conditions, the process of planning seldom leads to the abandonment of any activities. That is why a radical departure from normal operations must be handled at the top level of planning. More important, however, it is probably necessary to have a special session or to allocate specific time when there will be an effort on the part of the relevant people in the organization to think of radical alternatives. Such sessions should be freewheeling ones in the sense that anyone can bring up items, but there should also be a planned agenda of items about which innovative ideas are needed. In such a session it is desirable to have access to a simulation of the organization so that, for example, estimates of the savings and costs from dropping units can be determined quickly. Similarly, a simulation can be helpful in determining the way a new organizational structure might function.

Another problem that does not receive attention during the conventional planning process is the organization's entrepreneurial activity. During the usual planning process it is unlikely that deans or department heads will look at the development of nondegree programs, the establishment of a night school, or other operations that differ from the normal. Now, however, when universities need alternative sources of income, this kind of activity is particularly important. It is desirable to attend to such activities directly through special planning sessions devoted specifically to the topic. They should be organized in a fashion similar to that of the radical departure sessions.

Conclusion

In all of this activity, we are talking about a style of managing a university. Traditionally, universities have not been managed at all. They have tended to function as highly decentralized organizations in which deans and department heads essentially operated in an autonomous fasion. This kind of operation was possible and even productive when there were plenty of students and adequate resources. Unfortunately, those days are no longer here, and we must now operate in a more deliberate way in order to utilize most effectively the resources at our command.

References

1. Bloom, Benjamin S. "Testing Cognitive Ability and Achievement," in *Handbook of Research on Teaching*, ed. N.L. Gage. Chicago: Rand McNally & Co., 1963, pp. 379-397

2. Boldin, R., and Ziskind, R. "A Computer Simulation Model for Investment Portfolio Management." *Financial Management*, Autumn 1973, pp. 22-33.

3. These models are described in the following publications: *CAMPUS PMS: An Overview*. Systems Dimensions Limited, Toronto, June 1974. *DECADE User's Guide*. Cragwall Computer Center. Second Edition. Crawfordsville, Indiana: Wabash College, March 1974.

4. For an example of a goal system see *Focus* (Carnegie-Mellon University), Vol. 3, No. 1, 28 September 1973.

5. This statement is based on an unpublished study by Professor David Klahr of the Department of Psychology at Carnegie-Mellon University.

6. Massy, William F., and Hopkins, David S.P. "Long Run Financial Equilibrium Calculations for Stanford's Operating Budget." Stanford University Academic Planning Office Report No. 74-3, September 1974, and Massy, William F. "A Dynamic Equilibrium Model for University Budgeting." Stanford University Academic Planning Office Report No. 74-2, October 1974.

7. NCHEMS technical reports include publications on the following systems: Costing and Data Management, Resource Requirements Prediction, and Information Exchange Procedures Implementation. Information about NCHEMS can be obtained from WICHE, P.O. Drawer P, Boulder, Colorado 80302.

8. Zelby, Leon W. "Student-Faculty Evaluations." *Science*, Vol 183, 29 March 1974, pp. 1267-1270.

CHAPTER 2

by WILLIAM F. MASSY
Stanford University

Planning and Modeling in Higher Education

Attitudes Toward Planning in Academe

The critical importance of planning in higher education has never been more clearly manifest. The year 1975 is a time of great financial pressure, perhaps unprecedented, on colleges and universities. More important, it is a time of threat to some basic academic values; some would say the viability of the academic enterprise itself is at stake. Planning's challenge is not just to alleviate the current pressures, but to assure that the traditions of independence, creativity, and intellectual excellence survive and hopefully prosper during the years ahead.

Until fairly recently the concept of planning, or at least planning in an activist role by the central administration of a university, was viewed as unnatural if not suspect. It is tempting to assume that the contrary view now has been widely adopted. But it's still an uphill pull for a number of very good reasons that are relevant to one theme. Here's what some of the skeptics say about planning and *the application of analytical tools to* academic administration.

> Centralized planning is dangerous because it takes the initiative away from those best able to exercise it: the faculty, department chairmen, and the deans of individual schools.

There is fear that authority will be exercised by the wrong people. Even if the process is highly participative, the hoops and hurdles of a formal planning process may tend to drive out academic creativity and judgement in a manner described by Gresham's Law.

> Detailed and scientific modeling schemes that are often associated with centralized planning will make it difficult for profound but qualitative judgements to make themselves felt.

Another short quotation illustrates the point.

> The success which this elegant model has had . . . is matched only by

its failure to predict correctly the actual course of events—a fine illustration of the . . . maxim that a model is never defeated by facts, however damaging, but only by another model.

This argument takes force from the fact that the most important judgements an academic institution has to make are value laden and qualitative. Models used indiscriminately represent unfair and undesirable competition.

Planning doesn't work anyway. We've been planning for five years and look at the mess we're in now!

This view is not necessarily irrational. In a highly uncertain world it may be better to design a control system that relies on prompt response to feedback than to try to program events through detailed planning. In addition, there are real, and to some extent justified, threats to the credibility of higher education administrators and the planning process we try to lead. An important question is whether imperfect planning leads to more or less stability and predictability of expenditures than periodic reaction to environmental events.

Other, less reasonable objections are also raised in opposition to the application of planning principles in higher education. These may stem from inherent mistrust of administration or administrators, a desire to preserve the status quo by "stonewalling" or "no nothingism," or from simple ignorance or misunderstanding about planning principles or about the specific problems facing the institution. These less reasonable objections, when dominant, are hardly a credit to academic values and traditions. However, they should not be confused with the manifestation of differing values and judgements pursued vigorously and in good faith, which make any process of university decision-making an intense experience.

Planning, as defined here, was not really necessary as long as the resources available to academia were abundant and growing. Only five years ago the idea of reexamining the base budget in a formal multi-year context was seriously introduced at Stanford University. Prior to that time the planning process was incremental, relatively informal, and highly decentralized.

Years of decentralization and incremental budgeting led to some specific consequences for Stanford. First, the process was extraordinarily effective in developing teaching and research programs of very high quality. This point cannot be stressed enough; *academic effectiveness* clearly can be enhanced and even maximized. But the process also generated what Dr. Cyert has termed "organizational slack." Since 1970 Stanford has cut some $8 million out of the budget base with little serious effect on academic programs. Because these cuts have come from both the administration and the academic departments, it would be wrong to say that one group or the other were more inclined to slack building during the golden age of resources. The main question now, of course, is how much further the institution can go without more dramatic and serious consequences.

It seems clear that higher education will have to .e concerned with efficiency as well as effectiveness in the years to c...ie. The importance of this dual goal underlies the current stress on accountability to state and federal funding sources, to students who pay tuition, to donors, and even to oneself. Higher education has become too large a user of the society's resources to expect different treatment, especially in a time of diminishing enrollments and increasing competition from other societal programs. The problem is to find a way to be reasonably efficient without sacrificing overall effectiveness, especially on the non-quantitative dimensions that are essential to an institution's mission. The planning process, and the proper role of modeling in it, offer one solution.

A group of my colleagues at Stanford have been working hard to develop planning processes and models that meet these challenges. The following paragraphs describe the models, some of the implications that can be drawn from them, and the process by which they have come to have a certain amount of influence at Stanford.

First, what are these models *not* designed to do? They do not say what programs should be strengthened, retained, or reduced in scope. They do not tell a planner where to find "slack" in administration or elsewhere. They do not even tell what tuition to charge, how many students to admit, what the right payout from endowment ought to be, how big a budget the institution should have, or how big a deficit or surplus ought to be run in a given year. They *do* provide some practical guidance on the latter set of questions. Further, by so doing, they make possible greater participation in the planning process by members of the university community and provide a useful input to the more detailed and qualitative aspects of faculty and staff planning.

The Stanford Experience

The Stanford approach concentrates upon the growth rates of the components of income and expense. Figure 1 lists some of these components and suggests some of the things one can do to effect their levels and rates of change.

On the expense side are wage-drive costs, other cost-rise factors, and the need for quality improvements and new programs. On the income side lie payout from the endowment and gifts in addition to tuition and other special items like indirect cost recovery on sponsored research projects. Analysis of Stanford's budget data yields the magnitude of these costs in a given year. A combination of empirical analysis of multi-year cost

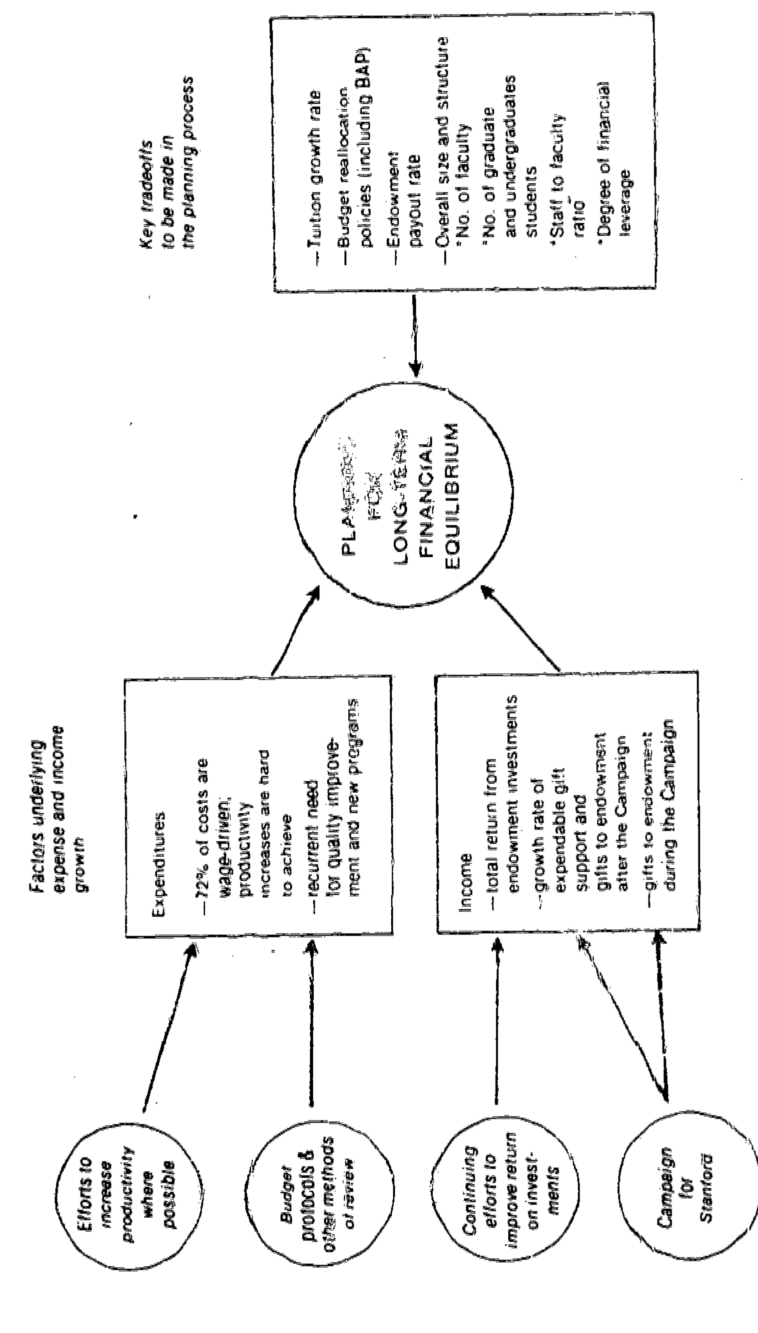

Figure 1. Outline of the Long-Range Financial Planning System

histories plus economic reasoning can provide estimates of their growth rates.

Projection of the future growth rates of budget quantities is a risky business, but it must be done. Here are some of the results of the Stanford analysis so far.

- Since universities are highly labor intensive institutions, costs must be expected to rise faster than the rate of inflation in the economy, even assuming no change in program quantity or quality.

- Analysis of Stanford's 1974 operating budget into wage vs. inflation-driven components suggests the following approximation for cost-rise*: Cost-rise = Inflation rate + 0.75 x Real per capita income growth rate.

- For the period from 1966 through 1974 the annual cost rise as estimated by the above formula was 7.0 percent (2.1 percent in real terms)+. This was 1.4 times the rate of inflation, and about 15 percent higher than the U.S. Office of Education Higher Education cost deflator.

- During the same period Stanford's core operating budget grew at an annual rate of between about 7.9 and 8.8 percent. (The exact rate is difficult to determine because the operating budget definition was being extended to include previously non-budgeted expenditures.) Since the number of students remained virtually constant during these eight years, the university was funding improved quality and/or declining productivity at an annual rate of between 1 and 2 percent. For four years during the same period the Budget Adjustment Program (BAP) was eliminating specific expenditures totaling about 1½ percent of the operating budget each year.

The Stanford estimation of budget growth rates represents a refinement of the work started by William Bowen in 1968.[1] *The methodology used urgently needs to be developed further and applied to data for a broad cross-section of universities.* This will not only lead to a better understanding of cost-rise factors, but will also allow our models to be applied broadly and in a comparative context.

A critical concept in the Stanford modeling work is the concept of long run financial equilibrium. Simply stated, a budget that is in "equilibrium" is one for which income equals expense in the current (base) year and the overall growth rates of income and expense are equal. By making explicit

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*For inflation we use the GNP implicit price deflator.

+The GNP price deflator grew at an annual rate of 4.9 percent on a university fiscal year basis. Real per capita income grew at about 2.7 percent per year.

estimates of long range growth rates and bringing them into the planning process one hopes to avoid the tendency to deal with budget imbalances by making short term "fixes" that tend to mask real problems or make things worse in the long run.

A number of key tradeoffs are highlighted by thinking of long run financial equilibrium as a constraint on the planning process. These include the tuition growth rate, the amount of budget reallocation (i.e. reductions in program to make funds available for new ventures), endowment payout, and possible changes in the university's size and structure. The notion of a tradeoff is critical because when planners "push in" somewhere in the system, the requirement for balance of budget levels and growth rates causes something to be "pushed out" somewhere else. Quantification of these relations is a major objective of the modeling.

One of the most important tradeoffs is shown in Figure 2. The growth rate of tuition, net of inflation, is plotted on the horizontal axis. On the vertical axis is the "net funded improvement factor." When multiplied by the previous year's budget, this determines the amount of new money that is made available for things like innovation, quality improvement, and meeting new demands for accountability or equity. In other words, the growth of the budget from one year to the next is the sum of necessary cost-rise on continuing programs plus "net funded improvement."

Concentrate first on the solid line in the center of the figure. It implies that a little more than 2 percent real growth in tuition will be necessary even if no net funded improvement is allowed. (Change would still be possible if funds are reallocated away from old programs each year.) This is close to the growth rate projected for real personal disposable income per capita. It is about the minimum increase in tuition that can be expected in the private sector of higher education given currently envisioned conditions. Should a one percent net funded improvement factor be necessary *for institutional viability, a tuition growth rate of* nearly twice that of real personal disposable income per capita will be required.

Stanford's real tuition growth rate was 4.1 percent during the period from 1966 to 1974. This is consistent with a net funded improvement factor of a little over 1 percent. (The actual funded improvement factor is estimated between 1 and 2 percent during these years, implying that other sources of funds were supplanting tuition to some extent.) Gross funded improvement (including BAP reallocations) averaged between 2.5 and 3.5 percent.

The solid line in the figure depends on another constraint not mentioned yet. The long run financial equilibrium should be stationary, in the sense that the proportion of the budget supported by endowments

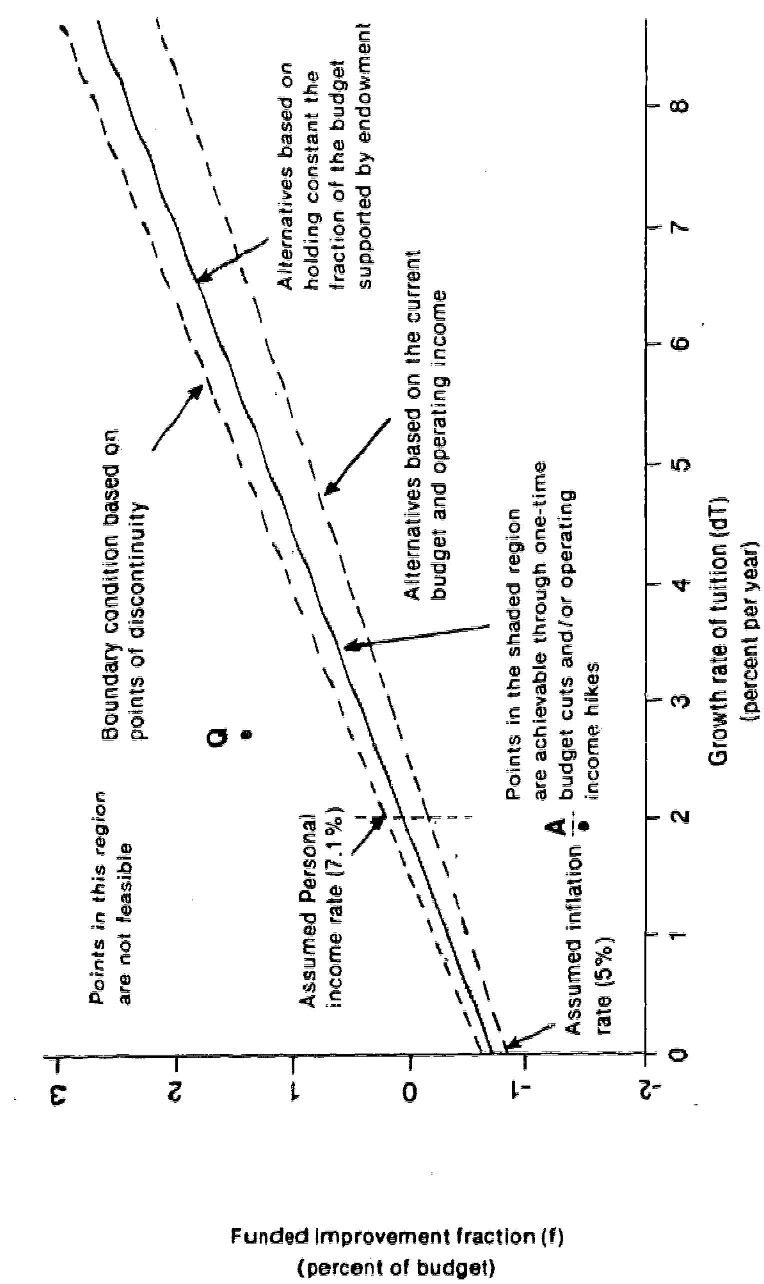


Figure 2. Trade-Offs Between Tuition Growth Rate and Funded Improvement Fraction

should stay the same over time. Other definitions of stationary equilibrium are possible of course. An "intergenerational equity" argument in favor of this requirement implies that the purchase power of the endowment, defined in terms of the fraction of the total program of the university that is supported, will be preserved. Future students will enjoy the same benefits from the endowment as present ones do, given stationary equilibrium.

Even if one doesn't accept the idea of stationary equilibrium the upper line is the limit for the position of the tradeoff between tuition growth rate and funded improvement. It can be reached by budget reductions beyond those that might be necessary to achieve stationary equilibrium. However, points above and to the left of the upper line are not practical no matter how much budget reduction is attempted.

The implication of the long-run financial equilibrium model applied to Stanford data is that the "price" of private higher education surely will grow relative to the prices of other goods and services. Indeed, it will probably grow faster than the growth rate of average family income. For the public sector, increasing support at similar rates would be required from a combination of state funds and student fees. Despite the understandable concerns of students, parents, and those in state government, it is difficult to see any practical way of halting this upward trend in costs.

The long run financial equilibrium model also has implications for the endowment payout rate. The model can be used to determine payout as a function of the type of equilibrium (whether it is stationary or not) and the funded improvement and tuition growth rate policies, as well as total return from investments and the flow of new gifts to endowment. The endowment payout rate is set in the context of a spending-saving strategy rather than only on the basis of market performance measures like total return or dividend and interest income.

For Stanford, it appears that a payout rate of between 4.5 and 5 percent will be about right. This compares to the 5.5 percent that had been budgeted and the approximately 7 percent scheduled to be paid in 1975 given the recent stock market decline.

The last modeling application which is the most significant, was invented by David Hopkins of Stanford's Academic Planning Office. It is a model for the transition of the university budget to equilibrium.

To see the significance of this model it is important to consider the context in which it was developed. For some time prior to the summer of 1974 a combination of intuitive judgement, long range financial projections, and the results of the model building efforts described so far were signaling that Stanford would be in for increasingly heavy financial weather. The evidence was hazy, but the several independent approaches seemed to be signaling the same thing. This culminated in the development of a detailed bottom-up five-year financial forecast for the operating budget. The university had previously been using ten-year projections of financial parameters for the University's overall or "consolidated" budget. However, this was the first effort to develop a set of predictions that could be defended logically on an item-by-item basis and applied to the budget that determines general fund allocations. This forecast was completed during the summer. It showed annual deficits growing to some $22 million in 1979-80!

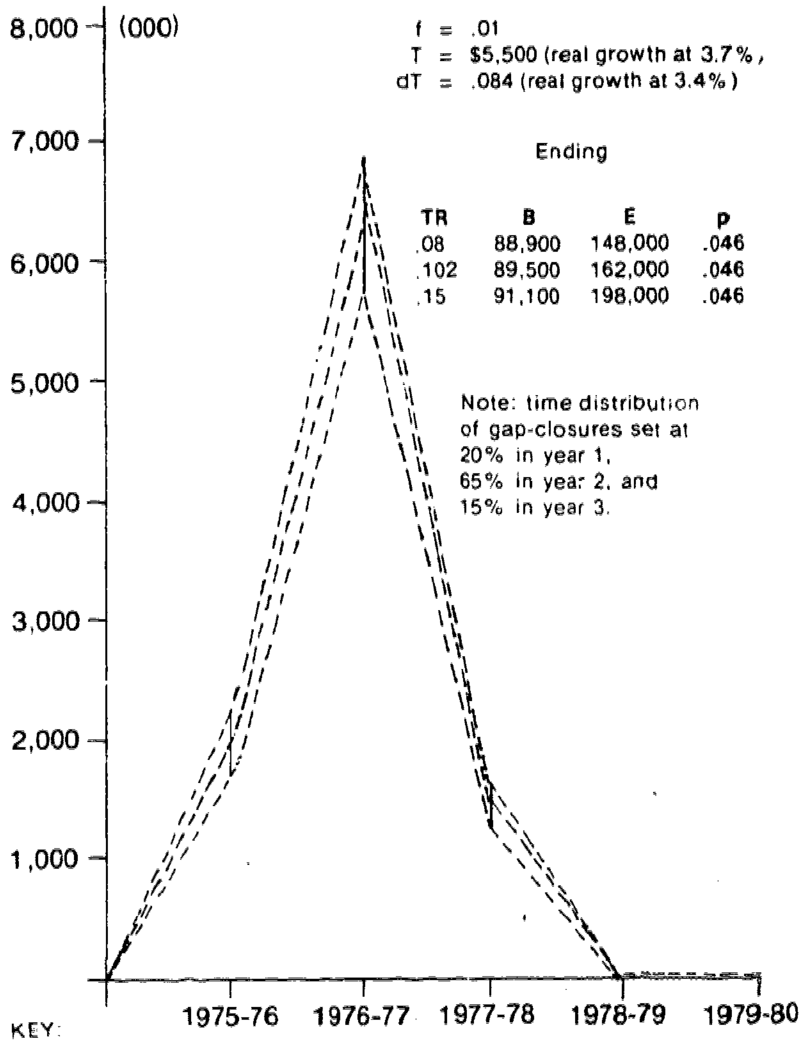
The problem could be attributed to a number of causes that were fairly clear *ex post facto* but very difficult to have predicted in advance. They included inflation, the decline in the stock market, and softening of government support. Also, some policies like a too-high endowment payout rate and a too-low tuition increase for 1974-5 had contributed to the problem. The question that faced planners in September 1974 was, "How much of a budget reduction would be necessary, and over what period of time could it be made?" Those responsible for budgeting asked the modelers, "How can you help—by next week?"

The "Transition-to-Equilibrium Model," whose main results are shown in Figure 3, provided an answer. The model starts from the detailed five year financial forecast mentioned above, invokes the constraint of stationary long run financial equilibrium at the end of the forecast period, assumes a desired time distribution of gap-closing measures, and then solves a system of 16 simultaneous linear equations. In addition to the yearly reductions that would be needed to achieve budget balance and equilibrium by 1979-80, the model estimates desired budget levels, endowment balances, and the deficits to be incurred each year on the way to equilibrium.

This exhibit shows three of the many runs of the model made in the autumn of 1974. The middle curve suggests gap-closing measures totaling $10.2 million, to be achieved during a three-year period. This target was adopted and announced by President Lyman at the October 1974 Board of Trustees Meeting. In addition, the various presentations made to the Board, the Faculty Senate, and other groups made heavy use of the five-year financial forecast and the transition-to-equilibrium model. President Lyman's Budget and Priorities Commission (composed of students and faculty as well as administrators) reviewed the reasoning that led up to the decision to set the "gap" at $10.2 million, including the logic and applicability of the model. They concluded that there was a problem and that the target was reasonably correct.

Here are some of the reasons why even this crude model has had a substantial impact.

- Long-run financial equilibrium is a useful construct that is understandable and has considerable common sense appeal. From a



KEY:

f = funded improvement factor
T = tuition rate in 1979-80
dT = growth rate of tuition after 1979-80
TR = total return on endowment, compounded annual rate to 1980
B = budget in 1980
E = endowment in 1980
P = endowment payout rate

Figure 3. Feasible Budget Reduction Schedules for Different Endowment Returns

technical standpoint, it provides a set of terminal conditions for what otherwise would be an infinite-horizon decision problem.

- It was possible to establish a logical and explainable relation between the highly disaggregative "bottom-up" five-year forecast and the gap-closing target that would bring us to equilibrium. Without this link it would have been much more difficult to agree on a realistic target.

- The model brought the funded improvement factor (set at 1 percent), tuition growth rate, endowment payout, and other variables all together into the same conceptual package where the effect of tradeoffs could more easily be seen. For example, the effect of changes in tuition or funded improvement policies could easily be represented in terms of "the gap."

- It is possible to do sensitivity analysis on key parameters. The most important one is shown in the exhibit. It rather conclusively demonstrates that the recovery in the stock market hoped for by many would not make our problem go away. Thus it eliminated from contention the argument that a strategy of "watching and waiting" might be better than a painful budget balancing program.

- Since it is easy to rerun the model when data change (currently a run costs about 22 cents) it is possible to trace variations in forecasts, assumptions, and choices upon the budget balancing target. Since October the "gap" has migrated from $10.2 million up to more than $12 million and now back down to between $9 and $10 million. Thus the budget balancing program can be dynamic in the sense of being responsive to changing conditions and assumptions.

- The model deals with a multi-year time horizon. Since the achieving of equilibrium is set at several years in the future, extreme shortterm fluctuations should be damped out. This property will become particularly important as the model is run and rerun over a succession of years, with differing assumptions.

The significance of the model is attested by the fact that the President's Budget and Priorities Commission has recently formed a Task Force to continue a review of the evolution of the model, the assumptions that are going into it, and the results therefrom. This development is welcome for many reasons, not the least of which is the expertise that will be brought to bear by faculty colleagues.

Looking to the Future

Where do the Stanford modelers go from here? The immediate agenda is the task of extending the transition model to accept uncertain parameter estimates and yield probability distributions for key budget quantities, including the gap. Progress on this aspect has been made already. It is important to understand better the risk involved in forecasts and calculations, and to communicate at every opportunity the fact that results are subject to uncertainty. This is particularly important in multi-period planning where a given year's target will be seen to fluctuate from cycle to cycle. Further steps, of a more basic research nature, include interesting control theory problems to be solved in the context of long run financial equilibrium. The group is making other modeling thrusts as well.

Models and planning definitely apply to higher education. Several conclusions have resulted from the Stanford group's thinking about the academic planning process and, in part, from attempting to apply models to it. For many, these points outweigh the ones made by the critics of planning and modeling quoted earlier.

- Centralized financial and institutional planning is necessary because, in academia, the commitments made to or decisions made by one academic unit can have a profound effect on other units. In other words, the university must be viewed as an integrated whole and not a heterogeneous collection of schools and departments. Global financial constraints must be well understood. Models can help one to look at the institution as a whole. Indeed they may be essential for accomplishing that purpose.

- The ecology of a top flight academic instititution is relatively fragile. Bringing out the best of human intellect in teaching or research requires a hospitable and reasonably stable environment. At the same time, one must respond to changes in financial parameters and the external economic environment. Given this, the absence of effective planning means a high degree of reactivity, start-stop budgeting, and the probable erosion of morale and accomplishment. Models can help in the process of developing multi-year plans, and can help stabilize the academic environment by putting bounds on uncertainty and minimizing surprises.

- Participating in planning and decision making by faculty and others is important. There are many wise heads in a university including minds the administration can scarcely do without if the best possible decisions are to be taken. Participation in the planning process may, in the long run, reduce the sense of frustration and mistrust that is sometimes apparent today. (This by itself would be a major benefit to academic institutions and those who live and work in them.) If used correctly, models can enhance participation. If used wrongly, they can make the planning process even more opaque.

Effective decision making requires the marshaling of data in a way that enhances the opportunity for judgement. Effective participation requires in addition a shared set of concepts—a framework within which to interpret data and debate assumptions and choices. Simple but relevant models can play a key role in furthering both objectives.

References

1. Bowen, Wiliam G., "The Economics of Major Private Universities." (Berkeley, California: The Carnegie Commission on Higher Education, 1968.)

2. Hopkins, David S.P. and William F. Massy, "A Model for Planning the Transition to Equilibrium of a University Budget." Stanford University Academic Planning Office Report No. 74-4, December 1974.

3. Massy, William F. and David S.P. Hopkins, "Constrained Maximization of a University Preference Function." Stanford University Academic Planning Office Report No. 75-1, February 1974.

4. Massy, William F., "Planning for Stanford's Long Range Financial Stability: A Time for Hard Choices." *Stanford University Annual Financial Report*, 1974.

5. Massy, William F., "The Economics of Endowed Universities." Stanford University Academic Planning Office Report No. 73-3, December 1973.

6. Massy, William F., and David S.P. Hopkins, "Long-Run Financial Equilibrium Calculations for Stanford's Operating Budget." Stanford University Academic Planning Office Report No. 74-3, September 1974.

CHAPTER 3

BY EDMUND T. CRANCH

Strategic Program Planning

Introduction

It is ironic that the decade of the 1960s, an era of unprecedented prosperity, closed with an economic outlook for higher education that could only be described as serious for most institutions and of crisis proportions for some. Cornell, one of the leading universities in the country with an educational responsibility of world-wide scope, emerged from the decade in a financial position which, while better than most, required stern measures. In the face of mounting deficits the University adopted a three-year program of budget cuts designed to bring its operating expenses into line with its income by the academic year 1973-74. It was clear from the outset that this program, even if it were successful, could provide no more than temporary relief. What was called for was a long-range planning effort, one that would help chart Cornell's course far beyond the moment of a balanced budget. With this in mind, in 1972 Cornell's president appointed an Advisory Committee on Long Range Financial Planning and gave it the task of assessing the financial state of the private portion of the University, establishing guidelines for long-range planning in the light of this assessment, and most importantly, evaluating the academic consequences of such planning. The scope of the Committee's investigation covered a broad range of topics, but the following five areas were considered in depth:

- Academic Affairs
- Educational Goals and Priorities
- Academic Productivity
- Nonacademic Affairs
- Tenure and the Reward System

This paper gives some of the central conclusions from this study and presents the case for strategic academic program planning in the context of an academic community.

While the study was made in 1972 and widely discussed at Cornell and elsewhere shortly thereafter, because the economic storm was not directly overhead, the University was slow in responding and implementing the needed changes. Events between 1972 and 1975 have only outlined in bold relief the urgent need for both strategic academic planning and the implementation of these plans. During this period the following series of economic waves rolled over our society, with each one dealing a special blow to universities: the contraction of the economy with its accompanying unemployment and decline of the stock market, the sharp rise of inflation to double digit heights, the impact of political instability both at home and abroad, and the long-term ramifications of the oil embargo with its greatly increased energy costs. The accumulated effect of these events shows that a prolonged delay in implementing strategic decisions only exacerbates the conditions and makes them more difficult to deal with at some future time. While universities are not used to consciously thinking about timing, events of the past five years have emphasized that timing is an important and sometimes a controlling factor.

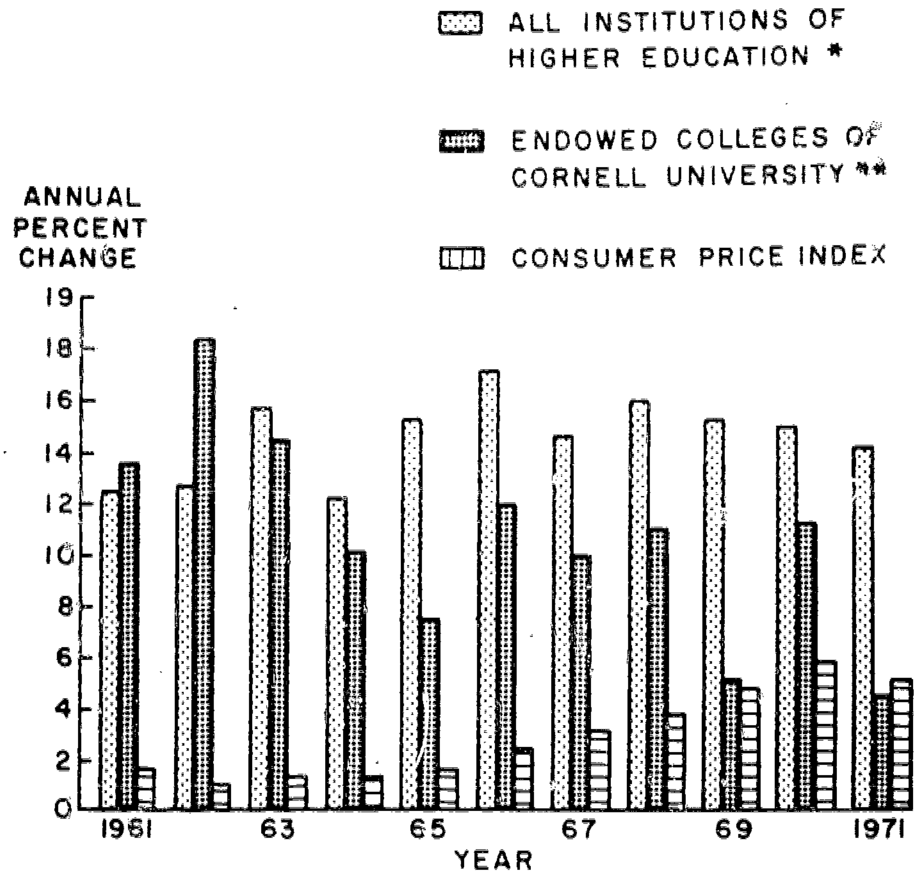
Balancing Expense and Income

In order to carry out the mission of the Cornell study, it was necessary to make a detailed review of the financial aspects and to relate these to the academic side of the University. While there was, of course, a wealth of information contained in the annual financial statements, it was very interesting to observe that in general it was not aggregated in a manner such as to be either readily understood by the uninitiated or directly useful in the academic decision process. Further, the nature of the interaction between the different categories of income and expense was not at all apparent. Though deeply experienced in neither the accounting practice nor the formulation of financial reports, the Advisory Committee did make a careful review of this aspect and attempted to put the information in a form which could be readily understood by the academic community. In fact, the translation of financial information into a form useful to nonspecialists is of prime importance in an academic setting. A very brief review of the financial findings and the kinds of policy issues they unveiled will now be described.

Growth often conceals defects, and the symptoms of financial distress began to appear in about 1967. Prior to this time, national economic growth coupled with a greatly expanded level of government and foundation grant activity masked the need for close scrutiny of the financial commitments which had been undertaken. Driven upward by program expansion, the annual increase in expenditures had far exceeded the historic rate of about 4.5 percent. This is clearly apparent from Figure

1. When the rate of increase of income faltered. Cornell slowly began to realize how thin its margin of safety had been. Beginning in 1967 substantial annual deficits began to occur, and they increased to almost two million dollars per year in 1970 and 1971. Thus, approximately two million dollars was being liquidated annually to meet operating expenses - a sum, which if retained, could be used to generate additional income. This very brief account of financial history shows how easy it is for an institution such as Cornell to slip into deficit financing and that once having slipped into this mode, sudden remedies are not available. The academic and financial momentum of universities makes rapid response to a deteriorating situation almost impossible. Continued deficits impair the vigor of current operations and undermine the basic institutional fiscal structure. A necessitous university cannot long remain free and independent - free to seek and speak, independent to choose its unique programs.

The overall strategy of the study was to assume that the program reduction measures already introduced would result in a balanced budget condition by 1974 and that the critical future need would be to match the rates of growth of expense and income. Thus, major attention was given to studying the growth rates of expense and income. In analyzing the trends, we tried to use categories which not only helped to understand what was happening but also lay at the base for prescribing remedies. Figure 2 shows the average annual rate of expenditure increase per student for some selected time periods. The data in Figure 2 show that no single category was responsible for the growth: rather, growth permeated the system. The fact that "Instruction" and "Student Aid" had high rates of increase per student for the decade of the 1960s, indicates that the increasing costs in these areas far exceeded the growth in numbers of both students and faculty. While the three-year period 1966-69 was one in which serious deficits arose, there were already indications that the rate of growth was being slowed down. But not until the year 1970-71 was there anything approaching a full realization of the University's dilemma. Included in Figure 2 are comparative data from a study jointly sponsored by the Carnegie Commission on Higher Education and the Ford Foundation. This study, conducted by Professor E. Cheit of the University of California at Berkeley, resulted in a book entitled *The New Depression in Higher Education: A Study of Financial Conditions at 41 Colleges and Universities*. Examination of Figure 2 shows that Cornell fell between the categories of "schools headed for financial trouble" and "schools in financial difficulty." Furthermore, the Cheit study showed that the two categories "Instruction and Departmental Research" and "Student Aid" display a diagnostic difference in comparisons of those "not in financial trouble" with the other two groups. Without going into details, this highlighting of "Student Aid" proved valuable in our study,



SOURCES:
* CHRONICLE OF HIGHER EDUCATION, APRIL 17, 1972
** CORNELL UNIVERSITY FINANCIAL STATEMENTS, 1960-1971

FIGURE 1: Comparison of annual percent change in total current fund expenditures.

Cornell University - Endowed Colleges Ithaca

Period	Total Expenditures	Educational & General	Educ. & Gen. less Organiz. Research	Instruction & Depart. Research	Student Aid	Safety Division
1959-60 1969-70	8.6%	9.2%	8.4%	9.9%	11.7%	12%
1966-67 to 1969-70	7.5%	7.4%	9.3%	8.4%	8.7%	32%
1970-71	0%	-0.3%	-3.7%	-0.4%	0%	11%
Carnegie Commission on Higher Education Study 1959-60 to 1969-70						
School not in financial trouble	7.5%	8.0%	7.7%	7.3%	12.0%	
Schools headed for financial trouble	7.3%	7.0%	6.8%	7.7%	18.1%	
Schools in financial difficulty	10.6%	9.5%	9.0%	8.0%	21.5%	

Figure 2. Average Annual Rate of Expenditure Increase Per Student

because it focused attention on this category and revealed appreciable ambiguity in Cornell's definition of this term. The final objective of the expense growth analysis was the summary given in Figure 3. It gives the estimates of the annual percentage increase in total expenditures per student by category source. Column I shows the results of analyzing Cornell's experience for the period 1967-70 and it shows that the overall growth rate in expenditures per student was 7.5 per cent. Column II, "Possible Cornell Projection," shows the growth rate levels which the Advisory Committee thought feasible if stringent control on the budget were introduced. It assumed that general inflation in the economy at large would be reduced from 4.2 per cent to 3.5 per cent. The overall target then was a 6 per cent growth rate of total expenditures per student. Column III shows the comparable results from the Carnegie Commission study of "schools in financial difficulty" while Column IV shows their "best judgment" projection. It maintains the 4.2 percent inflation rate.

The totals shown in Figure 3 together with the preceding discussion indicated that the probable rates of growth of expenses would be between 6 and 7 per cent depending on whether the general inflation rate was between 3.5 and 4.2 percent.

The next step in the financial review was to make a parallel analysis of income and compare the "best judgment" projection with the expenditure

Cost Factor	Extent of Campus Control	I Cornell 1967-70 Analysis	II Possible Cornell Projection	III Carn. Comm. "Schools in financial difficulty"	IV Carnegie Comm. "Best" Judgment
Inflation	None	2.5	2.1	2.4	2.4
Instruction & Dept. Res.	Substantial	2.4	1.4	2.0	1.3
Student Aid	Partial	0.8	0.8	1.7	0.9
Safety Division	Partial	0.2	0.1	1.0	0.3
New Responsibilities	Substantial	1.6	1.6	3.5	1.5
Total		7.5	6.0	10.6	6.4

Note: Columns III and IV data from Ref. (29) for 1967-70 period.

Figure 3. Estimates of Annual Percentage Increase in Total Expenditures Per Student

results. The results are given in Figure 4 which shows the annual percentage increase of total income per student. The sources of income are listed and it should be noted that the University has at best only partial control of these sources. Column I gives the income analysis for the 1967-70 period with the total rate of increase of 6.8 per cent. Comparison of this figure with the 7.5 per cent growth rate of expenditures (Figure 3, Column I) accounts for the deficit position of the University. Column II shows the "best judgment" projecton of income. Note that it anticipated an appreciable falling off of the rate of growth of gift income, a slight reduction in investment income, and in order to meet the overall 6 per cent goal it was shown necessary to increase the income from student fees. This latter conclusion pointed up the fact that the percentage of income from student fees had over a period of time been allowed to drop, and it was absolutely necessary to increase this category. This conclusion led to recommendations with regard to the steady-state size of the student body as well as the annual rate of increase of student fees which would be needed in order that expense and income would balance.

The expense-income analysis led to a whole series of recommendations, many of which were directly related to academic affairs, the

Income Factor	Extent of Campus Control	I Cornell 1967-70 Analysis	II Possible Cornell Projection
Student Fees	Partial	1.7	(2.0)
Gifts	Partial	2.2	1.0
Investment Income	Partial	1.1	1.0
Fed. & State Gov't.	Partial	1.0	1.2
Other	Partial	0.8	0.8
Total Income		6.8	6.0

Figure 4. Estimates of Annual Percentage Increase of Total Income Per Student

make-up of the student body and the faculty. A few of these recommendations are given below.

- *The expense-income margins are very small* and the University is living close to the limit of its resources. Thus, it is imperative to pursue a budget balancing plan and effect controls over expenditures. It is interesting to note that this recommendation is just now being implemented in full force.
- *Inflation in the national economy is the critical element in increased costs.* If national inflation rates continue at a high level (4.2 per cent!) then Cornell would have to initiate very stringent measures to keep the average annual rate of expenditure increase per student to 6 per cent. Of course, now that the economic waves previously mentioned have rolled over the universities for the last two years, we can see how prophetic this recommendation was. However, in looking to the future we can also see that national economic and political factors will in all probability continue to influence the inflation rate and universities will continue to be the victims of this process.
- *The income derived from student fees is a critical factor in balancing the budget.* One can no longer expect to enhance this source by increasing the numbers of students, so it is inevitable that higher

fees will be required. The probable rate of increase will be between 6 and 10 per cent depending on the national rate of inflation. Concomitant with this is the growth in financial aid to students. It must be carefully managed in order to meet both the educational objectives and financial realities.

- In order to bring the system under control, *unit planning at the smallest academic-budgetary program level* must be instituted. Unit plans should include definition of program purposes and scope, staffing plans, performance measures and evaluation procedures. The events of the past two years have brought home the absolute necessity of this recommendation and it is now being put into effect.

The overall result of the financial analysis was a realization that it would be extremely difficult, but not impossible, to effect a stable financial condition. Some very difficult decisions would have to be made - decisions requiring the cooperation and understanding of all members of the academic community including undergraduate and graduate students, faculty, research personnel, administrators, support staff, and alumni. The financial review also pointed out where questions should be asked and where policy formulation was required. The nature of these is described in the next section.

Some Questions and Findings

Cornell of the 1960s was part of a tremendous national educational boom. Nationally, enrollments more than doubled, income almost tripled as did expenditures, and the level of financial support from government contracts and private foundations reached new heights. As the nation moved rapidly toward a system of mass higher education, the demand seemed insatiable. This period of unprecedented growth has led us to a turning point in the history of higher education in the United States. Over the past hundred years, enrollment in institutions of higher education had, on the average, doubled every fifteen years. It is now clear that this process cannot continue and we will shortly be confronted with a new dynamics of growth - the number of high school graduates will decline markedly in the next fifteen years. Thus, one of the most fundamental issues which arose was the nature of Cornell's response to the new dynamics of growth. Specifically, what size should Cornell be?

Strange as it may seem, the Advisory Committee could find little evidence that the question of a steady-state size had even been seriously considered at Cornell. Thus, one of the most basic planning parameters had not been determined. Investigation showed that there was considerable evidence that the incremental growth in the number of students had been used to offset increases in expenditures. Once the interplay of the numbers of students and the ever-rising expenditures was brought out, it was clear that past practice could not continue unabated. Thus, an important recommendation was the the University examine its objectives as regards size. The Administration responded promptly to this and established the policy that the total enrollment should rise from the existing 15,200 to an upper limit of 16,500 students. It is interesting to observe that the internal distribution of students between fields of specialization and between undergraduate and graduate levels, still remains to be analyzed in any planned manner.

Concomitant with the size of student body, the Advisory Committee addressed the matter of faculty size. Again, the unplanned ubiquitous growth of the 1960s had a major influence on the size and distribution of the faculty. For example, from 1960 to 1972 the number of faculty members increased at about twice the rate of the student body and other data showed that the number of support personnel grew at a rate essentially proportional to the size of the faculty. While a kind of loose justification for this growth was made on the basis of expanding graduate and research activity, again there had been no overall University policy with regard to the size and distribution of the faculty, nor had there been a conscious consideration of student/faculty ratios. The basic question was, what is the proper size of the Cornell faculty and support staff?

An examination of this question opened up a series of fundamental issues which have yet to be resolved. Serious questions had to be asked about the deployment of faculty and the size of classes, the distribution of faculty between disciplines, the distribution of faculty between the various ranks and promotion policies, and other equally important topics. An investigation of class size revealed some very interesting things. Figure 5 shows the distribution of the number of courses by the size of the course enrollment for four of the endowed colleges at Cornell. In such major units as Arts and Sciences and Engineering it can be seen that approximately 50% and 40% of the courses had ten or less students in a class and that about 65% of the courses in these two units had twenty or less students per class. Figure 6 shows the distribution by credit hours in courses of different size, and together with Figure 5 reveals that a relatively small number of students benefit from the great number of small classes. While some argue that such small classes necessarily result in vastly superior instruction, there is little evidence to support this claim. One suspects that in some cases virtue is attached to extravagant practice. However, one must be mindful that such gross indicators slur over many factors such as the distribution of students and resources by field, the relative and changing attractiveness of different fields, and measures of quality. This information on class size led to a serious examination of further expansion of the faculty. This examination resulted in a 1973 administrative policy decision to essentially halt the

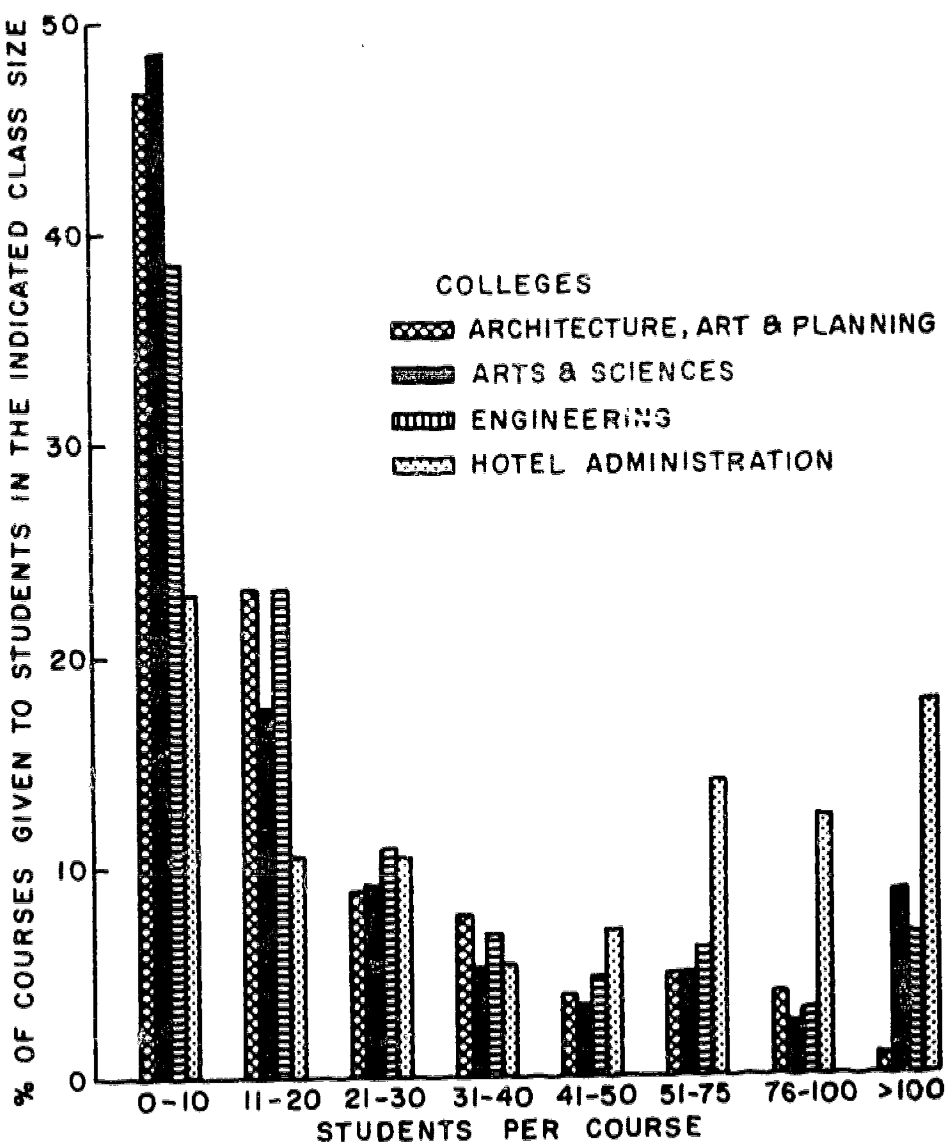


FIGURE 5: Distrubution of number of courses by size of course enrollment endowed colleges (Cornell University, Fall Semester 1971)

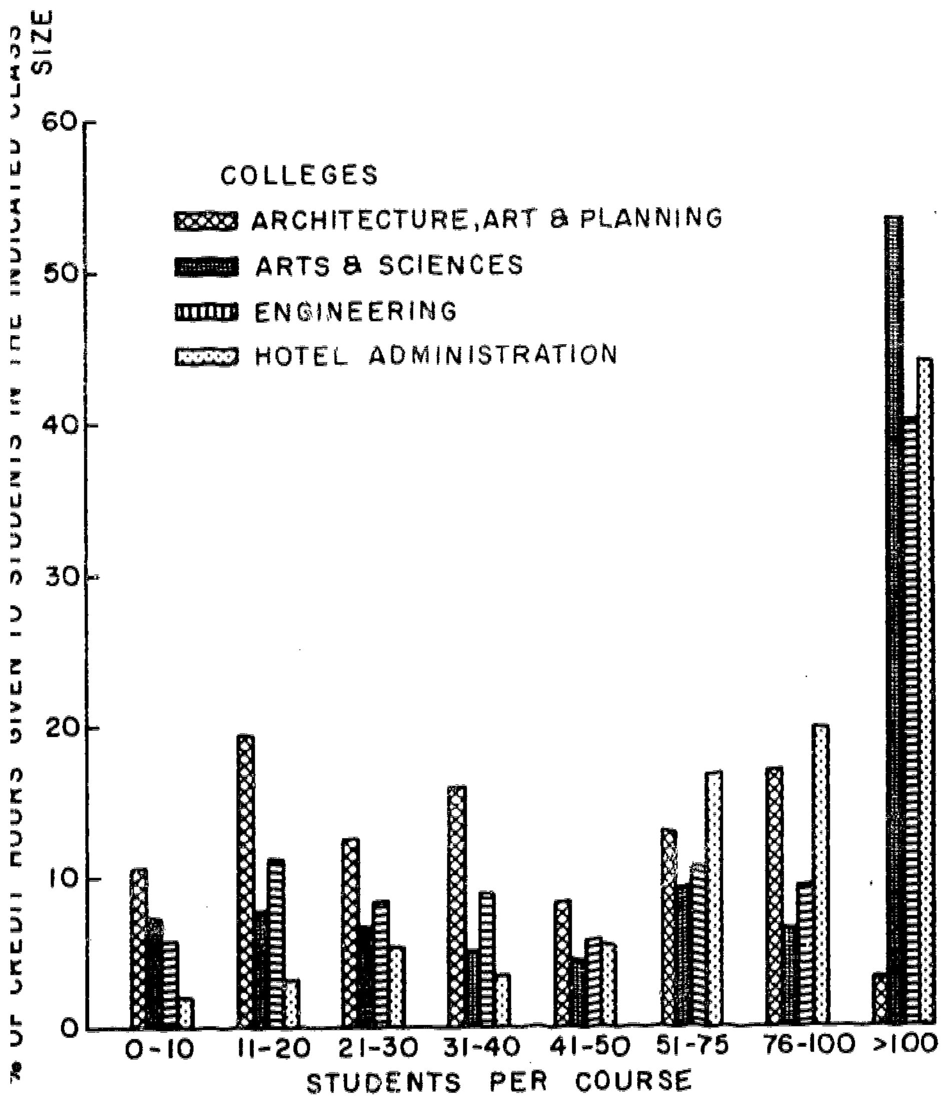


FIGURE 6: Distribution of credit hours by size of course enrollment selected endowed colleges (Cornell University, Fall Semester 1971)

addition of more faculty, and in 1975 this was toughened further to a policy of reduction in the size of the faculty.

This presentation does not permit a detailed description of the analysis and recommendations which followed from the full consideration of class and faculty size. However, as mentioned above, such important issues as the size of the support staff, the distribution of faculty between ranks, and the policies of promotion were all reviewed. The thing to bear in mind is that significant conclusions about the academic dimensions of a university were obtained from a study of the sort described here. However, such a study assumes that the background information is readily available and in a form which is useful for the academic decision process. It was a sobering experience when the Cornell Advisory Committee learned that the needed information was not readily available and that it had to be generated as part of the study. In fact, the absence of such a system at Cornell led the Advisory Committee to make the following recommendation. "Proceed now to develop a modern measurement and information system which will provide: (a) an improved system of reporting academic efforts and results, (b) the data resource base for program planning and evaluation including cost indices of diagnostic significance in such areas as undergraduate instruction, graduate instruction, research work, support activities, teaching loads, minimum or critical program size, and other areas." I wish I could report that this recommendation was both welcomed by the academic community and implemented by the University. Unfortunately, such is not the case, and even today we have made only a modest beginning at implementing a modern, useful measurement and information system.

Traditionally, measures of academic effectiveness have not been well defined and when such measures have been applied, financial dimensions have been conspicuous by their absence. Because of the nature of the decision making process in a university, wherein each discipline strives to improve its own program and eminence, it is not surprising that this state exists. While there is no substitute for this primary role of the discipline, it results in proliferation, self-sustaining justification and lack of concern for the combined effect of disciplinary decisions. However, we will have to realize that there are costs to diversity and that the aggregation of isolated decisions which maintain diversity can mount to sizeable financial obligations. The higher levels of administration are thereby confronted with the accumulated pressure of separate disciplinary aspirations and are forced to make decisions with little quantitative or comparative data. Usually, only such gross indices as student/faculty ratios, fraction of tuition to total income, degree production, or research support per faculty member have been determined. Information is not available which reveals the interactive nature of the many academic-financial decisions. For example, cost indices of various undergraduate and graduate degree programs do not exist, nor is there reliable information on the interaction between the two levels of instruction. There is a further ramification of the lack of an adequate measurement and information system which should be mentioned explicitly. One cannot take advantage of studies and information generated by other institutions if the knowledge of one's own institution is deficient. This extends beyond mere measures of productivity and includes the need for sharpening the bases for judgments of quality. In a period when difficult choices have to be made, comparative information is invaluable. Not only is comparative information useful in itself, but it encourages a policy of openness. Comparative evidence is essential in order to judge selective excellence. One is forced to conclude that regardless of historical precedent or the seeming distasteful nature of things quantitative or pecuniary, universities must develop measures of program effectiveness and cost indices if they expect to plan and control their futures. In short, there is no substitute for good data widely distributed and understood in order that universities understand themselves. Further, there is no substitute for informed, forceful leadership.

CHAPTER 4

by JON C. STRAUSS
University of Pennsylvania

Administrative Information Systems for Planning

Abstract

When the University of Pennsylvania adopted a responsibility center accounting structure, budget and departmental staff required new support Administrative Information Systems for planning and control.* The design and use of these systems are presented in this chapter. All discussion is related directly to the experiences of the university and specific examples are presented of the use of various Administrative Information Systems to support the processes of budget planning, budget development, budget approval and budget control.

Introduction

The title of this chapter suggests a general treatment of the development of Administrative Information Systems (AIS) for planning. The interests of the conference limit the scope to AIS for planning in higher education and the interests of the author further limit the scope to budget planning and control systems in operation and under development at the University of Pennsylvania.

An emphasis on budgeting results from the philosophy that the academic and administrative planning processes generate the inputs for the budgeting process. Budgeting is a quantitative expression of the fiscal planning that supports other planning processes. Without adequate budgeting, the other planning processes may become exercises in futility because the necessary resources to implement plans may not be there when needed.

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*The design and implementation of the responsibility center accounting system at the University of Pennsylvania is due largely to the efforts of Dr. John N. Hobstetter, Associate Provost for Academic Planning. The Penn Planning System has been developed by Dr. Robert Zemsky.

In this discussion unless otherwise qualified, the word budget refers to a one year fiscal plan. The process of budgeting builds on previous budgets and actual results and considers future financial performance. The result of the budgeting process is a budget(s) for the next year and an understanding of how this one year budget relates to longer term goals (e.g.: reach and remain in financial equilibrium while funding program improvement at 2% per year, or generate a surplus of X per year to apply to the accumulated deficit, or do not exceed a planned deficit level over some period).

AIS support the budgeting process in several ways:

- Provide a base of data on current and previous years actual and budgeted fiscal performance.
- Provide a data base for factors affecting fiscal performance. At the University of Pennsylvania these factors include a number of items related to income and expense. (see Table 1).

Table 1
Income & Expense Items
University of Pennsylvania Budget

Income:

Tuition — numbers of undergraduate and graduate students in various schools and departments and their patterns of taking courses.

Fees — application fees by school

Scholarships — by school and source

Investment Income — by school, by fund

Gifts and Grants — by school, source, duration, and restrictions

Indirect Cost Recoveries — by school and source

Sales and Services — by school and type.

Special State Appropriation — by school and type

General University Income — by source and how apportioned to schools.

Expense:

Compensation — salaries, fringe benefits and contracts of administrative, academic, clerical, and service personnel by individual schools, departments, etc.

Current Expense — expenses for supplies, phones, computer service, travel, etc. by school, department and budget accounts

Table 1 (Cont.)

Equipment — expenses by school, department, budget account

Student Aid — restricted and unrestricted student aid by student, graduate and undergraduate, department and school

Overhead (Indirect) Costs — by school indirect cost for student services, libraries, operations and maintenance, auxiliary enterprises, general administration, general expense, and space usage and charges

- Provide mechanisms for projecting future fiscal performance based on current and past data and known and projected trends. Associated with budget projection is the need for mechanisms to facilitate the development and testing of planning strategies to achieve prespecified fiscal performance.
- Provide mechanisms for analyzing submitted budgets to assure conformance to overall guidelines.
- Provide mechanisms for controlling organizational behavior to the submitted approved budgets at appropriate levels of organizational hierarchy.

At the University of Pennsylvania primary emphasis in using AIS support for budgeting is on the mechanisms for projecting performance, relating distributed budget plans to overall planning, testing detailed individual budgets for conformance with authorized plans, and controlling expenditures and income to budgeted levels. These mechanisms are most clearly understood when they are related to the organizational structure of responsibility center accounting at the university.

Responsibility Center Structure

Under responsibility accounting, the schools within the University of Pennsylvania have become responsibility centers which are responsible not for controlling their direct expenses to some preset budget level, but rather responsible for balancing total expenses to total income. For the academic year 1974-75 there are twenty-three responsibility centers at the university each headed by an academic dean or a director. The service units including the libraries, buildings and grounds, and central administration are expense budgeted indirect cost centers. The budgeted costs of these indirect cost centers are spread to the responsibility centers based on historical usage of their services and these budgeted indirect costs are included in the total cost for which the responsibility centers are held responsible. Also included as an indirect cost is a charge for space occupied by the responsibility center.

In addition to their direct income (from tuition and fees, gifts and grants, indirect cost recoveries, investment income, and sales and services) the responsibility centers receive an allocation of the general university income. This allocation, referred to as subvention, is not distributed on an algorithmic basis. Rather, the Provost of the University to whom the responsibility centers report, sets subventions to express the academic priorities of the institution. Subventions are increased to develop and/or maintain excellence and may be reduced to express, perceived needs for reductions in certain areas. The Provost is aided in this subvention setting process by advice from the Academic Planning Committee and by data on subvention requirements from the responsibility centers and the Budget Office.

At the conclusion of the fiscal year, the responsibility centers have either a surplus or a deficit based on the difference of total income (including subvention) and total expenses (including indirect costs). A banking mechanism has been established to provide year to year continuity. In theory, responsibility center surpluses are deposited in the bank at interest for subsequent developmental use by the responsibility center. Correspondingly, responsibility center deficits are covered by loans from the bank which must be budgeted for repayment at interest in later years. In practice, these are difficult times in which to capitalize a bank and without capitalization it has been impossible to make real loans and pay real interest. Temporarily, deficits are being budgeted for repayment over five years and these repayments are being employed to pay back previously attained surpluses of the centers.

The fiscal performance of the university is the sum of the performances of the responsibility centers plus the sum of the differences between budgeted and actual income and expense items that have been fixed to the responsibility centers during the budget process. Responsibility centers are held responsible only for their budgeted undergraduate tuition income and their budgeted indirect costs and undergraduate student aid. In recent years when uncontrollable and under-predicted increases in energy costs have caused the actual indirect costs to exceed budgets by appreciable margins, responsibility centers have been held responsible only for the predicted and budgeted portion of such cost increases. They have, however, been held responsible for the recent precipitous drop in investment income, not because they could control it, but because they budgeted the income with knowledge of the risks.

University of Pennsylvania Budgets

Not surprisingly the budget structure of the university reflects the organizational structure of the university. Income-expense budgets are represented by a 47 row, 9 column matrix illustrated in Figure 1.

SAMPLE FULL BUDGET MATRIX
(CHANGED: 5/2/75)

PENN PLANNING SYSTEM

	INSTRUCTION		ORGD ACTIVITY		SPNS- RESEARCH		TOTALS		
	Unr	Res	Unr	Res	Unr	Res	Unr	Res	Total
REVENUE	1	2	3	4	5	6	7	8	9
2 Tuition	48493	601	0	0	0	0	48493	601	49094
3 undergrad	27641	343	0	0	0	0	27641	343	27984
4 graduate and professional	20852	258	0	0	0	0	20852	258	21110
5 Special Fees	645	0	0	0	0	0	645	0	645
6 Scholarships	0	3771	0	0	0	0	0	3771	3771
7 endowed	0	959	0	0	0	0	0	959	959
8 gifts	0	1218	0	0	0	0	0	1218	1218
9 U.S. government	0	1336	0	0	0	0	0	1336	1336
10 other	0	258	0	0	0	0	0	258	258
11 GSAS	0	0	0	0	0	0	0	0	0
12 Investment Income	1300	2829	120	500	0	1150	1420	4279	5699
13 Gifts and Grants	525	14803	145	1190	0	36007	670	52000	52670
14 private	525	3450	145	1185	0	4740	670	9375	10045
15 federal	0	11224	0	0	0	31165	0	42389	42389
16 state	0	129	0	5	0	102	0	236	236
17 Indirect Cost Recoveries	393	0	0	0	8295	0	8688	0	8688
18 Sales and Services	9	1962	2496	6400	0	476	2505	8838	11343
19 Miscellaneous	333	700	0	600	0	323	333	1623	1956
20 TOTAL DIRECT INCOME	51698	24486	2761	8690	8295	37956	62754	71112	133866
21 Special state Appropriation	0	0	0	0	0	0	0	0	4977
22 From General University	0	0	0	0	0	0	0	0	27026
23 TOTAL AVAILABLE	51696	24486	2761	8690	8295	37956	62754	71112	165869
EXPENSE									
25 Compensation	39190	16155	2843	7257	0	26201	42033	49613	91646
26 administration	2702	440	957	491	0	2239	3659	3170	6829
27 academic	25765	11446	27	3584	0	11843	25792	26873	52665
28 clerical	4056	1325	1071	168	0	6951	5127	8444	13571
29 service	391	429	444	798	0	1238	835	2465	3300
30 employee benefits	6276	2515	344	2218	0	3930	6620	8661	15281
31 Current Expense	2059	3972	1589	1327	0	9497	3648	14796	18444
32 Equipment	223	568	4	106	0	2258	227	2932	3159
33 Student Aid	9728	3771	0	0	0	0	9728	3771	13499
34 undergraduate	5350	2074	0	0	0	0	5350	2074	7424
35 graduate and professional	4378	1697	0	0	0	0	4378	1697	6075
36 TOTAL DIRECT	51200	24486	4436	8690	0	37956	55636	71112	126748
INDIRECT COSTS									
38 Student Services	0	0	0	0	0	0	0	0	1453
39 Libraries	0	0	0	0	0	0	0	0	5808
40 Operations and Maintenance	0	0	0	0	0	0	0	0	7857
41 Aux. Enterprises	0	0	0	0	0	0	0	0	243
42 General Administration	0	0	0	0	0	0	0	0	6734
43 General Expense	0	0	0	0	0	0	0	0	9270
44 Space Allocation	0	0	0	0	0	0	0	0	7117
45 TOTAL INDIRECT	0	0	0	0	0	0	0	0	38479
46 TOTAL EXPENSE	51200	24486	4436	8690	0	37956	55636	71112	165227
47 VARIANCE	498	0	-1675	0	8295	0	7118	0	642

642

Figure 1. FY 1975 General University Income-Expense Budget Matrix

Each responsibility center has an income-expense budget of the matrix form presented in Figure 1 and the income-expense budget matrix of the University is the sum of the matrices of all responsibility centers.

In Figure 1 the columns of the budget matrix represent the unrestricted and restricted funds for the three major activity categories: Instruction, Research and Organized Activity. The rows break down the source of income and expense for each of the activity categories. Unrestricted items are discretionary to the university, while restricted income is available only to support the corresponding restricted expense. Restricted accounts, which must be balanced, include externally sponsored research projects, restricted gifts, clinical practices, and endowed projects such as endowed chairs.

There are certain strong ties between the restricted and unrestricted budgets. As an externally sponsored research project progresses and direct expenses are incurred, the corresponding indirect cost recovery percentage becomes unrestricted income to the University. The buildings and equipment portion of the indirect cost recovery is retained as general university income and a portion is collected as "Rollforward". The remainder is passed on to the responsibility center sponsoring the project as indirect cost recovery income to cover both the indirect costs that have been assessed against the responsibility center and the unbudgeted administrative and service support functions provided to the project by the responsibility center. From a somewhat less positive viewpoint, if expenses are incurred in a restricted budget that cannot be covered by the restricted income, the uncovered portion becomes an unrestricted expense. For example, when the recent reduction in investment income left several of the endowed professorships at the university without sufficient income to cover the committed cost of the chairs, the responsibility centers involved had to cover the additional expense from their unrestricted income.

Because the restricted budgets must be balanced and since their effects on the unrestricted budgets are well known, most budget analysis concentrates on the total unrestricted column of the budget matrix. Unless explicitly stated to the contrary all further discussion of budget matrices refers to this one column, 47 row matrix.

The budget matrix of a responsibility center summarizes the department budgets of the center. Typically each department has one or more accounts in the university accounting system and each account is expense budgeted separately with direct expenses categorized by class of personnel services, (e.g.: administrative, academic, clerical) class of current expense (supplies, travel), and class of university services (computer, telephone). Indirect cost centers have the same budget account structure, but are summarized by the expense portion of the budget matrix only.

Expense budgeting and control as practiced by the indirect cost centers is fairly well understood and further attention here is not necessary. Responsibility center budgeting and control is, however, not well understood even at the university and further discussion helps to set the foundation for the discussion of AIS presented in the next section.

Figure 2 presents the unrestricted operating matrix for a typical responsibility center. This matrix, which is produced by the Penn Planning System (PPS), contains all of the unrestricted income and expense items referred to in the introduction. This matrix represents the approved budget submitted by the responsibility center. Several items require further clarification:

Tuition. Undergraduate tuition income is determined by crediting the school with 10% of the tuition paid by its enrolled undergraduates and 90% of the historically smoothed share of the tuition paid by students taking its undergraduate courses. The 10% term is designed to cover the additional expense of enrolling, adivising, and graduating a student. An exponentially weighted historical smoothing is applied to the 90% factor in an attempt to smooth the budgetary effects of abrupt changes in student interests and therefore enrollment patterns. Since undergraduates are admitted, and tuition levels set centrally without direct control of the individual schools, the responsibility centers are guaranteed their budgeted undergraduate tuition income for purposes of determining year-end fiscal performance. Actual enrollments and tuition receipts are recorded and this data is employed in determining the next year guarantees. Graduate tuition income is determined by crediting the school with the appropriate share of the tution paid by students enrolled in its graduate courses. Smoothing is not done and the income is not guaranteed since the school sets the tuition and admits the students.

Student Aid. To create an incentive for a school to secure restricted student aid for its students undergraduate student aid is determined by historically smoothing the total restricted plus unrestricted student aid of students enrolled in its courses and then subtracting the restricted student aid for the school. Although undergraduate student aid is established as a guaranteed cost for determining year-end fiscal performance, actual expenditure data is recorded for determining the next year's guarantees. Graduate Student aid is treated similarly except smoothing is not employed and the cost is not guaranteed.

AIS for Budgeting

The University of Pennsylvania instituted the described responsibility center organizational and budgeting structure with little AIS support. Although a standard accounting system existed, it was expenditure

4/2/75 PENN PLANNING SYSTEM

SAMPLE OPERATING BUDGET RESPONSIBILITY CENTER
(CREATED: 4/2/75)

1	REVENUE	
2	Tuition	7866
3	undergrad	4012
4	graduate and professional	3854
5	Special Fees	52
6	Scholarships	0
7	endowed	0
8	gifts	0
9	U.S. government	0
10	other	0
11	GSAS	0
12	Investment Income	94
13	Gifts and Grants	65
14	private	65
15	federal	0
16	state	0
17	Indirect Cost Recoveries	524
18	Sales and Services	0
19	Miscellaneous	85
20	TOTAL DIRECT INCOME	8686
21	Special state Appropriation	0
22	From General University	821
23	TOTAL AVAILABLE	9507
24	DIRECT EXPENDITURES	
25	Compensation	4540
26	administration	331
27	academic	3010
28	clerical	411
29	service	60
30	employee benefits	728
31	Current Expense	533
32	Equipment	55
33	Student Aid	1295
34	undergraduate	923
35	graduate and professional	372
36	TOTAL DIRECT	6423
37	INDIRECT COSTS	
38	Student Services	198
39	Libraries	355
40	Operations and Maintenance	552
41	Aux. Enterprises	38
42	General Administration	414
43	General Expense	985
44	Space Allocation	698
45	TOTAL INDIRECT	3240
46	TOTAL EXPENSE	9663
47	VARIANCE	-156

Figure 2. FY 1975 Unrestricted Operating Budget for Typical Responsibility Center

control oriented. Also initially, the responsibility center budgeting process was maintained by the central administration and not integrated into the accounting system. Because budgeting was not well understood by the responsibility centers, the following sorts of things happened at the responsibility center level during the budgeting process:

- Tuition income was claimed for students taking courses in other schools and for students taking courses who had been forgiven tuition.
- Indirect cost recoveries were claimed for grants that had expired or which were paying very low overhead rates.
- Funds spent for student aid exceeded those charged on responsibility center budgets.

The responsibility centers had great difficulty controlling to their budgets because the accounting system reported only expenditures, not income. Moreover, the philosophy of responsibility center accounting required shifting responsibility for expenditure controls from the central administration to the responsibility centers. During the resulting learning process, funds were spent imprudently.

As these effects were observed, it became apparent that new AIS were necessary to support the budgeting and control process.

Budget Planning

The Penn Planning System (PPS) has been developed to automate the budget planning process. Written in APL, PPS provides a user oriented, interactive approach to budget planning. An income-expense budget matrix of the form illustrated in Figure 1 serves as the data base for PPS. Because the budgets of all responsibility centers and of the total university are represented in this form, PPS may be used at the total university, the school, and in some cases, the department level to facilitate budget planning.

An example drawn from the total university budget shows how PPS is used. Figures 3, 5, and 6 illustrate the results of three steps in the FY 1976 total university unrestricted budget planning. Figure 3 presents a base unrestricted income-expense budget matrix for the general university. By taking the current best prediction of every income and expense item in the matrix and removing all known non-recurring income and expense items, university budget staff develop a base for projection of future years performance.

During a dialog with the Penn Planning System, the escalators presented in Figure 4 are developed for each of the non total items in the budget matrix. In this particular plan for example, it is assumed that undergraduate tuition income will increase by 10.6%, graduate tuition

PENN PLANNING SYSTEM

UNRESTRICTED BASE BUDGET (SAMPLE)
(CREATED: 4/2/75)

1	REVENUE	
2	Tuition	49401
3	undergrad	28159
4	graduate and professional	21242
5	Special Fees	497
6	Scholarships	0
7	endowed	0
8	gifts	0
9	U.S. government	0
10	other	0
11	GSAS	0
12	Investment Income	756
13	Gifts and Grants	584
14	private	584
15	federal	0
16	state	0
17	Indirect Cost Recoveries	8921
18	Sales and Services	3069
19	Miscellaneous	908
20	TOTAL DIRECT INCOME	64136
21	Special state Appropriation	4977
22	From General University	26274
23	TOTAL AVAILABLE	95387
24	DIRECT EXPENDITURES	
25	Compensation	42096
26	administration	3865
27	academic	25325
28	clerical	5320
29	service	950
30	employee benefits	6636
31	Current Expense	5834
32	Equipment	174
33	Student Aid	10693
34	undergraduate	8143
35	graduate and professional	2550
36	TOTAL DIRECT	58797
37	INDIRECT COSTS	
38	Student Services	430
39	Libraries	5011
40	Operations and Maintenance	11979
41	Aux. Enterprises	619
42	General Administration	6377
43	General Expense	8787
44	Space Allocation	7828
45	TOTAL INDIRECT	41031
46	TOTAL EXPENSE	99828
47	VARIANCE	-4441

Figure 3. FY 1975 University Unrestricted Base Budget

PENN PLANNING SYSTEM

SAMPLE ESCALATORS

1	REVENUE	1
2	Tuition	1.11
3	undergrad	1.11
4	graduate and professional	1.11
5	Special Fees	1
6	Scholarships	1
7	endowed	1
8	gifts	1
9	U.S. government	1
10	other	1
11	GSAS	1
12	Investment Income	1
13	Gifts and Grants	1
14	private	1
15	federal	1
16	state	1
17	Indirect Cost Recoveries	1.07
18	Sales and Services	1.08
19	Miscellaneous	0.687
20	TOTAL DIRECT INCOME	1.09
21	Special state Appropriation	1.07
22	From General University	1.05
23	TOTAL AVAILABLE	1.09
24	DIRECT EXPENDITURES	1
25	Compensation	1.08
26	administration	1.08
27	academic	1.08
28	clearical	1.08
29	service	1.08
30	employee benefits	1.08
31	Current Expense	1.08
32	Equipment	1.07
33	Student Aid	1.06
34	undergraduate	1.06
35	graduate and professional	1.07
36	TOTAL DIRECT	1.08
37	INDIRECT COSTS	1
38	Student Services	0.963
39	Libraries	1.06
40	Operations and Maintenance	1.09
41	Aux. Enterprises	1.03
42	General Administration	1.07
43	General Expense	1.13
44	Space Allocation	1
45	TOTAL INDIRECT	1
46	TOTAL EXPENSE	1.08
47	EXCESS (DEFICIT)	1.23

Figure 4. FY 1975 Projection Escalators for FY 1976

PENN PLANNING SYSTEM

UNRESTRICTED PROJECTED BUDGET (SAMPLE)
(CREATED: 4/2/75)

1	REVENUE	
2	Tuition	54638
3	undergrad	31144
4	graduate and professional	23494
5	Special Fees	497
6	Scholarships	0
7	endowed	0
8	gifts	0
9	U.S. government	0
10	other	0
11	GSAS	0
12	Investment Income	756
13	Gifts and Grants	584
14	private	584
15	federal	0
16	state	0
17	Indirect Cost Recoveries	9501
18	Sales and Services	3315
19	Miscellaneous	624
20	TOTAL DIRECT INCOME	69915
21	Special state Appropriation	4977
22	From General University	26274
23	TOTAL AVAILABLE	101166
24	DIRECT EXPENDITURES	
25	Compensation	45465
26	administration	4175
27	academic	27351
28	clerical	5746
29	service	1026
30	employee benefits	7167
31	Current Expense	6322
32	Equipment	187
33	Student Aid	11373
34	undergraduate	8643
35	graduate and professional	2730
36	TOTAL DIRECT	63347
37	INDIRECT COSTS	
38	Student Services	430
39	Libraries	5335
40	Operations and Maintenance	13291
41	Aux. Enterprises	619
42	General Administration	6883
43	General Expense	9594
44	Space Allocation	7828
45	TOTAL INDIRECT	43980
46	TOTAL EXPENSE	107327
47	VARIANCE	-6161

Figure 5. FY 1976 University Unrestricted Projection Budget

PENN PLANNING SYSTEM

UNRESTRICTED TARGET BUDGET (SAMPLE)
(CREATED: 4/2/75)

1	REVENUE	
2	Tuition	54638
3	undergrad	31144
4	graduate and professional	23494
5	Special Fees	497
6	Scholarships	0
7	endowed	0
8	gifts	0
9	U.S. government	0
10	other	0
11	GSAS	0
12	Investment Income	756
13	Gifts and Grants	584
14	private	584
15	federal	0
16	state	0
17	Indirect Cost Recoveries	9501
18	Sales and Services	3315
19	Miscellaneous	624
20	TOTAL DIRECT INCOME	69915
21	Special state Appropriation	4977
22	From General University	26274
23	TOTAL AVAILABLE	101166
24	DIRECT EXPENDITURES	
25	Compensation	42172
26	administration	3873
27	academic	25370
28	clerical	5330
29	service	952
30	employee benefits	6648
31	Current Expense	5864
32	Equipment	173
33	Student Aid	10549
34	undergraduate	8017
35	graduate and professional	2532
36	TOTAL DIRECT	58759
37	INDIRECT COSTS	
38	Student Services	399
39	Libraries	4949
40	Operations and Maintenance	12328
41	Aux. Enterprises	619
42	General Administration	6385
43	General Expense	8899
44	Space Allocation	7828
45	TOTAL INDIRECT	41407
46	TOTAL EXPENSE	100166
47	VARIANCE	1000

Figure 6. FY 1976 University Unrestricted Target Budget

income by 10%, current expenses by 8%, and so on. During this dialog one could also fix certain changes to an absolute rather than a relative amount.

The preceeding paragraph mentions tuition income increases as through arbitrarily chosen. In fact, PPS was employed to investigate a number of tuition increase alternatives. The particular increases mentioned here are based on one particular rationale. Since tuition provides approximately half of the university unrestricted income, it must be increased to cover approximately half of the university budget problem which would have been in excess of $10,000,000 without the tuition increase.

When the developed escalators of Figure 4 are applied to the budget matrix of Figure 3, the one year budget projection of Figure 5 results. Using PPS to make alternative multi year projection studies, university budget planners decided that complete corrective action must be applied in one year. In another dialog with PPS, a control strategy was then developed to reduce direct and indirect (except for Auxiliary Enterprises) expenditures enough to not only remove the projected deficit but also create a contingency fund of $1,000,000. Figure 6 presents the resulting target budget matrix.

It is important to realize that the purpose of this planning exercise is really to come up with equitable targets for the expense budgeted indirect cost centers. While this particular demonstrated strategy is based on eliminating the projected deficit in a single year, other approaches to fiscal equilibrium could have been evaluated with PPS. The deficit elimination strategy presented here is based on expenditure reduction only, clearly the individual responsiblity centers must base their budget balancing strategy on some combination of income increase and expense reduction.

Once equitable overall expenditure levels have been projected for the indirect cost centers category totals, the budget planning process is still not complete. New information concerning economic conditions, testing of new strategies and/or difficulty in the budget development process may require another overall budget planning cycle to establish new guidelines.

Budget Development

The second phase of budget planning, development, begins with base data generated in the first phase. Indirect Cost Center budget development is rather straightforward. The uncontrollable expense items (mortgages, rents, utility costs, etc.) are then subtracted from category totals and overall budgeting guidelines are established in terms of previous year budgets.

At Penn FY 1976 indirect cost center budgeting followed this pattern through the budget development stage. From the data presented in Figure 3-6 plus known and projected uncontrollable increases, it was determined that overall controllable FY 1976 indirect costs should be limited to 97.7% of FY 1975 levels. A 95% target was given to the vice presidents responsibile for indirect cost centers with the admonition to practice selectivity across their budgetary units, but to present totals that met the 95% guideline. Because all inflationary increases had to be absorbed and budgets still cut 5% this was an uncomfortable guideline. The extra 2.7% was reserved as a contingency to facilitate the practice of selectivity across indirect centers at the Presidential level.

Budget development for FY 1976 for the responsibility centers included the following steps:

1. The budgeted indirect costs determined in the budget planning process were distributed by category to the responsibility centers based on previous year actual distributions.
2. The responsibility center subventions were determined, as discussed previously.
3. The effects of new tuition rates, new student admission policies, and new student aid formulae were factored into the tuition and student aid guarantees, and new guarantees were produced.
4. The above determined four fixed numbers (subvention, undergraduate tuition income guarantee, undergraduate student aid cost guarantee, and total indirect costs) plus the bank payment status were then presented to the responsibility centers in the form shown in Figure 7.
5. Responsibility center personnel then employed the data in combination with the best available projections of income and expense items to produce the PPS default budget projections for the responsibility centers as shown in Figure 8.
6. Finally the responsibility centers were requested to submit a plan for balancing their budgets justifying all changes from the default budget projection.

In developing their budgets, the responsibility centers can make use of PPS to test out short and long term strategies. For example, to achieve short term budget balance they might choose to increase their graduate tuition and decrease their controllable current expenses. Recognizing, however, that such an approach would not solve the long term problems of an inflationary economy they might wish to explore the effects of increasing undergraduate and graduate student enrollment, filling positions of retiring faculty with lower paid junior faculty, attracting more research money, etc. PPS provides an environment where combinations of these strategies are readily evaluated.

PENN PLANNING SYSTEM

Center 7

PROPOSED SUBVENTION (SAMPLE)

(INCLUDING space allocation of 722)

21 Special state Appropriation	0
22 From General University	1258
TOTAL	1258

Preset undergraduate tuition income: 4189

Set total UNRESTRICTED student aid equal to 1658
(includes estimated undergraduate aid = to 1174)

TARGET indirect cost (including space allocation) 3675

USEABLE BANK BALANCE 145
BASIC RESOURCE PROJECTION FOLLOWS
GIVEN:
FY 76 (Projection) subvention = 1258
space allocation = 722

REVENUE	11104
EXPENSE	10689
VARIANCE	415

Projected variance plus Subvention =

< 7.6% of Projected Revenue

< 7.9% of Projected Expense

Figure 7. FY 1976 Responsibility Center Default Budget Summary

PENN PLANNING SYSTEM

DEFAULT TARGET BUDGET (SAMPLE)

1	REVENUE	
2	Tuition	8388
3	undergrad	4189
4	graduate and professional	4199
5	Special Fees	479
6	Scholarships	0
7	endowed	0
8	gifts	0
9	U S government	0
10	other	0
11	GSAS	0
12	Investment Income	106
13	Gifts and Grants	65
14	private	65
15	federal	0
16	state	0
17	Indirect Cost Recoveries	716
18	Sales and Services	0
19	Miscellaneous	92
20	TOTAL DIRECT INCOME	9846
21	Special state Appropriation	0
22	From General University	1258
23	TOTAL AVAILABLE	11104
24	DIRECT EXPENDITURES	
25	Compensation	4721
26	administration	390
27	academic	
28	clerical	507
29	service	74
30	employee benefits	0
31	Current Expense	576
32	Equipment	59
33	Student Aid	1658
34	undergraduate	1174
35	graduate and professional	484
36	TOTAL DIRECT	7014
37	INDIRECT COSTS	0
38	Student Services	108
39	Libraries	350
40	Operations and Maintenance	933
41	Aux. Enterprises	87
42	General Administration	486
43	General Expense	989
44	Space Allocation	722
45	TOTAL INDIRECT	3675
46	TOTAL EXPENSE	10689
47	EXCESS (DEFICIT)	415

Figure 8. FY 1976 Responsibility Center Default Budget

In practice the budget planning process and the budget development process are strongly coupled and related to the process of budget approval. Several iterations of these processes generally occur.

Budget Approval

At Penn there are two unrestricted budget approval processes that must be supported by AIS: outline budget authorization and account budget reconciliation. As each process is applied in responsibility centers or indirect cost centers, slight modifications in the process may be required. Outline budget checking and authorization for the expense budgeted indirect cost centers is a straightforward well understood process and needs relatively little AIS support. AIS support being developed for the responsibility center outline budget authorization process will provide an item by item comparison of the submitted budgets to the PPS projected default budgets. Differences are reconciled through responsibility center and budget office discussions. The accepted authorized outline budgets are then employed by responsibility centers and budget staff as base budgets for future year projections with PPS.

The account budget reconciliation process is common to both responsibility and indirect cost centers. Once outline budgets are authorized, the centers prepare detailed account budgets for accounting system control purposes. Accounts typically represent a department, office, project or fund and are either restricted or unrestricted. An individual center may have one hundred or more accounts. Since account budgets are submitted as prepared, the AIS must monitor whether the sum of the unrestricted account budgets of a particular center agree with the authorized outline unrestricted budget.

An AIS module is currently under development to compare the running total of submitted center unrestricted budgets to the authorized outline. When the module is applied the first account budget to cause total expenditures in one or more categories to exceed authorized limits by some tolerance will be rejected. In addition to performing account budget checking it will also save the authorized and projected base outline budgets for PPS.

Budget Control

As has been indicated previously, one of the more serious problems that the university has experienced in instituting responsibility center accounting has been budget control. When responsibility centers do not receive up-to-date information on income, they cannot control expenditures efficiently. An income-expense reporting system has been under

	UNRESTRICTED				RESTRICTED			
	BUDGET	YEAR TO DATE	% RECEIVED or EXPENDED	PROJECTED VARIANCE	BUDGET	YEAR TO DATE	% RECEIVED or EXPENDED	PROJECTED VARIANCE
REVENUES								
2 Tuition	7279	7756	106.54%	223	22	0	0%	
3 undergrad	3458	3819	110.44%		0	0	0%	
4 grad/prof	3821	3936	103.01%		22	0	0%	
5 Special Fees	517	264	51.08%		9	54	600.00%	
6 Scholarships	0	0	0%	0	244	331	135.66%	
7 endowed	0	0	0%		28	42	150.00%	
8 gifts	0	0	0%		193	245	126.94%	
9 U.S. government	0	0	0%		15	10	66.67%	
10 other	0	0	0%		8	34	425.00%	
11 GSAS	0	0	0%		0	0	0%	
12 Investment Income	224	65	29.02%	144	235	158	67.23%	
13 Gifts and Grants	0	45	0%	45	3924	2351	60.07%	
14 private	0	0	0%		1831	1075	65.91%	
15 federal	0	0	0%		1617	768	47.50%	
16 other	0	45	0%		878	514	78.04%	
17 Ind. Cst. Recv	524	574	109.54%	126	0	0	0%	
18 Sales & Services	465	-1	-.21%	-469	1812	741	45.97%	
19 Miscellaneous	0	0	0%	0	76	542	713.16%	
20 TOTAL DIRECT	9013	8702	96.55%	219	5970	3099	51.91%	
21 Spec. St. Appro	0	0	0%		25	0	0%	
22 General Univ	1034	1034	100.00%	201	1	0	0%	
23 TOTAL AVAILABLE	10047	9736	96.90%	-18	5995	3099	51.69%	
EXPENDITURE								
25 Salaries and Wages	4026	2791	69.32%		2875	1814	63.27%	
26 administration	450	254	56.44%	80	543	408	75.14%	
27 academic	3076	2215	72.01%	142	1657	1038	62.64%	
28 clerical	432	282	65.28%	0	485	259	53.20%	
29 service	68	40	58.82%		190	115	60.53%	
30 Employee Benefits	784	533	68.78%	48	491	312	63.54%	
31 Current Expense	667	410	61.47%	120	3007	1723	57.30%	
32 Equipment	64	22	34.38%	35	48	14	29.17%	
33 Student Aid	1334	1335	100.07%		306	796	260.13%	
34 undergraduate	585	0	0%		29	618	2331.03%	
35 grad/prof	749	0	0%		277	120	43.32%	
36 TOTAL DIRECT	6855	5091	74.27%	425	6727	4664	69.33%	
INDIRECT COSTS								
38 Student Services	0	0	0%		0	0	0%	
39 Libraries	0	0	0%		0	0	0%	
40 O and M	0	0	0%		0	0	0%	
41 Aux. Enterprises	0	0	0%		0	0	0%	
42 General Admin	0	0	0%		0	0	0%	
43 General Expense	0	0	0%		0	0	0%	
44 Space Allocation	0	0	0%		0	0	0%	
45 TOTAL INDIRECT	3410	2708	79.41%	-201	0	0	0%	
46 TOTAL EXPENSE	10265	7799	75.98%	224	6727	4664	69.33%	
47 EXCESS (DEFICIT)	-218	1937		-12	-732	1565		
48 ACCUM. RESOURCES					2560	3027		
49 G & C OVERUN					0	1116		

Figure 9. Typical Responsibility Center Income-Expense Report

development for some time and is just coming into production status in 1975.

A typical responsibility center income-expense monthly summary report (see Figure 9) summarizes all unrestricted and restricted accounts for a responsibility or indirect cost center. The column labeled BUDGET in Figure 9 presents the accounting system recorded budget for each of the income and expense items of the rows. The YEAR-TO-DATE and % RECEIVED OR EXPENDED columns are self-explanatory. The column labeled PROJECTED VARIANCE presents the differences between the budgeted amount and the projected amount based on year to date figures.

In May 1975 the reports are still being developed and reconciled to the monthly accounting reports. To date most of the trouble has not been with AIS development, but rather with cleaning up the data base associated with coding the types of accounts. Initial experience suggests however that the income-expense reports will be extremely useful.

Conclusion

The University of Pennsylvania has made a significant investment in AIS to support the budget planning and control processes for its responsibility center organization. The experience to date, while occasionally frustrating, has been very positive. It is certainly clear, that without appropriately designed and implemented AIS, the university's move to responsibility center organization and accounting would have failed.

CHAPTER 5

by FRANKLIN PATTERSON
University of Massachusetts

The Politics of Expectation in Educational Change

George Santayana, who generally had a rather gloomy view of humanity's long-range changes, said of life that it is not a spectacle or a feast, but a predicament. To a fair degree, his diagnosis applies to the relationship between education and the newer technologies. Webster suggests such synonyms for predicament as dilemma, quandary, plight, fix, jam, and pickle.

Perhaps the most drastic of these synonyms don't apply, but the situation of higher education and technology certainly has some of the features of a quandary or problem. While becoming a mass phenomenon in our country, higher education has remained a labor-intensive, high-cost activity, profoundly resistant to newer technologies presumed by their promoters to be potentially useful to instruction.

Scepticism about instructional technology and its potential magic is wide-spread in the 1970s, running far beyond the fusty academic community. A young friend put it this way recently:

> "Educational innovation has been taking quite a knock lately—pick up a national news magazine or, for that matter, your local Sunday paper, and chances are, tucked away with items about the vagaries of General Idi Amin or the possible shortage of seeds for home vegetable gardens will be something about the national trend of 'returning to the three R's'. These articles are usually not very specific, but tend to disparage such things as the new math, self-paced learning, teaching machines, educational television, and a permissiveness that leads to the perditior of entropy. Such articles appeal to that part of the American soul which years, in this Bicentennial era, for 'fundamentals'."

In addition to mass scepticism about the newer instructional media and forms, it is not difficult to find more thoughtful scepticism on the part of scholars as diverse as Nisbet, Bruner, and Barzon. This is certainly a change from the educational writings of the 60s. In 1966 in his introduction to a book called *Man-Machine Systems in Education*, John Guy Fowlkes said:

"It seems evident that the classical concept of schooling can no longer hold. Indeed, a single worker, called teacher, is no longer qualified to stimulate and direct learners . . . It is fortunate indeed that the specific detail demanded for effective learning and teaching is now possible through the use of man-machine systems . . . In an exciting and sound fashion, . . . computers, media technology, and systems technology... pertain to instructional, administrative, pupil personnel services, and preparation of staffs for educational institutions in terms of the society of today and tomorrow and as opposed to the society of the past."

Slightly less rhapsodic, but similar thoughts were offered by David A. Sohn in a 1964 book entitled *Programs, Teachers, and Machines*:

"It is likely that programmed instruction will be with us for a long time. What it has told us of the learning process and what will be discovered may have vast implications for education. No one can predict how widely it will be accepted, but it is a revolutionary development that holds great promise."(5)

An opinion of the author expressed in 1966 in *The Making of a College* has a quaint ring to it now:

"The technologists of communication are rightly not modest about technical capabilities of their field . . . The net message, in reply to queries about what education can expect to have from communications technology in the next decade or so, is: 'Anything you want'. What such technologists say is that in terms of technical facilities for information transfer, the present state of the art is such that the only real limits are those that may result from timidity, lack of imagination, or lack of funds on the part of education. Even if a specific technical device does not now exist, if needed and demanded, it is likely to be devised and produced."(4)

With a certain amount of realism, I noted that there already existed a far greater technology for information transfer than schools, colleges, and universities had begun to think how to use. Examples of technology for instruction then already available laid the basis for some questions and some more than ready answers:

"Should colleges and universities *want* the kinds of information transfer facilities and systems that modern technology can make available? And if they should, can obstacles of finance and lingering Luddite sentiment among faculty be overcome?

The answers to both questions, with some qualification, are likely in the long run to be affirmative."(4)

What has happened since those optimistic days and statements a decade ago? Great expectations for a happy marriage between educational innovation and instructional technology have not quite turned to ashes, but their fire certainly does not burn as brightly now as then.

The term "education innovation" a decade ago had about it the expectation of sudden, redemptive change that characterized such other phenomena of the 1960s like the "war on poverty". In the decade since then, some positive change has occurred in higher education, but is has been slow and difficult, and the term "educational innovation" has become a shop worn cliche. In certain of the areas of information transfer with which EDUCOM is most concerned, remarkable forward strides have been taken in the past ten years. But the utilization of instructional technology in learning situations has proved to be a most reluctant dragon.

Limits of Innovation

Any discussion of the process of innovation in higher education and its relation to technology must begin with a basic understanding of the very real limits of such innovation. One of the lessons of sociology is that accustomed structures and patterns of human organization and behavior change slowly and with difficulty. Surfaces and symbols may change, but underlining realities tend to move at a more glacial rate than believers in radical progress like to admit. Educational innovation is a case in point.

There has been undeniable growth in the number of things going under the rubric of educational innovation in the past decade of American higher education, but there have been few significant, widely-adopted innovations in the *essential processes* either of pedagogy or learning. Most innovation has occurred in the overt forms and structures of the social organization of education and in the trend toward the individualization of learning situations. But essental processes of instruction and learning, and the intellectual and material tools involved, have changed relatively little.

Hampshire College, is an institution whose organization was planned for learning around a central process that Daniel Bell called "conceptual inquiry". Toward this end, the College is not departmentalized; it is organized instead by very broad major fields into four schools. No course work at Hampshire is compulsory. No fixed time-limit is set for graduation. No grades are given in courses taken, and assessment of educational progress rests basically on a sequence of three major examinations, in whose design the student participates.

Through the institution's consortium membership in Five Colleges, Incorporated, Hampshire students have remarkable access to the educational offerings of other member institutions in the Connecticut River Valley: Amherst, Mt. Holyoke, Smith, and the University of Massachusetts. Currently Five Colleges offer free student interchange, faculty interchange, joint academic programs, academic coordination and varied specialized activities. Such cooperation has greatly broadened the curricular possibilities for Hampshire students. Hampshire also has the basic components of an information transfer cable network installed on its campus, in the library facility, with a link to the cable television system of the Town of Amherst.

The Hampshire faculty is young, very well prepared academically, and tends toward liberal and activist politics. Most students have a background of school and family education that is strong, and many of them are intellectually and artistically creative. Hampshire achieves a level of educational success that is very respectable with the benefit of certain internal organizational, structural, and programmatic innovations, coupled with the benefits of the innovative interinstitutional cooperation that Five Colleges, Inc. represents.

However, it would not be accurate to claim that essential processes of pedagogy and learning at Hampshire have been radically changed or that utilization of available instructional technology has been substantial. Quite the reverse. A young and politically enthusiastic faculty turns out to be nearly as conservative pedagogically as their predecessors elsewhere. The main pedagogical innovation at Hampshire is to individualize undergraduate instruction in a mode that resembles at its best the small, flexible graduate school. Some very good things happen as a result. What has not happened yet is any serious venturing into the organization of learning experiences around such a radical integrating notion as that of conceptual inquiry, or any serious effort to utilize instructional technology to solve the logistical and economic problems of the individualization of learning. In consequence, Hampshire is even more labor-intensive a college than most, and the faculty are hard-pressed in meeting their pedagogical commitments. Innovation in structures, surfaces, and symbols has exceeded innovations in essential teaching/learning processes and in the use of technology.

A Note of Optimism

There is room for hope, but not for utopian optimism, with regard to the understanding and planned use of instructional technology. In the Five College area, for instance, the Town of Amherst is presently negotiating a new cable television license agreement for the period 1976 to 1984 and beyond. This agreement outlines a system of 30 channels including two public school channels and five postsecondary educational channels, as well as a two-way video service between the University, Amherst, Hampshire College, and town points in between. The leadership of town officials in this regard is indeed a hopeful sign, and they raise the clear possibility of substantial and valuable networking which would link the area's schools, homes, and higher educational institutions in an exciting way. The other side of the coin, however, shows in a comment by the town's Cable Advisory Committee Chairman that "there is as yet little awareness among educators here of the possible uses of telecommunications generally, and still less of the proposed system and any future Five College or regionally interconnected two-way service. Yet final planning and licensing arrangements must be completed by June 1".

Another example of room for hope but not for utopian optimism lies in the operations of The Association for Graduate Education and Research (TAGER) headquartered at the University of Texas at Dallas. TAGER operates a micro-wave educational broadcasting system designed to bridge electronically the distances that separate its participant institutions. Presently nine colleges and universities, as well as a number of industrial firms, are electronically interconnected in the Dallas-Fort Worth area. The system is technologically simple, consisting of the sending studios, the network, and receiving classrooms.

A sending studio at a participant campus seats twenty-four students for live instruction, has two fixed television cameras at the rear of the room, and one fixed television camera directly above the table at which the professor sits. Because the cameras are fixed, there is no requirement for cameramen. Because the system is simply switched on and begins operating, there is little subtle or creative camera work done, but the whole operation is very straight-forward and easy to manager. In receiving classrooms, each pair of students has a telephone which links directly to the sending studio and enables two-way audio interaction between the student and the teacher.

Because TAGER places faculty and students in live interaction over relatively long distances and for very low operating costs, it provides the possibility of pooling and mobilizing scattered faculty resources for delivery to classrooms in factories and firms as well as in colleges and universities.

Ironically, TAGER was not conceived by academics but by three principal officers of Texas Instruments who were interested in enlarging graduate education in science and technology for industries in the area. TAGER has succeeded in serving this purpose, but the colleges and universities in the consortium have been slow to use TAGER for enriching their own curricular and faculty resources through the interchange the consortium network enables.

Obstacles to Acceptance of Instructional Technology

Some of the reasons why instructional technology has generally not been more eagerly accepted by the academic community are best articulated by people who know technology well enough to face its limitations. Take, for example, computer-aided instruction (CAI), one of the more widely-heralded advances of the 60s which has not gone a great distance toward mass acceptance by schools and colleges. John Kemeny summed up its shortcomings, saying:

"I have . . . two major prejudices against CAI. These are, first, that the computer is a very expensive substitute for a book, and second, that it is a very poor substitute for a teacher."(2)

Much of the same argument can be advanced in connection with non-interactive educational television.

Many technologists have been slow to realize how profoundly passive an experience is involved in non-interactive television viewing, and how profoundly active and involving the reading of a good book can be. Many academics, while unsophisticated in technology, have had the right instincts on these things. The lack of favor for instructional technology is earned, and the responsibility belongs in good part to innovators who oversold their product to its ultimate detriment. Technological innovation in education has fallen victim in many ways to the politics of expectation. Too much promised—too little delivered. It is unfortunate however, that so much good innovation in instructional technology has been buried by spectacular failures.

There are at least two major choices facing the academic who wishes to respond to present realities of educational innovation in higher education. One of these is technocratic, and the other is humanistic, complex, and dependent on serendipity.

The technocratic alternative is summed up by Lawrence Fraley and Ernest Vargas in their article "Academic Tradition and Instructional Technology" in the Winter 1975 issue of the *Journal of Higher Education*. They will understand my reasons for feeling depressed by the Fraley-Vargas article in terms of its posture and prescription. The Fraley-Vargas posture is suggested by their initial statements:

"Learning is change in behavior and can be prescribed, produced, and guaranteed like any other product. It is now possible to specify the desired performances of learners and arrange the circumstances of learning such that those performances will be developed and exhibited by the learners . . . The behavioral products, explicitly delineated in advance, can and should be guaranteed. There is no theoretical reason why schools should produce ill-formed and inadequate behavioral products while we expect manufacturers of physical products to produce near perfect items . . . Educators would be far more prepared for their task if they recognized that they are in the behavior-modification business."

. . . Today's learners live in a society so complicated that they must be highly-skilled and sophisticated just to act responsibly. The repertoires of many people are taxed by the complexity of acquiring necessary information, casting an intelligent ballot, utilizing the transportation systems of being an effective part of today's communication networks.

To meet these challenges, today's instruction must become equally technological and sophisticated. Traditional instructional arrangements, though often viewed with nostalgia, cannot do the job of providing mass training to high skill levels. This is because traditional arrangements were not evolved to control a sufficient number of the critical variables affecting learning."(1)

Messrs. Fraley and Vargas are aware of academic resistance to applied instructional technologies of the newer kind. Their prescription for response combines the innocent simplicity of the technocratic utopian with the fearful symmetry of the planner who pays little attention to human reality. Their prescription is simply to displace the instructional function of the existing apparatus of higher education in favor of what they term an "Instructional Systems Organization", centrally controlled by an Administration Division, with four adjunct components entitled respectively the Curriculum and Design Division, the Production Division, the Operations Division, and the Quality Control Divison.

The devil, which Messrs. Fraley and Vargas propose to exorcise, is what they call the "content expert". They see higher education as unfortunately dominated by persons who are what more old-fashioned observers would have called scholars, and who happen also to be in charge of teaching. This regrettable condition the authors propose to remedy by saving academic departments from the task of teaching which they do so badly, using content experts as "team members" in the Instructional Systems Organization, and thereby generally saving education from itself.

The humanistic alternative is not nearly so neat as this and is scarcely reduceable to a single systems chart. To implement this alternative one must begin by acknowledging that educators generally underestimate the difficulty of basic social change in education, over-estimate what instructional technology can do, underestimate the powerful inertia of established patterns and media of instruction, and overestimate the capacity of mo[illegible] people to exploit inferential learning and autoinstructional devices.

Often the most important technological breakthroughs turn out to be like the wheel or the book. Such innovations share a number of significant features.

- *They are not passive.* Unlike the television screen, they require an active commitment from the user—be it as elementary as turning pages or as complex as the exercise of imaginative intelligence that the book requires.

- *They are not overtly complex.* The universal user can grasp the technology with relative ease.
- *They are not expensive.* As these breakthroughs are further refined, they often become proportionately less expensive.
- *They are so beautifully obvious* that we wonder why they were not thought of sooner.

Consider the book for a moment. The single most important and influential piece of technology in education, it has remained essentially unchanged since Gutenberg. If anything, modern technology has enabled the book to expand its competitive edge over other forms of learning devices. Today's book is cheaper, faster to respond to a determined need, and more versatile than at any earlier time. It is more portable, less destructible, more adaptable to any condition than any competitive device. It requires no separate support system, such as electricity, and is universally accepted. All forms of educational technology must be considered in relation to the book, and unhappily most fail woefully.

Some of the present communications technology amply meet these criteria. One example is the portable transistor radio. While noted more for gum-chewing, finger-snapping annoyance in the United States, it has had massive distribution in developing countries and substantial impact on cultural change. Self-contained, needing only occasional batteries, it has the potential to serve the illiterate in the manner the book serves the literate. Another example is the hand calculator. Its introduction has changed school and college mathematics learning the way the fiber-glass pole changed pole vaulting. Every shopper can turn the supermarket ordeal into a seminar in econometrics. In the hand calculator, however, one finds the benefits of speed, potential accuracy, and universal mathematical ability traded off against certain possible losses. A possible negative side-effect of this device is a diminution in the individual's own capacity for quantitative analysis. Judging by the epidemic marketability of the calculator, it is evident how the cost-benefit analysis of most consumers comes out on this matter.

The audio cassette is another breakthrough, a variation on the book or the written statement, with advantages of use for certain individuals in situations that are altogether new. Its compact size, simplicity, and reiterative capability tend to off-set its disadvantages of relative brevity and the lack of an interactive dimension important in learning situations.

Interactive television, such as the TAGER network and other systems with greater capability, has the potential to be a major breakthrough in developed, sophisticated societies. Although expensive in initial capital outlay, it features simplicity in design and use, and relatively unlimited content ability. Perhaps its greatest strength for higher education is its ability to extend the classroom and educational access beyond the campus.

The humanistic alternative looks realistically toward a longer courtship and voluntary marriage between education and technology, rather than toward the kind of shotgun wedding Messrs. Fraley and Vargas propose. The more a specific technology can readily be apprehended by the potential user as a tool for radically enlarging one's own capabilities, the greater is likelihood of rapid acceptance and incorporation into the work kit of teacher and learner. Perhaps the greatest illustration of this is the acceptance of the computer, not as a tool of education in the narrow pedagogical sense, but as a revolutionary enlargement of capability to move through the dog-work on which intelligent quantified analysis must rest.

The humanistic alternative recognized how much the factor of serendipity, rather than rigid forward planning, affects what educators and students do with instructional technology. Few of the technological breakthroughs mentioned in this chapter were developed by educational technologists for education. They burst unannounced upon the scene, were seized and adapted by ordinary people before educators grasped their significance, and proceeded to carve their own niche through their simple competence. While some educational technologists were fiddling around with CAI, millions of students were having their educational horizons enlarged by inexpensive xerographic reprints, by paperbacks, by tape players, and even by the transistorized radio. While educators were deep in trying to revolutionize quantitative literacy through the New Math, engineers had begun taking home their pocket calculators to figure out their income taxes. There are many other devices of similar importance waiting in the wings to be discovered and broadly accepted. The serendipity factor will undoubtedly strike again and again, each time end-running the presumptive technological innovator in education who struggles with his mighty sophisticated electronic mountain that persists in turning out to be an academic molehill.

Conclusion

A healthy scepticism about educational innovation and instructional technology is warranted by the experience of the past ten years. Educational technologists must be wary of over-selling themselves and others, and must understand that academics who do not frantically plunge into the use of instructional technology are not necessarily evil. Change will come if one persists wisely. Most often it will come because the technological tool is clearly a servant of human purposes and fits easily in our hands.

References

1. Fraley, Lawrence G. and Ernest A. Vargas, "Academic Tradition and Instructional Technology," *The Journal of Higher Education*, January/February 1975, p. 2

2. Kemeny, John G., *Man and the Computer*, New York, Scribners, 1972, p. 74.

3. Longhary, John W., *Man-Machine Systems in Education*, New York, Harper and Row, 1966, p. ix-x.

4. Patterson, Franklin and Charles Longsworth, *The Making of a College*, Cambridge, MIT Press, 1967, p. 22-23.

5. Solin, David A. in Alfred de Grazia and David A. Solin, Eds., *Programs, Teachers and Machines*, New York, Bantam Books, 1964, p. 1-2.

CHAPTER 6

by BRUCE LUSIGNAN

The Public Service Satellite Consortium

Two former governors and a public broadcasting official have been given a mandate to create a new corporation to bring satellite communications within the reach of schools, colleges, hospitals, and other public institutions throughout the United States. Such a system would use satellite receivers costing less than one tenth the $100,000 price of the large "dishes" required by presently available satellites.

"In Eskimo villages in Alaska, Indian reservations in the Rockies, and Veteran Administration hospitals in Appalachia and a NASA satellite is already demonstrating that such a service is technically feasible. What we need now is to turn these experiments into a permanent service available to all," said H. Rex Lee, former governor of American Samoa and now visiting professor at San Diego State University which hosted the organizational meeting of the Public Satellite Consortium. Lee, a member of the Federal Communications Commission until his retirement last year, Jack M. Campbell, ex-governor of New Mexico and now president of the Federation of the Corporation for Public Broadcasting, were chosen by more than 200 doctors, educators, and communications specialists to incorporate the consortium as a permanent not-for-profit corporation. To assist them, the other members of an eleven-man steering committee were asked to continue their efforts. Later, another eleven members will be added to insure adequate representation for all potential beneficiaries of the proposed system.

The consortium was initiated in December 1974 after a series of meetings brought together educators, health care specialists and communications experts who were excited by the early results of an array

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of health and education experiments now underway on NASA's ATS-6, the most powerful communications satellite ever launched.

Under a previous agreement with India, the satellite was be moved to a new orbital location in May 1975 so that India may demonstrate the use of satellite communications for literacy training, family planning, and teaching better farming methods in 5,000 locations in the vast subcontinent.

PSSC Goal

The goal of the new Public Service Satellite Consortium is to see that the technology demonstrated by the experimental NASA satellite becomes the basis for a permanent operational system. Reports at the San Diego meeting indicated that there is a substantial demand for the kinds of services such a satellite system could provide and that sufficient revenues to support such a system could be generated from user fees.

On the basis of a preliminary survey, Dr. Kenneth Lokey, Chairman of the PSSC's Traffic Model committee, estimated that seven television channels would be required to meet the demand for service if the system is to serve the Public Broadcasting System for interconnecting PBS stations and at least four channels without PBS traffic. However, these early estimates may be too conservative. Several representatives of the health field complained that they had not been contacted in the preliminary survey, and that immediate requirements by medical users would necessitate still more channels if the health community was not to find itself left out.

Further definition of the market is one of the prime goals of the consortium, and studies will continue. It is anticipated that if sufficient evidence of future business opportunities can be gathered, one or more of the commercial domestic satellite operators may be attracted into the field. The PSSC plans to explore meeting the needs for such a service through existing carriers as well as looking at the possibilities of establishing a new special service system.

Draft articles of incorporation and by-laws were approved at the meeting and Lee, Campbell, and Quayle were instructed to proceed with the process of incorporation under District of Columbia law. A not-for-profit corporation with membership limited to other non-profit groups was established.

Representatives of more than thirty organizations in attendance at the San Diego meeting paid or pledged dues of $500 - $5,000 in the consortium. While the consortium has limited membership to other non-profit organizations, continued cooperation was pledged with private sector groups interested in supplying and/or using low cost satellite communications.

First Steps

The first steps after incorporation included the appointment of an executive committee; the three incorporators, plus two others. Governor Lee continues as chairman until the election of a full slate of officers at the corporation's first regular meeting. Quayle also continues as vice chairman and Frank W. Norwood, of the Joint Council on Educational Telecommunications, as secretary.

The committee has asked the Joint Council on Educational Telecommunications, a council of national education and public broadcasting groups, to serve as secretariat until the Public Service Satellite Consortium can establish its own office and staff. The JCET is located at 1126 Sixteenth Street, N.J., in Washington, D.C. (202 659-9740).

Other members on the continuing steering committee are: Ralph P. Christensen, Mountain States Regional Medical Program; George Geesey, National Public Radio; Gordon A. Law, Satellite Technology Demonstration; Bruce B. Lusignan, Stanford University; Harold Morse, Appalachian Regional Commision; Marvin R. Weatherly, Office of the Governor, Alaska; and Daniel R. Wells, Public Broadcasting Service.

CHAPTER 7

by ROBERT H. SCOTT

Planning for Computing Resources

This chapter focuses on two general premises. First, that information processing is an expensive and important resource; and, second, that information processing should be recognized, planned for, measured, and treated as an expensive and important resource. With the first of these two premises, there is little disagreement in the higher educational community in the United States. However, behavior with respect to the second is far less uniform. In some institutions, computing receives significant attention in the planning process from those who establish policy. In others, information processing is a problem left to middle-level administration without significant attention from the policy-making level.

Several factors are most important if an institution is to assure effective management of information processing resources and harmony between the various goals of the institution and the information processing services provided to assist in meeting those goals.

Strategic, Tactical, and Operational Issues

Precisely what factors should one consider in planning for computer use at colleges and universities at the strategic, tactical, and operational levels? At the strategic level seven issues must be addressed.

First, administrators must define the *role of information processing in the institution's mission*. For example, is the institution anxious to be at the forefront of information processing technology, to affect the state of the art in this field, and to contribute to the development of industrial practice in information processing, or is it primarily a consumer of information processing in its programs of research and instruction? Will information systems play a central role in planning for the institution or will planning be dispersed throughout the organization?

Second, *what direction will the institution take* and how does the establishment of this direction affect information processing? Is the institution increasing or decreasing its level of activity in areas such as science, engineering, and management which are typically heavy users of information processing technology? Is it expanding or contracting its research program? Will its management be centralized or decentralized?

This is the issue of *understanding the institution's long-range plans*. Precisely what will be the role of information processing at the institution in five to ten years?

What is the direction of development in information processing technology? What will the cost curves be for hardware performance, and, perhaps more important, what are the developing technologies in operating systems and applications software? How will the institution capitalize on new information processing services provided by industry?

How can policy be determined for information processing at the institution? Clearly, policy must reflect various viewpoints including the strategic plans of the institution, financial reality, and the consent of the governed; but there are many mechanisms that can be used for such policy determination.

What should be the rate of expenditure for information processing compared with expenditure for other resources? Should computing represent one, two, or three percent of the educational budget? Should this rate grow or shrink?

Seventh, what is the history of information processing at the institution, and what relation does this history have to goal setting? Does the existence of investments in certain programs preclude certain changes?

At the tactical level seven related issued must be addressed. *What should the organization be like?* Organizational structure can and should change to reflect current needs as well as strengths and weaknesses of individual employees. Organizations must reflect current expectations and current realities, but it is unwise to expect that a single organizational structure will endure for a long period of time in a quickly changing field like information processing.

What are the needs of the community of users at the institution? What are the groupings developing within the user community; What are the concerns of these groupings and what does the future hold for them? Are they prospects for user group funding?

A relatively concrete, medium-range plan must be determined for the institution. In this plan, the specific objectives for a two or three year period can be identified and short-range decisions can be seen as steps towards the achievement of these plans. Clearly, such plans are subject to many external influences, and it is important to revise plans as external influences change. *Understanding of options available to the institution in the intermediate range*, together with the associated risks and promises, must be sought. It is important that an analysis of the available options extend as widely as possible in order to assure that no option and no constituent group is accidentally neglected. In the *selection of options to be followed*, all of the factors important to the institution must be brought to bear in order to integrate a good solution.

How can resources be allocated in the intermediate range for information processing? Resource allocation decisions typically are made either as a part of or parallel with the budgeting process. In all cases the process should allow effective analysis of the benefits associated with allocating more or fewer resources to information processing. Concerning cost recovery the institution must decide whether computer service should be charged directly or managed within the community as a free good. The answer to this question is complex and depends on the goals the institution is trying to achieve, on its style, and on the costraints it faces.

For planning at the operational level, five areas should be considered. First, *how will the institution meet its short-run needs?* What specific individuals and organizations are needed to assure that the service required is provided in the best possible way? Second, *how will inputs and outputs be controlled and measured?* What cost and performance measurements should be developed for information processing service facilities? How should the benefits of computer service be related to the costs? What control systems should be in place? Third *how will the institution assure that information processing operates with a user conscience.* What management techniques, reward structures, and personnel development programs are needed to assure that all facets of the information processing organization are directed at providing the best possible service to the user community? Fourth, *how can maximum knowledge be gained and fed into tactical level planning?* Results from the day-to-day operations on a short-term basis frequently indicate problems and challenges that have long-range impact, and which should be recognized as early as possible. Fifth one must consider a *large set of specific functions* of an information processing facility, such as operations, accounting, user services, applications development and maintenance, publications, software systems, education, data control, and personnel development.

Of the strategic, tactical, and operational level issues, three are of paramount importance. Experience at M.I.T. and elsewhere in the information processing community, indicates that a large majority of information processing problems are caused by a lack of attention to three critical issues: at the strategic level, the place of information processing in the mission of the institution; at the tactical level, the community needs; and at the operational level, operation of information processing with a user conscience. If the institution focuses on these three issues and is able to provide good answers to the questions they raise, it will find a substantial compatibility between its information processing facilities and the goals, desires, and needs of its community.

Cost-Benefit Issues

Costs and benefits of information processing can be weighed effectively in the planning process. In that process an institution must consider both supply and demand in information processing concerns. Individual users within a community make demands on information processing on a daily basis and typically at small financial levels. Supply decisions, however, are wholly different, for they must be made with the long term in mind and one supply decision must meet many demand decisions. Few areas in the university other than the information processing face supply and demand decisions which differ by so many orders of magnitude. This fact heightens both the difficulty and importance of the information processing decision.

Demand decisions should be made, as much as possible, at the same level as other demand decisions in the university to ensure an accurate reflection of the relative values of information processing and of other resources. Supply decisions, on the other hand, clearly must reflect short-run and long-run issues. Total costs must be considered, for example, in a decision to change computer operating systems, for it is possible that such a decision will cause financial disruption to a very large number of programs. In addition, supply decisions may lock the institution into certain types of hardware systems or operating environments for a period of time.

In this area, it is important to quantify projections, predictions, and expectations whenever possible. If the individuals within a community say that far more computing is needed in a particular program, it is important to understand specifically what is meant by "far more computing" as well as the relative costs of the increase to the department or project involved. While it is important to reduce decisions to a financial basis where possible, institutional style and the long-range goals must always be reflected.

Another area to consider is the value to the institution of the operating system environment and of its continuous development. What seems like a good short-term decision may not be best in the long run. Sometimes universities tend to grasp at short-term solutions to nagging problems, but it is important, whenever possible, to raise these issues to the highest level and to understand their long-term implications.

Finally planners must recognize that costs tend to be clear while benefits are unclear. Because this difference sometimes makes costs overshadow benefits, it is important continuously to enhance the visibility of benefits. Costs and benefits can and must be effectively weighed in the planning process.

Control Issues

Can pricing schemes allocate resources better than other planning approaches? The answer to this question clearly depends on the institution's characteristics and on its long-term goals. For example, matters of concern include the degree to which an institution has sponsored research and external sales or the degree to which it is dependent on external suppliers and is in the situation where computing is a marginal rather than a fixed cost.

There are several advantages to using pricing schemes to allocate resources. For one, quick, short-term feedback on the value and quality of service is provided. In addition, given free economics (the fact that funds are free and not restricted to the purchase of computing), an institution can ensure maximum effectiveness in its operation. For example, individual computing resources can be appropriately scaled, the relative value of computing to a particular program is clear, and a good balance can be made between internally and externally provided computer service. Third, if computer services are carried at full cost, attention will be paid to the computer resource at all levels of the institution on a value basis, and the expenditure for computing will not be over or undershadowed by other expenditures. Finally, when computer service purchase is placed on a financial basis the rationality of the process improves and planning issues are substantially simplified.

Some of the issues discussed here are illustrated by data from MIT. MIT has a very heavy commitment to information processing in programs of instruction, research, and administration and in the study and development of computer and information systems. In addition, since MIT has large and diverse information processing capabilities it can serve as a microcosm of the education community on the issue of external and internal computer sales. MIT administrators continuously face the issue of whether to increase the size of the central computer facility or add to the number of departmental computer facilities located on the campus.

Figure 1, Central Facilities, outlines the costs of academic and administrative computer facilities operated by MIT as central services on the campus. During fiscal year 1975, these services cost MIT approximately $6,700,000 to support and had a net value to the instituion of $5,300,000 since $1,400,000 in computer service was sold externally. This external sale has two fundamental benefits for MIT. First, it allows the institution to cooperate with other organizations, particularly colleges and universities, in the exportation of computing methods and techniques internally developed. Second, it allows MIT to operate at a more

	Fiscal 1975 Cost	Capital Equipment Not Included	External Sales	Net Value to Institute
Academic & Research Services	$4,778,000	0	$1,400,000	$3,378,000
Administrative Services	1,194,000	0	0	1,194,000
Institute-Wide Management & Planning	116,000	0	0	116,000
Administrative Systems Development	541,000	0	0	541,000
External Purchases	100,000	0	0	100,000
Subtotal	$6,729,000	0	$1,400,000	$5,329,000

Figure 1. M.I.T. Information Processing Costs; Fiscal 1975; Central Facilities

efficient point on the economy of scale curve than would otherwise be possible.

Figure 2, Departmental Facilities, outlines the cost of the ten computer service facilities operated at MIT to serve particular department and laboratory needs. To the approximate annual cost of $900,000 for these facilities, one must add approximately $900,000 in additional cost to reflect the fact that equipment has been purchased for these centers in previous years and is not being amortized. The inclusion of this capital equipment equivalent reveals the true cost of these facilities ($1,790,000) on a replacement basis. Similarly, Figure 3, Project Facilities, outlines the approximate cost to the Institute the mini-computer systems that serve programs of instruction and research and of the 250 terminals located on the campus. These systems cost the Institute $1,580,000 ($500,000 annual cost, $1,080,000 capital equipment equivalent).

Summarizing the $8,700,000 MIT computer budget Figure 4 indicates that approximately 60% of the budget is provided centrally, 20% through departmental facilities, and 20% through project facilities. Over the past five years, the number of project facilities has grown at a substantial rate, and the balance between departmental and central facilities has shifted in favor of central facilities. In the long run, M.I.T. will probably have fewer

	Fiscal 1975 Cost	Capital Equipment Not Included	External Sales	Net Value to Institute
Management School	$ 25,000	0	0	$ 25,000
Mech. Eng.-Civil Eng.	135,000	0	0	135,000
Chemical Engineering	15,000	15,000	0	30,000
Nuclear Science (general)	325,000	300,000	0	625,000
Archiecture & Planning	60,000	60,000	0	120,000
Project MAC Dynamic Modelling	100,000	100,000	0	200,000
Project MAC Automatic Programming	100,000	100,000	0	200,000
Artificial Intelligence	100,000	200,000	0	300,000
Nuclear Science (PEPR)	40,000	100,000	0	140,000
Research Lab for Electronics	15,000	0	0	15,000
Subtotal	$915,000	$875,000	0	$1,790,000

Figure 2. M.I.T. Information Processing Costs; Fiscal 1975; Departmental Facilities

	Fiscal 1975 Cost	Capital Equipment Not Included	External Sales	Net Value to Institute
Research Facilities (~165 machines)	$ 300,000	$ 900,000	0	$1,200,000
Educational Facilities (~10 machines)	20,000	100,000	0	120,000
Terminals (~250 devices)	180,000	80,000	0	260,000
Subtotal	$500,000	$1,080,000	0	$1,580,000

Figure 3. M.I.T. Information Processing Costs; Fiscal 1975; Project Facilities

		Amount*	% of Total
1.	Central Facilities	$5,329,000	61.2
2.	Departmental Facilities	1,790,000	20.6
3	Project Facilities	1,580,000	18.2
	Total	$8,699,000	100.0

*Includes capital equipment equivalent; exludes external sales.

Figure 4. M.I.T. Information Processing Costs; Fiscal 1975; Summary

	Total Budget	Computing Costs*	% Computing	% of Total
Direct Academic Budgets	$ 28,799,000	$ 640,000	2.2	7.3
Direct Funds Budgets	8,008,000	100,000	1.3	1.2
Direct Research Budgets	60,813,000	5,964,000	9.9	68.6
All Administrative Budgets	41,962,000	1,995,000	4.8	22.9
Total	$139,582,000	$8,699,000	6.3	100.0

*Includes capital equipment equivalent; excludes external sales.

Figure 5. M.I.T. Sources of Funds for Information Processing; Fiscal 1975

SUMMARY
BATCH PROCESSING SYSTEM
MONTHLY ADJUSTMENT FACTOR = 1.12

COST POOL	EXPECTED INCOME (MONTHLY ADJUSTED)	ACTUAL INCOME
CARDS READ	9,007.79	9,161.76
LINES PRINTED	25,507.22	28,302.73
CARDS PUNCHED	2,516.27	2,105.55
TAPE SETUP MIN	3,431.[illegible]	3,213.29
DISK SETUP MIN	1,887.19	2,362.52
CPU MINS	42,080.63	29,332.61
CTC IO OPS	1,609.59	1,525.59
TAPE IO OPS	2,205.70	1,419.31
DISK IO OPS	11,116.75	12,015.47
K BYTE MIN	23,645.80	23,272.08
RJ UNIT RECORD	408.47	.40
JOB HANDLING	9,048.11	9,282.90
SETUP HANDLING	3,823.14	4,200.12
RJ HANDLING	305.89	1.10
SOFTWARE SETUP CHARGE	3,212.59	3,160.14
TOTAL INCOME	139,806.45	129,355.64

Figure 6. M.I.T. Information Processing Center Income Distribution Report, March 1975

departmental facilities and the balance will shift further towards central and project facilities.

In Figure 5 one can see the source of funds required to meet the $8,700,000 computer budget and the relationship between information processing expenses and the $140,000,000 annual operating budget for on-campus activities at MIT. Approximately 2.2% of the direct academic budget is spent on computing. This amounts to about $80 per student, an amount which, while large relative to universities in general, is in fact not large when one realizes that a substantial portion of MIT's student body is engaged in programs of instruction and research in engineering, science, and management. The 9.9% of the direct research budget provided for computing is, in fact, atypically large and reflects the heavy concentration of computer use in research at MIT, both as a tool and as a subject of [illegible]. The $2,000,000 provided for computing in the administrative budget represents 1.4% of total expenditures which is slightly larger than the 1 [illegible] found in industry, but is not unusual for large, private universities.

Finally Figure 6 illustrates the degree to which the costs of various resources can be tightly controlled in the short run. In March, 1975 expected and actual income for the large batch-processing system operated by the MIT Information Processing Center were, with three exceptions, substantially in balance. Two of these exceptions are small and not significant, and the third exception (CPU minutes) reflects a conscious decision to sell below cost in order to encourage usage. MIT uses this type of report which includes a comparison of expected and actual income on a short-term basis to determine whether rates should be raised or lowered or services expanded or contracted.

Summary

In this brief discussion, issues have been outlined that are important to assuring a first class information processing facility in an institution of higher education. The main theme is clearly that information processing should be consciously managed as the important and expensive resource that it is.

CHAPTER 8

by CHARLES C. JOYCE, Jr.

Computer Networking and National Telecommunications Policy

Over the last five years, developments in communications technology have permitted computers in different locations to be connected to each other, and to a great variety of types of remote user terminals. Not surprisingly, one finds an array of obstacles to the effective employment of a new communications technology. There have been similar difficulties with communications satellites, broadband cables, and other communications technologies all of which have been the subject of intensive government policy studies and initiatives. It is, therefore, appropriate to explore what effect government policies will have on the use of networking technology, and whether any policy initiatives are desirable.

Networking is not an end in itself. One of the conclusions of the EDUCOM networking seminars, as reported in the book "Networks for Research and Education"(1) was:

> "Networking does not in and of itself offer a solution to current deficiencies. What it does offer is a promising vehicle with which to bring about important changes in user practices, institutional processes, and government policy that can lead to effective solutions."

To what deficiencies does the quotation refer? Problems such as excess computing capacity, duplication of software development efforts, incompatibilities, excessive strategies are all deficiencies. In a word, higher education must rationalize its total investment in computer resources including hardware, software, and people. What networking has shown is that to deliver computer service, the computer doesn't have to be near at hand. It doesn't even have to be under one's direct control. It can be anywhere and belong to anybody. What networking does is to destroy what has been, for over twenty years, the cardinal rule of getting started in data processing, namely, that the first step is to get a computer.

It's one thing [illegible] destroy the myth of the essentiality of a local computer. It's another thing to bring about some new order based [illegible] current technical and economic realities. Bringing about such a new order is in fact a fairly staggering challenge. How does one go about it?

Basic Strategies

Most of the strategies fall into one of two categories: the Grand Design and the Market Mechanism.

The Grand Design is an engineering-oriented approach. It seeks to encompass all of the facilities and resources in the area of interest into a fully coordinated and rationalized ent[illegible] subject to centralized planning [illegible]. The end g[illegible] of the Grand Design is frequently described by analogy to the exist[illegible] networks for the generation and distribution of electrical power, or the public telephone network. The Grand Design typically represents [illegible]e engineers view of how a complex but widely needed system should [illegible] designed, organized, and man[illegible]

The other approach to [illegible]lizing national investments is to [illegible] gradually to introduce mor[illegible] [illegible]ore market mechanisms into the are[illegible]. If market forces are given [illegible] [illegible]nt room to operate, they will militate against duplication of eff[illegible] [illegible]xcess capacity, disfunctional subsidies, and other forms of ineffic[illegible]. Although market forces may not deal with them p[illegible]ctly, neither do admi[illegible]strative approaches bring about economically optimal results at every point in time.

There are sincere, eminent and reasonable people who would defend each of the[illegible] propositions. It is fair to say, however, that at least in the field of information, computers, and communications, present government policy is heavily weighted toward reliance on market mechanisms. Some elements of the grand design do affect government thinking, but these considerations are definitely secondary in 1975 as a strategy for rationalizing either government or national investments. The primary thrust is a market approach.

As a consequence of this basic policy thrust, one will for example find little support in government for the idea that the government must, as a matter of national policy, and at whatever cost, bring about the construction of a National Science Information Network, or a National Educational Computing Network, or any totally integrated system of that sort. Consistent with that also, there is no effort to create within the government a completely integrated computer-communications network designed to meet all of the government's own teleprocessing needs.

Advantages of The Market Approach

A marke· approach is a situation where the end users recognize what they need terms of computing, or information, or an ability to transfer informatio They then attempt to meet those needs by buying data processing nformation or communications service in an organized market for h services. Contrast this with a situation where the users buy and ope ·te capital equipment, such as computers and communications devices, to meet directly their own anticipated needs for service.

There are several advantages to the market approach which lead the Office of Telecommunications Policy (OTP) and other government policy sources to believe that it has much to offer in this field at this time. Under this approach, the user buys, and pays for only what is needed in the way of specific service, and only when it is needed. One isn't forced to buy capabilities which may not be needed in the future. In a highly organized market for services, one may also be able to judge more realistically the value of certain service performance requirements, like accuracy, reliability, or speed of service, when a differential price is associated with each. Those tradeoffs are much harder to deal with, if they are dealt with at all, when one is planning an in-house system.

A second advantage to the service approach is that it relieves the user of the requirement to become expert in the planning and design of technical facilities. This does not mean that the user need have no expertise at all. But it does limit th depth to which one need go in facilities design and management in order to get a job done.

The service market provides a better economic framework within which suppliers can make economic investment decisions in new data processing and communications facilities. Having a good idea how much users are willing to pay for various services and features, suppliers can perform fairly straightforward econo· ·c investment analysis. A user trying to do the same analysis is rapidly forced into a cost-benefits framework and is overcome by the problem of attempting to quantify intangible benefits. Rational nvestment analysis for a user is much more difficult than investm ·t analysis for a business firm serving an orderly market for services.

As a corollary to this, technological cha ·es that improve efficiency will be more readily and correctly assimilated in a service market because their value can be determined in relation to the bottom line of profit-making service suppliers. Users, on the other hand, who are already ha · · are · difficulty putting their operation on an economic basis, are m ·re ·· ·ily trapped by considerations of having the latest the fastest, and the best.

Finally, a reasonable degree of sharing should occur in a ·· ·erly organized market because business firms are more likely to resolve make-or-buy decisions in the interest of economic efficiency. Users find it more difficult to escape from the idea of having their own facility.

Policies Favoring the Market Approach

These advantages of the market approach seem almost made-to-order for the kinds of structural deficiencies which most observers see in many areas of computer and communication application today. In response to these considerations, OTP issued in 1974 a policy favoring a market approach in meeting the government's own communications needs. The policy encourages Federal agencies to view themselves primarily as users of telecommunications services. It suggests that they minimize their own involvement in the acquisition of capital equipment and the in-house production of telecommunications services to meet their own needs. A key to the success of this policy will be the continued evolution of a competitive commercial market for telecommunications services.

This policy is beginning to take hold, though it will not quickly permeate all of the government. Full compliance with the policy will require profound changes in system planning, requirements specification, and procurement practices which will take some time to develop.

There is also the possibility of a policy shift in the Federal data processing policy away from extensive government dependence on in-house data processing facilities. A 1974 strategy study completed within the government shows that 85% of government computing expenditures are currently going to in-house systems, compared with only 15% for commercial services. There is a distinct possibility that government policy will be developed favoring a radical shift in this mix. An important component to this strategy may also be a revision in pricing arrangements for internal government service bureaus. As long as government computer installations can sell computer services to one another under mandatory sharing rules at prices approaching short run marginal cost, it is going to be difficult for any commercial service bureau to compete. Full cost pricing of internal service bureaus is a minimum essential step to producing better market mechanisms within the government arena.

Making the Market Work

It's easy enough to talk about the advantages of a market approach. It's easy enough to write down and send out government policies favoring the use of commercial services. Making it work takes something more than words.

Experience in higher education shows that it takes much more than a technical capability linking computers together to bring about a rational sharing of computing resources. The seminars on networking which EDUCOM sponsored came to the conclusion that there were really three different networks which had to be organized before a market could evolve and operate within the higher education community. These three networks were termed a user services network, a transmission network, and a facilitating network.

The transmission network is the communications system that physically links the user sites with the node supplying computer service. The user services network is not a technical network at all, but rather a representation of the physical and organizational resources of the market—the users who are willing and able to buy, and the sup iers with data processing facilities whose services they are anxious to sell.

One of the most powerful result of EDUCOM's networking efforts has been the recognition that these two networks alone are not sufficient to make the market work. What is missing are the necessary resources and arrangements to create and enforce standards, establish basic user protocols, perform centralized accounting and billing, furnish documentation and general user support, and perform other critical functions which are essential to bring users and suppliers together in an orderly market situation. The organization for providing this third se[illegible] is the facilitating network. A sound facilitating network is a sine qua non for creative viable new markets. It is the absence of effective facilitating networks that makes it so difficult to put to use in the private sector some of the latest developments to communications and computer technology, such as, for example, advanced communications satellites.

The Case of High Power Satellite Technology

NASA has developed [illegible] technology of high powered satellites to the point where small and inexpensive earth terminals are capable of receiving television signals directly from the satellite. Earth terminals, costing as little as $5,000, can receive home quality television signals from such a satellite.

NASA has placed one experimental satellite of this type in orbit, and a very enthusiastic user community has developed in the areas of health and education. There are many who feel that the capability to distribute high quality audio-visual materials inexpensively to a nationwide, institut[illegible] could have revolutionary effects on education, and that [illegible] [illegible]ld have a significant impact on portions of the health service[illegible] system.

As a re[illegible] this interest, there has been pressure for NASA to launch additional [illegible]ellites of this type for continued use by the health and education communities. OTP feels, for all the reasons cited earlier, that this type of technology should be transferred as soon as possible to the private sector where it can be put to work in a private market for communications services. However, the transfer is not easily accomplished. Although many people feel that the market is there, suppliers who would have to invest up to a hundred million dollars in order to service this market are unable to identify enough users with sufficient assurance to justify immediate investment. Users in educational institutions might view the satellite earth terminal costs as minimum, but wonder where the audio-visual programming will come from. Producers of educational software aren't sure what programming will sell, or what the cost of distribution will be. What's missing is the mechanism to get it all together. The components that are missing are very closely analagous to the components of a facilitating network.

In fact, an organization has just been formed in the private sector to provide facilitating network services for satellite users. The Public Service Satellite Consortium is an organization of users and others who are interested in promoting the development of this market.

Facilitating Networks for Computer Communications Services

Some type of facilitating network is obviously necessary to change any portion of the current computer-communications complex from a situation in which users own and operate their own facilities to one in which there is an organized market for services. Yet two principal obstacles block effective progress in this direction in the private sector. One is a general lack of people and institutions experienced in performing facilitating network functions. The other is a lack of adequate funding sources for at least the start up costs of new facilitating networks.

In the short run, either the Federal Government or private foundations are the most likely sources of funding assistance for developing the know-how to perform facilitating network functions, and for funding the start up costs of facilitating networks in basically new areas. This is not to say that the users will not play some role in the funding of these bodies. But in the face of so much uncertainty, user contributions seem to be presently inadequate to meet the start up costs and the costs of developing the proper know-how.

Brokers as Facilitators

There is a recent development which could change this situation. The Federal Communications Commission is currently considering whether, and to what extent, sharing and resale of communications facilities should be permitted by brokers and value-added network vendors, and whether such entities should be subject to regulation [illegible] OTP has submitted an analysis and opinion in this important docket, advocating the elimination of restrictions on resale and brokerage, and a maximum of freedom for unregulated entities to act as communications brokers and to provide value-added network services. If the OTP recommendations were accepted by the Commission, it is quite possible that brokers or value-added network vendors would begin to perform facilitation functions. In the case of a pure communications offering, such as high powered satellite service, communications brokers might provide the missing link between carriers, program suppliers, and the user community. In the case of computer-communications networks, we might see hybrid computer-communications services being developed by value-added network vendors who obtain transmission capacity from existing carriers, combine it with specialized switching or data processing features and sell it to specialized user communities.

In order to effectively create and sell network services of this type, a broker will have to perform most or all of the facilitating functions. Broker revenue will derive directly from the efficiency gain which has been achieved by designing a network for the particular community of users. Brokers may require little or no investment in facilities since their investment is primarily in marketing, system design, and general know-how. This investment would be recovered through user charges over the economic life of his network.

In short, a permissive environment on resale, brokerage and value-added network services may be the necesary and sufficient condition for the private sector to bring forth the investment capital required to set up and operate facilitating networks.

Overall Technical Planning

What is the relevance of the Grand Design? Is there no need to worry about the technical infrastructure which is emerging as a result of market forces? Is all broad-gauged technical planning unnecessary or counter productive?

First of all, to the extent that the government or any user community continues to operate at least some of the technical facilities it uses, technical planning will be needed. The government is certainly going to need some type of broad architectural plan governing the future relationships among the computer and communications facilities which continue to be operated in-house. The consolidation of in-house facilities is likely to be a continuing trend, and the government is going to have to determine whether this should be along geographical, organizational, or functional lines, and how far it should proceed. It must also be recognized that the sharing of communications may not be on quite the same basis as the sharing of computer facilities.

Equally important, the government and other users should address themselves forcefully to the area of technical standards. It is well known that industry uses technical standards as a way of segmenting the market and capturing particular user communities, who after some time find themselves with significant investments that are not transferable to other service vendors because of standards problems. An effective market for technologically based information services cannot exist without the existence of sound user-oriented standards.

OTP recognized both of these needs in the area of Federal Government communications and has established a long-range planning process for government communications, to evolve a general architecture governing those communications systems used or operated by the Federal Government. The office has also directed the establishment of a Federal Telecommunications Standards Committee to accelerate the development of user-oriented standards. The National Bureau of Standards has similar responsibilities for the Federal Government in the data processing area. A close and effective working relationship has been established between the National Bureau of Standards and the Federal Telecommunications Standards Committee so that the emerging area of teleprocessing can be effect[illegible]

Privacy

When talking about networking computers, the subject of privacy invariably comes up. The relationship between privacy and networking technology is a bit complicated, and hard to cover in a brief paper, but a few points deserve mention.

Before passage of the Privacy Act of 1974, the linkage of government computers by means of a single communications network could have led to a de-facto national data bank, allowed linkage of different records containing personal information, and resulted in some sort of national dossier on each citizen. The Congress, OTP and others were very concerned about this possibility. The Privacy Act established new rules which limit the situations in which personal information can be disclosed by any Federal agency, and require an accounting of interagency disclosure. As long as these requirements are built into the design of information systems, the threat of deliberate linkage of personal records by the government is essentially eliminated. What remains is to prevent, to an acceptable degree, unauthorized access to data from remote terminals or by other means. This problem is not unique to computer networks, but exists in almost any on-line system. Neither is it unique to protecting personal information. All types of financial and proprietary information require adequate protection against unauthorized access.

Legislation covering general privacy protection in the private sector is not covered by existing privacy legislation. However, Several Federal bills have been introduced, and many states have measures under consideration. Generally these measures do not dictate specific technological measures, though some state bills are limited to automated information systems and thus create something of a double standard.

Any linking of computers which contain personal information should be examined in the light of the probable requirement to restrict the possibility of unauthorized access to such information. This is especially true in any situation in which users of the network are afforded a general programming capability. A legislated requirement to provide such protection in the private sector will undoubtedly come forth in the near future.

Importance of Rationalizing the Information Infrastructure

At least two papers published in the early months of 1975 suggest that as much as half of the U.S. gross national product derives from information handling activities. Authors also propose the hypothesis that America is now a post industrial society, in which the production of services exceeds in economic value the manufacturing of goods. These considerations suggest the conclusion that continued improvements in the productivity of information handling operations may be an essential condition for continued economic growth in the United States. If this hypothesis is true, then the rationalization of our information handling resources is a vital national economic priority.

EDUCOM is a leader in developing and applying techniques for improving information handling productivity. There is no task within the information sector which is more important or critical at this time.

References

1. Greenberger et al. editors, MIT Press 1974, p. 23

Appendix A

Conference Attendance
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Appendix B

Conference Workshops and Workshop Leaders

GROUP I
PLANNING WITH TECHNOLOGY

1. Strategic planning: national priorities for higher education and funding
George Weathersby
Graduate School of Education
Harvard University

2. Strategic planning at the statewide level: academic, finances and facilities
Thomas D. Truitt
Assistant Chancellor
N.J. Department of Higher Education

3. Strategic planning within the larger university: academic, finances and facilities
William F. Massy
Vice Provost for Research
Stanford University

4. Strategic and tactical planning for the smaller institution: academic, finances and facilities
Walter Kenworthy
Program Manager
Exxon Foundation

5. Strategic planning: resource allocation and responsibility accounting
Richard M. Cyert
President
Carnegie-Mellon University

6. Tactical planning for facilities
Richard Van Horn
V.P. Business Services
Carnegie-Mellon Univ.

7. Operational systems: student records, admissions and financial aid
Weldon Ihrig
Asst. Vice President for Admin.
Ohio State University

Alice Irby
Vice President for Student Services
Rutgers, The State University of N.J.

8. Strategy, tactics and operational systems for research administration
Jerold L. Zimmerman
Professor
Grad. School of Management
University of Rochester

9. Operational systems: fund-raising and development
Bernard Hayden
Administrative Data Systems
Yale University

10. Operational systems: budget planning and control
Robert W. Blanning
Asst. Prof., The Wharton School
University of Pennsylvania

11. Operational systems: energy management and automation
Charles Codding
Director of Physical Plant
Bowling Green State University

GROUP II - ADMINISTRATIVE INFORMATION SYSTEMS FOR PLANNING

1. National priorities for funding AIS for higher education
George Weathersby
Graduate School of Education
Harvard University

2. Statewide planning for AIS
Thomas D. Truitt
Assistant Chancellor
N.J. Department of Higher Education

3. Planning within larger universities for AIS
Robert Scott
Director
Information Processing Services
Massachusetts Institute of Technology

4. Planning within smaller institutions for AIS
Robb Russell
Director of Computing Services
Bryn Mawr College

5. Transportability of AIS planning packages (Campus & RRPM)
Robert R. Caster
Asst. Vice President, Management & Finance
University of Cincinnati

6. Project management of MIS development and use
Norman Zachary
Executive Vice President
Data Architects, Inc.

7. AIS for decentralized operation and budgetin
Joe B. Wyatt
Director, Office of Information Technology
Harvard University

8. Cost/benefit analysis of AIS
James Emergy
Executive Director
Planning Council on Computing in Education and Research

9. The introduction of AIS to the college
Willard Enteman
Provost
Union College

10. AIS information requirements
Jon Strauss
Executive Director of Budgeting
University of Pennsylvania

11. Staffing of AIS
Martin Solomon
Director, Computing Center
University of Kentucky

12. Transportability of AIS operational packages
David Lyons
Controller
Rockefeller University

GROUP III - PLANNING FOR COMPUTING AND TELEVISION

1. Educational productivity and technology
Franklin Patterson
Boyden Professor
University of Massachusetts

2. **Strategic planning for television**
Seymour Siegel
Director, University Office of Educational Technology
City University of New York

3. **Economics of television use**
Bruce Lusignan
Dept. of Electrical ications Engineering
Stanford University

4. **Cooperative programming for television**
Robert McCabe
Executive Vice President
Miami-Dade Community College

5. **Forecasting demand and stimulating interest in television**
Monty Ruth
Office of Educational Planning & Development
Coast Community College District

6. **Forecasting demand for on-campus and remote computing: planning for a mix of services including network computing**
John Stephenson
Associate Director
Triangle Universities Computation Center

7. **Budgeting for computing: centralized or decentralized?**
Richard Van Horn
Carnegie-Mellon University

8. **Pricing of computational services**
Norman Nielson
Senior Research Engineer
Stanford Research Institute

9. **Achieving greater technical efficiency in computing**
Philip J. Kiviat
Technical Director, Federal Computer Performance Evaluation and Simulation Center

10. **Mini's versus maxi's**
Peter M. Wolk
Former Director of Computer Services
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GROUP IV - ISSUES IN COMPUTING AND TELEVISION FOR HIGHER EDUCATION

1. **Protection and security of computing resources**
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Vice President
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2. **Library networks and information dissemination**
Glyn T. Evans
Director for Library Services
State University of New York

3. **Role of minicomputers in a distributed network**
Robert L. Ashenhurst
Director, Institute for Computer Research
University of Chicago

4. **Role of the Federal Government re computing: privacy and confidentiality regulation**
Carole Parsons
Assoc. Executive Director
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5. Extending the life of existing hardware systems

Pauline Nist
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6. Importing packaged systems for television

Ken Warren
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7. Computer managed text processing and printing systems

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