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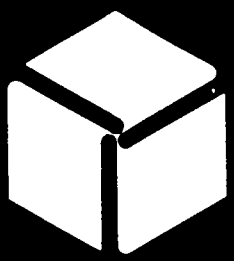
ABSTRACT

Most efforts to achieve more effective administrative computing in higher education have focused on technical questions or on isolated applications required by middle management. Much less attention has been paid to the question of the proper role of administrative computing in the accomplishment of overall institutional objectives. The enormous variety of environments, missions, and goals found among institutions in postsecondary education precludes easy, all-inclusive answers. But answers must be found if institutions are to make major improvements in their information systems and administrative computing functions. Improvements will occur only if top-level management takes an active role in finding those answers. After defining the alternative roles that administrative computing can play in an institution, and after the various stages by which administrative computing is developed, an institution should be able to assess where its administrative computing effort stands. The next step is the involvement of top-level management by identifying the roles and responsibilities of users, the administrative computing organization, and external agencies. (Author/KE)



National Center for Higher Education Management Systems at WICHE

ADMINISTRATIVE DATA PROCESSING: THE CASE FOR EXECUTIVE MANAGEMENT INVOLVEMENT

by

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WESTERN INTERSTATE COMMISSION FOR HIGHER EDUCATION

National Center for Higher Education Management Systems at WICHE

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PREFACE

Administrative computing clearly plays an important role in most planning, management, and operational activities in colleges and universities today. In its implementation efforts, the National Center for Higher Education Management Systems (NCHEMS) has found that deficiencies in institutional information systems usually are the most critical factors limiting the use of the Center's new planning and management information products. It is not surprising, then, that considerable attention has been given to improving the effectiveness of administrative computing in technical journals, at numerous forums and conferences, and by statewide task forces that have studied various aspects of the subject. A good many institutional budgets and organizational plans reflect a similar concern.

But most efforts to achieve more effective administrative computing in higher education have focused either on technical questions (what hardware configuration to use, what software system to acquire or develop, what programming standards and procedures to adopt) or on isolated applications required by middle management (what subsystems to develop in the student data area, how to meet the reporting requirements of a particular state or federal agency). Much less attention has been paid to the role that administrative computing can play in the accomplishment of overall institutional objectives. Institutions seldom address questions such as these:

- How should administrative computing be integrated into the overall administrative structure of the institution?
- What contributions should information systems make to such institutional functions as controlling, planning, and evaluation?
- Who should be responsible for developing information systems? What staff should be involved?
- What will information systems cost, and what will be the benefits? What should be the time frame for development?

The enormous variety of environments, missions, and goals found among institutions in postsecondary education precludes the formulation of all-inclusive, pat answers to these questions. The authors of this publication are convinced, however, that they must be answered if institutions are to make major improvements in their information systems and administrative computing functions. They are equally convinced that this will happen only if top-level management takes an active role in finding the answers.

Chapter One of this publication defines the alternative roles that administrative computing can play in an institution. Chapter Two describes the various stages by which administrative computing is developed. With this information, an institution should be able to make a benchmark assessment of where its administrative computing effort stands. Chapter Three presents the case for the involvement of top-level management. The final chapters consider how this can be achieved: Chapter Four identifies the roles and responsibilities of users, the administrative computing organization, and external agencies; Chapter Five offers guidelines for bringing about the involvement of top-level management.

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CHAPTER ONE

LIKELY ROLES FOR ADMINISTRATIVE DATA PROCESSING

A Definition

Throughout this book, the term administrative data processing unit refers to any and all units in an institution that are devoted wholly or partly to processing administrative data for more than one other institutional unit. It does not apply to units that process the data of one client exclusively. We use the term to apply to:

- central full-service administrative data processing units (hardware, systems, programming).
- units reporting to a major user but serving other users.
- combined academic/administrative computing centers.
- outside service bureaus that meet the various needs of a number of users.
- separate systems design and applications programming units.

Our definition does not include data automation activities undertaken for the benefit of one user and fully supported by that user--for example, an Admissions Office unit that provides automatic typewriter service for the preparation of responses to admissions applications.

Four Roles

An administrative data processing (APD) unit can fill one or more of these four institutional roles:

- as a service bureau for users.
- to support more efficient institutional operations.
- to support a management information system.
- as an extension of the activities of operational and top-level management.

In this hierarachy, the first two roles are well documented by institutional experience, and the third is expressed as a goal by many institutions. The fourth is postulated by the authors to be the highest and best use that can be made of ADP in serving operational and management needs. The possible roles in the hierarchy are differentiated by the extent to which top-level management is involved in decisions about the uses found for ADP in an institution, as the following examinations of each role will show.

Service Bureau

In the service bureau concept, user need largely determines the variety of services provided, hardware configuration, staff size, and priorities for automation. Since a user's relative need for service is not a criterion in determining service priorities, users with the best imagination and ability to pay will be best served. Whether users with the greatest need receive the best service is largely a matter of luck. When, for example, dairy herd testing and automated student grade reporting operations compete for the same computing services, dollar clout typically decides the priority question. Since service bureau users call the shots in this way, they are very likely to participate in the planning of the ADP unit's expansion to provide extended or different services.

The pure service bureau concept has its counterpart in industry. It is easiest to justify in a decentralized organization and requires the least involvement of top-level administrators. It can be placed in any neutral organizational slot and, with some base-level funding and an entrepreneurial leader, can support itself by providing services that knowledgeable users find profitable.

Many institutions begin employing ADP by using an instructional/research computer center as a service bureau. Most such centers provide hardware and consulting services to students and sophisticated users. But the administrative user's demands are of a different order. The instructional/research center must step out of its traditional role to provide the systems development, programming, data conversion, and data control services that administrative applications require. Systems development and programming services usually are quite difficult to allocate, schedule, and price. Moreover, the massive amount of data conversion and data control associated with ADP usually is foreign to the established instructional/research computing environment. In consequence, one of a number of hybrid arrangements customarily develops between the administrative user and the computer center turned service bureau.

One such arrangement is to organize the methods and applications analysis and programming activities as an administrative unit and expand the computer center's capabilities to include data conversion, data storage, and perhaps data control. In theory at least, this keeps the administrative users and their technical staffs separate from the data processing services staff, whom we may call computer utility providers. This

assumption of computer utility or service bureau functions by the instructional/research computer center has three principal advantages for the user: independence, awareness of prices, and choice of services.

Whatever institutional advantages accrue when the ADP unit assumes the character of a service bureau, this role proves inadequate for any institution with these concerns:

- costs of redundant data lodged in different systems.
- consistency of data definitions used in the various systems.
- a balanced approach to the automation of the records of various organizational units.
- minimizing total costs of information processing.
- developing integrated systems to serve ultimate and intermediate providers and users of data.

Because of these concerns, most institutions have assigned a role to administrative data processing that is more specifically related to institutional goals than a service bureau can assume. At the same time, it should be recognized that the cost awareness and user involvement benefits inherent in the service bureau concept are important to the success of any administrative data processing effort.

More Efficient Operations

Administrative data processing units have most often been employed to support more efficient institutional operations. Although economists have yet to produce a precise definition of "efficiency," the general hope has been that through automation, the institution could meet growing needs for data in various operations without increasing the cost of

those data. Typically large-volume transactional operations such as processing registration records, student grade reports, payrolls, and expenditure accounting get first attention. In these operations, efficiency usually is regarded as the ability to handle greatly increased volumes of work with a modestly increased staff. To handle the rapid growth in enrollments in the 1960s, many operational offices would have had to contend with wall-to-wall staffing situations had they not automated.

In developing administrative data processing to improve operational efficiency, central administration involvement usually has been limited to making the budgetary decisions required to establish a data processing center and assigning automation priorities to various institutional operations. The budgetary decisions are largely concerned with what hardware to acquire and on what terms. Top-level administrators seldom address such important issues as personnel costs, data conversion costs, data redundancy costs, cost of developing new data processing applications versus costs of maintaining existing applications, and dollar benefits that can be expected from automation. They tend to take it on faith that more efficient operations will somehow result if they verbally support automation, provide adequate hardware, and authorize the hiring of technical computer staff where needed.

The operational areas and managers customarily viewed as candidates for data processing support include:

- Registrar/Admissions Officer--for records of admissions, registration and enrollments, courses, course scheduling, grades, transcripts, and degrees.

- Financial and Accounting Officers--for receipts and expenditures accounting, budgetary accounting, purchasing, student aid and loan accounting, inventory records, costing data, and portfolio management data.
- Alumni Officers--for alumni records, gift acknowledgement, and accounting.
- Campus Planning Officers--for room and building inventory records, utilization reporting, and space-planning models.
- Personnel Officers--for personnel data, payroll, faculty service reports, benefits and tax data, personnel budget, and applicant/position data.
- Research Administration Officers--for proposal records, grant reporting, and accounting.
- Managers of Major Public Service Operations--for records associated with hospitals/clinics, cooperative extension services, continuing education programs, and ticket operations.
- Librarians--for cataloging, purchasing, circulation, and information retrieval services.
- Managers of Physical Plant and Auxiliary Operations--for the scheduling, acquisition, use, and costing records required by janitorial, maintenance, housing, food services, general stores, bookstore, airport, and similar operations.
- Planning, Budgeting, and Institutional Analysis Officers--for generating composite profiles of basic data, major external reporting requirements, integrated cost studies, and resource use and prediction models.

Clearly, the "more efficient institutional operations" approach will produce a large number of significant improvements. One- and two-day turnaround on grades, transcripts, payroll checks, scheduling, and month-end accounting is not at all unusual. Transaction volume has doubled and tripled in areas where staff increases have been most modest. Communications potentials have increased dramatically: for example, labels for students, alumni, parents, and staff can be printed in a matter of minutes.

However, this "more efficient institutional operations approach" to administrative data processing also inevitably results in:

- a relatively large number of independent applications.
- such high demands by users upon existing resources that new applications keep being postponed.
- more visible data redundancy because the data processing center maintains many files that appear quite similar in content.
- increasing demand for hardware and personnel expansion at the central site accompanied by decreased user awareness of what actually is needed to meet their automation needs.
- top-management frustration about the general difficulties of getting answers to questions in information areas that they know are "on the computer."

Numbers of institutions have carried the "more efficient operations" approach a step further, developing operational data systems that link allied applications. For instance, a system may be developed by linking

admissions, registration, fee assessment, grade processing, transcripts, and student loan applications.

Frequently these linkings are given the rubric Management Information System (MIS). However, we view them rather as logical extensions of the "more efficient operations" approach and reserve MIS for the more restricted use defined in the following section. An operational data system in a given applications area, characterized by shared data bases, common definitions, modularly related applications programs, and non-redundant maintenance responsibilities, most certainly requires more management involvement than do isolated applications. Developing operational data systems also requires more technical expertise and generally places increased responsibilities on the administrative data processing staff.

Many times, the large number of programs that logically fall together contain so many built-in restrictions on linking that the data processors consider it easier to develop a new operational data system from scratch. At the same time, they will want to design a system that will serve institutional operations not currently using data processing and provide information not because the proposal for the new operational data system is likely to entail the acquisition of new hardware and the purchase or lease of software, and also require decisions about jurisdictional boundaries between institutional units. With top-management approval, operational data systems can be developed that will eliminate significant data redundancy, balance automation efforts and achieve data consistency

within major operational areas, permit better control of total information costs, and promote first-stage integration of data for ultimate providers and users of data.

Just as automated applications can improve the efficiency of institutional operations, data systems can improve the efficiency of automated applications. But even when applications have been linked into operational data systems, the institution will find that it cannot satisfy top-management needs for integrated and projected information. Awareness of this deficiency leads to the concept of ADP as a support for a true management information system.

Management Information System Support

We use the term management information system (MIS) in this book as it is defined by Walker Kennevan: "an organized method of providing past, present, and projection information related to internal operations and external intelligence. It supports the planning, control, and operational functions of an organization by furnishing uniform information in the proper time frame to assist the decision process."[1]

In effect, this definition of an MIS adds "past and projection data to the typical operational data system, adds "planning and control" to the functions supported, and restricts MIS output to "uniform information in the proper time frame for decision making." This is a more specific, restrictive definition of an MIS than is usually applied. Indeed, most

[1]Walter J. Kennevan, "MIS Universe," Data Management, September 1970.

so-called MIS efforts or computer-based MIS efforts undertaken to date in postsecondary education more closely resemble what we call operational data systems. We use Kennevan's definition of an MIS because we find it meaningful and relevant to our purposes and because it clearly delineates what must be added to an operational data system to make it useful to the higher levels of management.

Most MIS literature is either silent or, worse yet, assumes a neutral attitude, with respect to who the managers are, what it is that they manage, and how they are organized to discharge management functions. Higher education has a 900-year history of complex governance structures. Administrators, agencies, alumni, churches, faculty, legislators, parents, patrons, the public, and students all play a part in the management of higher education. What this part is and how they are organized to play it depends upon the society, the institution, and the times. Obviously no MIS can purport to meet the decision-making needs of all of these participants, even within one institution. The information needs of merely one group at one institution present a formidable problem.

In this book, the MIS focus is on institutional administrators as managers of resources, organized in relatively traditional structures. Our specific assumptions about administrators, their data needs, and organizational relationships are discussed in subsequent chapters. For now, we assume that an ADP unit that supports an MIS serving institutional administrators will at a minimum be expected to provide:

- historical and current profile information regarding the resources, users/sponsors/patrons, and programs of the institution.

- methods for integrating this information across traditional organizational boundaries.
- computational support to various analytical and projection techniques.

Considerable top-level management involvement is required if an ADP unit is to assume these functions. Budget and ADP service priorities are still important, but top-level administrators also participate in defining the structure of the MIS and determining relationships of components and the time and content requirements for the different kinds of information needed by administrators.

For example, the structure of an MIS could be designed around three major systems with related subsystems, as follows:

1. Resource Management Information--to collect and store data and provide reports about sources, inventories, needs, acquisitions, allocations, and activities or use of resources and use of evaluations. Resource management information categories reflect the way the institution structures its operations to acquire and make use of resources. Typical subsystems would include:
    - personnel
    - facilities
    - equipment/supplies/materials
    - finance.
2. User/Sponsor/Patron Information--to collect and store data and provide reports about the market, candidates, selection, preferences, contributions, activities, and

evaluations of users/sponsors and patrons of the programs of the institution. Typical subsystems would include:

- students
- government/industry/foundations
- alumni/parents/patrons
- participants/clients/patients.

3. Program Management Information--to collect and store data and provide reports about the programs of the institution. Program information includes goals, content, capacity, demand, requirements, schedules, and evaluations of a program. It is augmented by being related to the resource management and user/sponsor/patron systems. Typical subsystems would include:

   - degree-credit instructional programs (such as degrees and courses offered)
   - research programs
   - public service programs (such as co-op extension, hospital)
   - student service programs (such as housing, activities)
   - learning service programs (such as library, computer-assisted instruction)
   - general service programs (such as physical plant, general administration)

Agreeing on the structure for the MIS is just the first step. Common data definitions and interrelationships must be agreed upon and careful information analysis is required to determine what management tools and data will be provided, to whom, and when. A number of NCHEMS products

can provide valuable definitional starting points, particularly with respect to data definitions, faculty activity analysis, resource requirements prediction models, and costing. CAUSE (College and University Systems Exchange) can provide examples of existing systems. Task forces, data analysts, institutional researchers, and consultants can help determine the scope of management information needs. But clearly, top management is mainly responsible for deciding what is needed, by whom, and when.

It is possible to develop an MIS that is not supported by operational data systems. In fact, numerous federal and statewide requirements for institutional management information can be met without using such systems, and they are not necessary to the use of most generalized forecasting and resource analysis models now available. Often it is easier to get management information if the complexities of operational data systems are avoided. Institutional research, planning, or budget office analysts generally can come up with enough data to operate almost any forecasting or costing model. Usually they can do it in less time than it would take to develop or convert an operational data system for the purpose. We contend, however, that the traditional way of generating management information has mainly short-run advantages. We believe that in the long run, automation is best used when basic planning information is largely a by-product of operational data systems, when policy choices are illuminated by operational data system information and decisions are translated into controls that can be employed in such systems, and when the same systems serve management information needs at all levels in an organization. In this perspective, ADP becomes an extension of both operational and top-level management.

ADP as an Extension of Management

Data processing can assist unit managers in their unique tasks and also can aggregate information to meet various anticipated as well as unexpected needs for management information. In its highest and best use, ADP will support three kinds of activities:

- basic transaction processing and control, through operational data systems, to meet the specific needs of individual unit managers.
- comprehensive profile and exceptions reporting, to help program managers see the interrelationships, history, and status of data from a variety of related units, and to meet needs for external reporting requirements.
- projection information processing, to help planners evaluate likely futures and policy alternatives by applying forecasting, simulation, and other analytical tools to profile data derived from transactional processing systems.

These activities directly support the critical top-management functions of planning and control, and of course require significant top-level involvement. Systems can be developed that will also support day-to-day operational processes. But while good management information systems and good operational data processing systems are compatible, they never will be synonymous. No management information system will automatically evolve as a by-product of even a good data processing system. Both

require planning, both require organization, both require a high level of technical and administrative skills. And in postsecondary education, both require inordinate patience, political aptitude, and resources.

To recapitulate, ADP has at least four possible functions--as a service bureau, as a support to more efficient operations, as a support to a management information system, and as an extension of operational and top-level institutional management. Individually or in any combination, these services can be valuable. But the new demands for information today and the new capabilities of analytical and data processing technology make it both feasible and advisable to develop data processing systems that function as an extension of management.

Higher education is moving from an era of growth and production orientation to a more stable era of cost orientation. University administrators are under myriad pressures to elicit quantitative rationalizations of the process of higher education. Employment and salary patterns, unit costs, inflation impacts, energy use alternatives, minority goals and achievements, faculty work loads, and tenure attrition models are just a few of the "nontraditional" data items that administrators are supposed to have available and, furthermore, to use in day-to-day operations.

There is both need and a great opportunity for administrators in higher education to use administrative data processing as an extension of their management activities. Obviously, this takes considerable executive

involvement. In succeeding chapters, we consider why that involvement is necessary, identify the organizational areas that can be helped by that involvement, look at what some institutions are doing, examine the various roles that ADP should undertake, and consider how ADP performance should be measured.

CHAPTER TWO

AN ASSESSMENT OF THE EVOLUTION OF ADMINISTRATIVE COMPUTING

From Tab Shop to Computing Center

In most colleges and universities, the role of administrative computing has not been expressly planned or designed by top-level management. Rather its evolution has been shaped largely by technical advances in hardware, software, and application systems technology.

A number of colleges and universities began to automate clerical and bookkeeping functions in the late 1940s. In most instances, these early "tab shops" emerged in either the business office or the registrar's office. Current organizational relationships (such as the fact that the administrative data processing unit reports to the vice-president for financial affairs) and the degree to which various ADP applications are developed (such as more emphasis on the student data area than other applications) often can be traced to these historical roots.

The tab shops of the 1950s were equipped with mechanical card sorters, calculating card punches, reproducing punches, mechanical collators, and tabulators that added and subtracted and printed reports at some 150 lines per minute. By contrast, the computer center of the 1970s is an array of tape drives, disc storage units, high-speed printers, card readers, and video devices connected to a high-speed, large-memory computer housed in a room that rivals a hospital surgery room in cleanliness. Reports now are prepared at speeds of 2,000 or more lines per minute. The operations of an up-to-date computer center are characterized by

functional integration (sorting, collating, calculating, data retrieval, record creation, and reporting--all done on the same machine), huge files on-line, minimal operator intervention, and simultaneous local and remote service for multiple users. With this has come high monthly rental of equipment or large purchase prices, highly integrated application programs, and sophisticated operating system programs for scheduling the machine resources, storing and retrieving data, and communicating with remote users. The major trends in hardware are toward higher speeds, large memory or memory-like storage, larger on-line storage capabilities, and better devices and methods for storing and retrieving data. These trends promote consolidation and sharing of hardware costs. But at the same time, there is a lesser countertrend toward mini computers to automate one or more specific tasks.

Despite this blur of rapid changes in technology and increase in sophistication, one aspect of administrative computing has remained relatively constant. Executive-level administrators still are being called upon to make important decisions about the tools of automation, even though most executives have had no direct experience in using them. Their questions still go largely unanswered: How much should I expect to pay? What benefits should I expect from administrative computing? Where in the organization should this function be located?

While recognizing that expert judgement still provides the most reliable answers to such questions, NCHEMS conducted a small-scale survey in the hope of collecting some benchmark information that could be used for guidelines for making decisions concerning college and university administrative computing. The survey was designed to assess the state of the

art--what resources are involved in administrative computing, the proportions in which resources are distributed between hardware and manpower, and across application areas, the kinds of technology being employed, the organizational relationships between administrative computing and users/top-level administration, and the major problem areas associated with administrative computing. Some key results of this survey:[1]

1. Administrative computing accounts for about 1.9 percent of the total operating budgets of colleges and universities. (This figure is an average across a sample of 52 colleges and universities of all types that participated in the NCHEMS survey.)
2. Across all institutions, 34.5 percent of the resources for administrative computing are spent on hardware, 15.1 percent are spent on software, supplies, and such, and 50.4 percent are spent on personnel. Of the amount spent on personnel, management functions accounted for 19 percent, operations/production accounted for 45 percent, while development accounted for 36 percent (averages for all types of institutions: two-year/four-year, public/private). The maintenance tasks (such as updating software and redesigning to improve applications and meet new requirements) account for about 25 percent of the personnel effort in the typical administrative computing office.

[1]Details will be found in Richard L. Mann, Charles R. Thomas, and Robert A. Wallhaus, The Results of Surveys Concerning Administrative Computing and MIS in Colleges and Universities (Western Interstate Commission for Higher Education: Boulder, Colo., forthcoming).

3. Seventy-six percent of all applications in colleges and universities are operated in "batch mode." Private institutions reported that 26 percent of their applications were operated in an "on-line" mode; the average for public institutions in the sample was 15 percent. The punched card/tabulating approach is still being used: 20 percent of the institutions surveyed reported at least one application using a punched card tabulating system.

4. Eighty-one percent of the institutions surveyed used the computer center for both administrative and instruction/research purposes instead of maintaining a separate center for administrative computing. Among those institutions with a "combined shop," an average of 57 percent of the resources allocated to computing went for academic use and 43 percent went for administrative use.

5. Sixty percent of the institutions responding to the NCHEMS survey said that the administrative computing function reports to either the provost or the executive vice-president.

6. The survey also dealt with problems and concerns that could affect the operation of the administrative computing office. (opinions were solicited from the president, two vice-presidents, and the administrative computing manager). Two major problems were identified by all levels of management: (1) "key application areaas were not developed," and (2) "user involvement and capability in systems design" was inadequate.

7. The rate of growth of administrative computing, as measured by percent of dollar increases annually, averaged 33.4 percent between 1963 and 1968. Among public institutions, the rate was as high as 60 percent during the academic year 1966-67. Personnel growth, as measured by increases in FTE staff, generally lagged behind dollar growth. The annual FTE growth percentage averaged 37.4 percent between 1965 and 1970 in private institutions and 19.8 percent in public institutions.

From Computational Tasks to Applications

The number and scope of tasks subjected to automation technology have risen rapidly in the past twenty years. The registration and grade-recording assistance provided in the 1950s by the tabulating shop, using packets of punched cards, has in the 1970s evolved into elaborate student information systems. These systems provide on-line access to basic files, computational procedures and reports for admissions, registration, scheduling, course drops and adds, class rosters, classroom utilization, grades, transcripts, housing, student aid, enrollment forecasting, and such. Similarly, the payroll applications of the 1950s have grown into full-blown personnel systems with biographical, job description, activity, appointment, and budget data and reporting capabilities. More and more applications are seen as coming under the umbrella of the system and many potential users of automation are waiting their turn to have their applications automated.

The NCHEMS survey also attempted to assess the extent and scope of application development in colleges and universities. Nine broad application areas were identified and survey respondents were asked to estimate the percentage of computer resources devoted to each area. The average percentages across all institutions surveyed are as follows:

Application Area	% of Use
Student (admission, registration)	37
Facilities and equipment	3
Faculty/staff (payroll, personnel)	16
Financial	23
Administration in academic units	5
Alumni and development	8
Planning and institutional research	4
Physical plant operations	1.5
Logistical services (inventory/ purchasing)	2.5

The reported data clearly indicate that student and financial areas claim the lion's share of administrative computing resources. All institutions reported some applications developed in these two areas, while about 75 percent of the institutions are using administrative computing in such areas as alumni, development, planning and institutional research, or logistical services.

For the most part, computer-based administrative systems have been designed to replace clerical procedures. In most institutions, administrative systems were developed independently in each major application area with little attention to or planning for the interrelationships between application areas. At present, administrative computing at many institutions stands somewhere along the path of evolution from computational tasks to application areas. As we have pointed out, "key application areas not developed" was the major problem identified in the NCHEMS

survey by presidents and vice-presidents as well as administrative computer center managers. The problem of insufficient "user involvement and capabilities in systems design, data acquisition, etc." was a close second. More than two-thirds of the respondents listed both concerns as problem areas. Clearly, problems regarding what areas to automate, to what extent, and when, will be with us for some time. Again, executive-level administrators, most of whom have neither designed nor managed the design of a data processing system, are being called on to make the hard priority and people/software/hardware investment decisions required to solve the problems of underdeveloped applications and inadequate user involvement.

From Applications to Integrated Information Systems

To meet diverse operational needs, a good many institutions have developed a large number of separate systems. It is not unusual for an institution to support 15 to 30 different operational systems. Frequently each system has been designed to meet the particular needs of one user and generally the relationships among the various systems are not well defined. For example, the time period used for reporting fee payments and the definition of a full-time student for fee paying purposes used by a bursar may differ considerably from the time period used and the definition of full-time students for academic degree purposes used by the registrar. Both may produce reports concerning fees paid in a given semester by full-time and part-time students, and the two reports may contain greatly different data. To further complicate matters, since the 1960s institutions have been called upon to supply more and more

data to external agencies. Almost innumerable requirements have developed: detailed enrollment, salary, financial, staffing and space data, organized by uncommon "common groupings"; historical salary practices by sex, rank, and discipline; auditable records of cost allocations supporting research overhead claims; inventories of full-time and part-time scientists and technicians by area; and specific budgeting and reporting requirements for state, federal, and local appropriations and grants. Even those institutions that have managed to link applications into integrated data systems to achieve internal consistency and efficiency have nonetheless been unable to fulfill top-level management needs for integrated and projected information.

Still, many institutions have made significant progress in linking relatively independent applications. Most frequently, they have successively integrated existing applications. For example, this has been a typical pattern of development for a student information system:

1. Relate programs supporting student fee accounting to programs supporting registration and grade reporting.
2. Relate programs supporting admissions to those supporting registration so common data can be "passed through."
3. Relate fees collected for dormitories and other student services to fees collected for instruction so that more comprehensive bills can be prepared.
4. Automate transcripts of grades by providing history files.
5. Add automated student scheduling "between" the admissions and registration/grade reporting system with appropriate links to the fee assessment and payment process.
6. Develop a link to the alumni system so that student data can be passed through.

This approach had the merit that each step supported clear-cut objectives of specific users at some point in time and also correspond with the increased ability of computer hardware to deal efficiently with larger programs and larger files. However, the approach has been labeled "building bridges between sand bars" because the applications being linked might have:

- great variance in the quality of programs supporting the various applications.
- parochial definitions of terms and data.
- different built-in policy and procedural constraints about the gathering and use of data.
- different methods and rules for file updating.
- different requirements for modification and maintenance.

For these reasons, linking applications to make a system, a pragmatic approach in its original conception, has created a number of severe maintenance problems at the data-processing level. When a system embraces a large number of programs and inflexible procedures have been written into the basic logic of these programs, accounting for differences that existed between applications at a given point in time becomes a maintenance albatross.

Both data processors and users have been frustrated by the persistence of seemingly insurmountable problems hindering the adaptation of these systems to changes in requirements or to new technology. This has led to a sizeable interest in developing major systems, nearly from scratch.

Student systems and personnel systems have received the greatest attention to date because they represent the amalgamation of the greatest number of different suppliers and users of data. One of the most promising technical developments accelerating the use of data processing to support operational and management information systems has been the introduction of data-base management software programs. Various products of this type are available commercially, each with its particular benefits and drawbacks. In common, however, they:

- provide for the creation and maintenance of complex files in a very flexible way, allowing new elements or partial files to be added readily.
- require that a dictionary of common terms be developed for each data base and that dictionary terms be used in any application program that accesses the data base.
- provide for cross-relating different files in a way that is transparent to the programmer.
- provide for security protection of whole files, segments of files, or key data elements so that they can be accessed only by authorized users.
- support batch or on-line processing.
- support high-level reporting languages that can be used to meet unplanned requests.
- support the use of translation tables to convert data from an institutional format into externally required formats.

The implications of this technology are particularly significant to systems development and program maintenance. Although using a data-base language demands a most comprehensive approach to defining data needs, it becomes much easier for different users to supply available data to the system and draw data they need and are authorized to have. It also simplifies the design problem of adding new data elements to a file. All that is generally required is to supply a name to the dictionary, a relationship of the new element to other elements, and sufficient storage space to contain the data that will be supplied. Certainly, data-base management is not the only way to proceed. However, the concept of data-base management is important enough to merit the amount of management attention required to decide why it is not being used or thought not to be appropriate.

Toward A Computer-Based Management Information System

Costing procedures such as those developed by NCHEMS[3] require data that extend far beyond those maintained in a college or university accounting file. Institutional planning and budget requirements and the use of simulation models such as CAMPUS and RRPM 1.6 require information that cuts across student, personnel, accounting, and other such applications systems. In addition, federal, state, and other agencies are bombarding institutions in postsecondary education with requests for data at a rate that taxes the imagination, let alone the institutions' data systems. In institutional planning and management as well as federal and state reporting, trends suggest that even more information, of increasing complexity, will be required in the future. The rising interest in

[3]See James Topping, Cost Analysis Manual: Field Review Edition, Technical Report 45 (Western Interstate Commission for Higher Education: Boulder, Colo., 1974).

comparable cost information, the increasing adoption of program budgeting, and the greatly increased interest in nontraditional forms of and markets for postsecondary education certainly will increase the pressures for data.

Institutions have turned more and more to their data processing systems to meet the complex problems of translating data derived from relatively independent data systems so that the data meet the needs of top-level planners and managers as well as the requirements of external reporting. For the most part, this means that the need will increase for well-developed interrelationships between systems, and that it will be even more important in the future for an ADP unit to be able to adapt to changing needs. We may expect an increasing number of institutions to try to walk the path from more or less integrated systems toward management information systems.

But what is a computer-based management information system? One of the most frustrating aspects of administrative computing for many top-level administrators in colleges and universities is the often conflicting and always confusing jargon that surrounds the enterprise. For the purpose of the present analysis, we define a computer-based management information system (CBMIS) as one employed to store, manipulate, and retrieve data for use in management, planning, and resource allocation. The CBMIS differs from standard data processing applications (such as payroll or student records) in that it emphasizes the capability to rapidly integrate and display data from various sources, both current and historical, and to assist in planning, resource allocation, and general management

decisions. Technically, CBMIS is characterized by (1) an integrated data base, (2) commonly defined data elements, (3) a generalized information retrieval capability, and (4) the techni es required to assure the security and integrity of the data maintained in the data base.[4]

Aside from the difficulties of understanding the technical aspects of a CBMIS, top-level administrators are confronted with a bewildering set of decisions regarding the costs and benefits of CBMIS: What steps should be taken in moving toward a CBMIS? Who should be involved? What will be the costs? What will be the impacts on institutional planning and decision making? What will be the organizational ramifications? There are no easy answers, but benchmark data are available. These data derive from a large-scale survey conducted by Richard Mann[5] concerning the state of the art and the impacts of CBMIS in colleges and universities. Here's how a large sample, consisting of 442 colleges and universities, responded to some key questions about CBMIS:

1. Why are colleges and universities moving toward computer-based management information systems? In order of importance, the highest-ranked reasons are "to improve internal management," "to support other management tools (e.g., costing procedures, simulation models)," and "to meet state reporting requirements."

[4]Definition taken from Richard L. Mann, "A Study of the Development of Computer Based Management Information Systems in Institutions of Higher Education" (unpublished Ph.D. dissertation University of Illinois, 1974), p. 25.

[5]Summaries of the results of this survey are included in the forthcoming Mann, Thomas, and Wallhaus report previously cited.

2. To what extent are colleges and universities developing computer-based management information systems? Sixty-nine percent of the institutions responding are "planning or implementing a CBMIS," 40 percent reported that their CBMIS is in partial operation, and 28 percent indicated that they were in the planning stage. But less than 1 percent of the schools stated that they had a fully operational CBMIS. Large institutions, multicampus institutions, and institutions with graduate programs indicated the greatest percentage of CBMIS involvement. On the other hand, the survey results suggest that less complex institutions have made more progress toward actual implementation, even though many of these schools began their CBMIS development at a later date. In any case, it is clear that a major effort to develop CBMIS is under way in colleges and universities throughout the United States and that most CBMIS efforts have been launched within the past three years.

3. To what extent are various types of information included in computer-based management information systems? Student information has been included most frequently, followed in order by financial, staff, and facilities information. Private institutions have progressed somewhat further than public institutions in incorporating financial information and student information into the CBMIS. However, public institutions have emphasized facilities data to a greater extent than have private institutions. In general, private institutions appear to be slightly ahead of public institutions in CBMIS development.

4. What components of a computer-based management information system are being used and to what extent? As we have already noted, four major components appear to characterize most CBMIS developments in academic institutions: integrated data bases, commonly defined data elements, generalized information retrieval systems, and techniques to insure data security. Key features of component use:

- Virtually all institutions working toward the implementation of a CBMIS use at least some commonly defined data elements. Interestingly, institutions in the 3,000-6,000 enrollment range provided the greatest frequency of reports that all data elements had been commonly defined. This probably is due either to the ease of achieving commonality in a small institution or to relatively recent establishment of administrative computing, which allowed the institution to start with commonly defined data elements.

  While nearly all institutions were planning a generalized information retrieval system, a significant number had not yet implemented one. Large institutions reported with significantly greater frequency that their systems already were in use, and that their information retrieval systems supported both on-line and batch requests and also scheduled as well as "unanticipated" reports.

- Almost all institutions had policies and procedures to ensure data security, and the majority of schools indicated that software security features were part of their CBMIS.

To sum up, the most critical components of a CBMIS are an integrated data base and commonly defined data elements. More than 95 percent of the institutions working toward CBMIS implementation are including both of these components. About half of the responding institutions reported that all four components are included in their CBMIS.

5. Who is responsible for the computer-based management information system development project? The administrator most frequently mentioned as having overall responsibility for CBMIS development is the director of data processing. Next are the director of institutional research/planning and then the vice-president or director of finance or business affairs. Forty percent of the responding institutions said that the chief administrator responsible for CBMIS reports to the chief financial, business, or planning officer. With respect to top-level administrative support, the vice-president for administration, planning, or finance is cited most frequently as the primary initiator of the CBMIS project. The president, however, is cited most frequently as the highest-level administrator to support the CBMIS project.

6. To what extent do institutional constituencies contribute to the development of computer-based management information systems and to what extent are they served by computer-based

management information systems? While the responsiblity for CBMIS development at most institutions lies heavily on the data processing staff, contributions are made not only by the administrative support officers who traditionally have been influential, such as registrars and business managers, but also by presidents, vice-presidents, and their staffs. Similarly, the administrative support offices make most use of the CBMIS, followed closely by top-level administration. Faculty, students, and academic administrators rank very low or not at all among the important contributors to our users of CBMIS. So in academic institutions, CBMIS appears typically to be a system both designed for and supported by support and top-level management, for their use exclusively.

7. To what extent are institutions providing additional funds for computer-based management information systems development? Slightly more than half of the responding institutions indicated that no new funds are being allocated for CBMIS. Apparently CBMIS is being evolved in these institutions by reworking and reconceptualizing existing administrative applications over a period of years.

8. What factors influence the time frames involved in computer-based management information systems development? Survey responses indicate that the longer an institution has been using a computer for administrative purposes, the more likely that school is to be planning or operating a CBMIS. Dr. Mann also observed that for each information area, such as student

information, the greater the extent of computer use devoted to an area before CBMIS, the more advanced it appears to be in terms of CBMIS.

On the other hand, past computerization of administrative information areas appears in some instances to have impeded CBMIS development. It frequently has happened that larger institutions and those with a lengthy administrative data processing history have gained an advantage from computerized administrative information for operational and control purposes, but have then lost that advantage because these administrative applications were developed on an unrelated piecemeal basis, using an earlier computer technology. Thus many institutions find themselves being forced, at great expense in time and money, to redesign and reprogram existing application systems to support CBMIS.

Another factor that emerged as important in CBMIS evolutions was the medium (such as punch cards, magnetic tape, direct access devices, teleprocessing) primarily used in the computer processing of each information area. In general, the more advanced the medium being used, the greater the likelihood that the information area is included in the CBMIS plans or implementation.

Organizational Impacts

One major difference between postsecondary education and other enterprises is that postsecondary education typically has diffuse organizational hierarchies. In corporations, organizational hierarchies normally follow functional lines (for example, marketing, production, personnel, finance) or product lines. Postsecondary education institutions usually take a task organization approach, with some integration of tasks. For example, personnel tasks seldom are organized functionally. Instead there is likely to be a payroll office, a nonacademic personnel office, a student employment office, an affirmative action or equal opportunity office, an institutional research office producing personnel and faculty activity statistics, a budget office controlling personnel appointments, and so on.

Frequently these offices will report to as many as five different executive administrators (such as president, academic vice-president, vice-president for planning, vice-president for finance, vice-president for student affairs). In the student area, it is not unusual to find separate offices, reporting to a variety of vice-presidents, charged with the task of admissions, registration, scheduling, fee payments, grades and transcripts, student financial aid, student housing, student health services, student aid, organized student sports, and student activities.

In a diffuse, task-oriented organization, the decisions about what units should participate in the development of administrative systems and whose definitions should prevail are often not made because there appears

to be no administrator authorized to make them. Such situations result in considerable redundancy of effort and an absence of data coordination required for management information. For these reasons, the primary requirement for a successful management information system in postsecondary education is support, understanding, and involvement of the chief administrative officers. The results of both the NCHEMS survey and the survey conducted by Dr. Mann indicate that the degree of involvement of top-level administrators in the development and use of computer-based administrative systems is indeed increasing. In many cases, however, this involvement appears to be rather passive: the support is overt, but it stops short of making the administrative computing function the desirable "extension of top-level management."

The Mann survey included the question: "What is the impact of CBMIS upon the organization and decision-making practices of colleges and universities?" Over half the respondents felt that the use of CBMIS tends to be accompanied by some increase in the centralization of administrative decision making. It appears that the introduction of CBMIS has had little effect on the number of levels in the administrative hierarchy, but is related to increases in the size of data processing and institutional research/planning staffs. CBMIS seems to have little effect on the staffing of administrative support offices (such as business office, registrar's office), but the survey shows that the number of administrators with quantitative or computer backgrounds is on the increase. Finally, the reported lack of involvement of faculty

and academic administration in the development and use of CBMIS would seem to erode their position in the overall institutional decision-making process.

We cannot confidently predict the directions that change will take in the governance and organizational structures of colleges and universities, or how these changes may be related to future trends in administrative computing. It is clear, however, that the potential for change is present. Our assessment of the evolution of administrative computing in postsecondary education shows that we can expect further substantial efforts to address the enlarging needs of executive administrators. We must expect also that, in their turn, these efforts will impact with increasing force on administrative areas of high-priority concern. Since changes in administrative computing inevitably have radiating effects in the institution, it is incumbent on top-level administration to influence these changes in positive ways.

CHAPTER THREE

A CASE FOR TOP-LEVEL INVOLVEMENT

The Environment

Independently of what each of us might desire, higher education is changing from a growth-oriented or, to use the economist's term, a production-oriented activity to a stable or cost-oriented activity. This is a common line of development in other sectors of the economy and there is little reason to think that higher education might avoid it. We know also from experience that shifting to a cost orientation precipitates the development of more systematic analysis, the formulation of long-range plans, and increased demands for information. There is much evidence that these reactions already are beginning.

First, there is a very significant trend, at both the federal and state levels, to increase the "consumerism" aspect of higher education by channeling more funds through the hands of students instead of directly to institutions. The trend results partially because funding agencies want to force what they consider to be needed changes in higher education by creating a buyer's market. Whether or not one fully accepts this philosophy, the demand in the public sector for data will continually increase. There will be a concomitant increase in the need to describe the outputs of the academic programs, research, and service activities carried out in the higher education community. Such descriptions will require more and more analytical capacity.

Second, there is a trend in higher education toward increased accountability--to all levels of government and to an ever-expanding

constituency. There is a corresponding increase in requirements to demonstrate efficiency in the use of resources and in the need to close the credibility gaps perceived by the various groups to whom higher education must be accountable. Accountability takes many forms. One is the increasing use of the review process by state coordinating boards, budgeting agencies, and legislatures. If implemented, the proposed federal budget reform act will provide more analysts to help the Congress with details of the budget. We may expect the legislative and executive branches of government to keep moving in this direction. With respect to higher education, many states are stiffening requirements for state involvement in purchasing, data processing, accounting, and so forth. One can argue that this is philosophically wrong and counterproductive, that it simply will increase the credibility problem and consume resources.

Nonetheless, the various sectors of higher education do not seem able to maintain and coordinate their activities among themselves. Without improved administration, we see no practical alternative to increased government control in these matters.[1] It is very clear, though, that

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[1]The Carnegie Commission on Higher Education has said:

> The governance of higher education in the United States is currently more subject to challenge than it has been in most earlier historical periods. It has been subject, particularly over the past decade, to a number of internal and external attacks and collisions. This development reflects the pressure of conflict and change now offsetting academic life, because both conflicts and changes make the processes of decision making more important to those who participate in, or are substantially affected by, higher education. Central issues have been raised. Basic principles are at stake.
>
> External authorities are exercising more and more authority over higher education, and institutional independence has been declining. The greatest shift of power in recent years has taken place not inside the campus, but in the transfer of authority from the campus to outside agencies.

Carnegie Commission on Higher Education, Governance of Higher Education: Six Priority Problems (New York: McGraw-Hill, 1973), p.1.

these complicated review, accountability, and governance processes will require data and thus will contribute to the general need for systematic procedures to collect and analyze data.

Third, it is obvious that higher education is now faced with and will continue to confront a situation generally described as one of constrained resources. Inflation, the increase in numbers of institutions and participants, the declining rate of increase in enrollments or in some cases the absoulute decline--all this combines with the large fixed-cost and labor-intensive characteristics of higher education to produce an environment in which new funds cannot keep up with built-in cost demands. New programs, and in many cases the maintenance of quality in existing programs, will require funding of larger orders of magnitude than in the past. The internal governance and decision processes of higher education will not function properly in the long run without systematic review and visible analysis. This is particularly true when outside agencies are demanding such reviews, and in some cases are impacting the planning and governance aspects with little consultation with the affected university community.

Finally, the combined effect of these outside forces and situations is creating the need for internal changes in organization patterns and decision-making processes. This perhaps has become the most pressing issue because it has been so long avoided. Presidents must now concern themselves with issues that for a long time were addressed in various procedural offices of the administration. Vice-presidents, deans, and faculty have only recently become concerned with labor unions, the price

of oil, and environmental protection agencies. Organizational effects, caused mainly by the new need for different kinds of information and new technology, are being felt most sharply at the level of major functional areas and in middle-level operational departments. This brings about the need for executive management involvement in the information systems business.

We should now consider a concrete definition of involvement, particularly to distinguish it from support. Many senior administrators do in fact support the new needs for planning and analysis and many have provided resources, not just lip service. There remains, however, a vast difference between support and involvement, as responses to the NCHEMS survey on administrative computing and MIS (see Chapter Two) illustrate by clear implication. Seventy percent of the survey respondents reported that they had no problem with management support, and 69 percent said they had no organizational problems. But the two greatest concerns, as we have seen, were a lack of development in key application areas and a lack of user involvement.

Why this apparent paradox? Although management supports the concept of administrative computing and many people desire service, the essential catalyst obviously is missing. It must be that senior management is not providing leadership for the development of the system and its integration, as it develops, into the decision-making process. Despite its supportive attitude, management remains basically uninvolved until it takes initiative in the development effort.

The Impact on Involvement

In Chapter One, four possible roles for ADP were discussed, although the four categories are somewhat arbitrary and more realistically should be viewed as a continuum. The continuum represents the various possible degrees of top-level management involvement in decisions on planning and control of ADP development and use. The thesis of this chapter is that a specific level of executive involvement should be decided upon, and that the most appropriate choice in the 1970s is that represented by the fourth category, in which ADP serves as "an extension of management."

Before we explore the rationales for this position, it is necessary to pay some attention to the semantic red flag already raised--management. This word has only recently gained acceptance in higher education, and administration remains the preferred term. The subtle semantic difference perceived between the terms suggests that higher education "administrators" are significantly different from their commercial counterparts. They are indeed, and the management information and administrative data processing systems in higher education highlight this difference. The management functions of planning, control, and operations are widely dispersed in higher education. Individual faculty and students, academic department chairmen and administrative unit managers, deans, and central administrators all play roles in the management process. Each has his own perception of the needs for information. For the most part, management information system activities in higher education have focused on the needs of central academic and administrative offices. From the standpoint of planning information, the president, academic, administrative, and support vice-presidents, deans and administrative division heads,

and chairmen and heads of departments are the relevant managers. They should expect coherent profile and projection data about:

- students and other sponsors or users.
- personnel, facilities, equipment, supplies, travel, student aid, and other resources used.
- courses, research projects, continuing education, and other public service projects that require resources supplied by sponsors or users to meet the institutional objectives.

Someone must be responsible for the processes by which planning, resource allocation, evaluation, and control take place. These processes, however, are not wholly independent of the involvement of various groups in the substance of decisions, and are not fully separable from governance at all levels. In this chapter, we are concerned with a very restricted subset of the constituent involvement process. Fully aware that many other considerations bear on the substance of the decision-making process, we deal here only with the case for involving top-level management in the affairs of administrative computing. Two propositions are fundamental to this position:

- It is necessary to have a systematic planning and evaluating process.
- Therefore it is necessary to have a large amount of consistent, reliable, and timely data available in a variety of forms for use in the deliberative process.

In making these presumptions, we penetrate to the heart of the debate between those who advocate systematic planning and evaluation and those who feel that such procedures are not only difficult to establish in higher education, but also contrary to the best interests of the institutions. Those opposed to our position are concerned about the effects that management systems may have on quality differentials, research, the interaction between instruction and research, and service. They are concerned, too, about the impact of such systems on autonomy and the roles of faculty and students, and on the governance processes within the institution. In a larger sense, they are worried about the potentially homogenizing influence of management systems on higher education. These are perfectly understandable fears. There can be very little doubt that in their present stage of development, the management tools, as they are called, emerging in higher education embody relatively simplistic views of a complex process--views that do not recognize these concerns in any meaningful way.

Nevertheless, the forces that have brought management tools to the forefront will not diminish. Higher education has grown until it consumes a substantial portion of the gross national product, and most people are not totally satisfied with the output. And it continues to seek substantial new resources, despite a general reduction in the availability of new revenues and despite a growing public skepticism about the need for increased expenditures on higher education.

We are not merely stating an opinion. Well-known commissions, legislative committees, and agencies are reporting on these issues. They are making recommendations about standard cost data, standard program classification structures, and standard financing arrangements. These kinds of recommendations inevitably will find their way into legislation and into the financing and evaluation processes at the federal, state, and local levels, regardless of what "higher education" does. The question is not whether or when it will be done, but rather by whom and in what precise form. The so-called information explosion is here, and the fuel that drives this process is data. The technology that consumes this fuel is progressing in enormous strides, and we see nothing on the horizon that leads us to expect that the trend will stop, let alone reverse.

We should now briefly assess the present state of higher education vis-a-vis the information explosion. By over-generalizing somewhat, one can analyze the situation in terms of inside processes and outside processes. Almost all institutions have an internal planning and evaluating process. In each institution, students are admitted and graduated, research continues to advance knowledge, resources are allocated and consumed, and programs are modified, expanded, or deleted. These activities take different forms and decision processes, appropriate (or inappropriate, as the case may be) to the individual institutions. These processes are not very well understood by the outside world, and in fact are hard to describe in general terms: their forms vary extensively from institution to institution and they do not rely upon standard information. But the outside world sees resources being allocated from public sources to a

multiplicity of institutions, many of which by their rationale are competing for the same scope and mission. Therefore the outside world is bent on obtaining comparable information from the institutions.

Many see this as a negative fixation. But it is not difficult to understand why it has come about, nor to realize that it will not disappear. Each college and university administrative structure finds itself supplying more and more data to the outside world, and this information is being used more and more to shape public policy. At the same time, the internal planning processes continue at work, in many cases quite independently from counterpart processes in the outside world and in many cases using different kinds of data in different ways. One can argue that this is not therefore a bad world--that the outside world cannot understand the subtleties and complexities of higher education, and that what may be an appropriate outside strategy for achieving necessary resources is not applicable to inside planning and decision making.

For a long time, this probably was the best view. Now, however, we contend that the internal planning mechanisms should reflect more awareness of the new outside planning mechanisms, and that top management should become involved in <u>administering</u> the creation of data systems. This involvement is needed to bring about a continuum of consistent and reliable data throughout all of higher education, and also to insure that the complex realities of institutional organization and operations are not lost sight of. Either technology will be managed or, like it or not, the technology will manage the institutions.

The need for more and better data and the need to control burgeoning technology combine to make the case for senior management to look at administrative data processing in a new light. Its role should be an extension of the management function so that:

- data processing systems can serve the institution at all levels, from department chairmen to the president and governing boards.
- the technology is not dominated by the technical staff of either the computer centers or the outside planning agencies.
- the cost-effective processing of data can be consistent, reliable, and fully serviceable.

This cannot happen without the involvement of senior management. Nor can it happen without removing the buffers that so often exist between internal planning processes and data needs on one hand and external planning processes and data needs on the other, however unpleasant this task may be for the institution.

With this objective in mind, it is appropriate to distinguish between tasks of data processing and the relation of these tasks to functions utilizing data. We are used to looking at ADP as a payroll processor instead of the assimilator and in many ways the creator of information. The information value in management processes can be categorized into three functions: controlling, planning, and evaluating (see Figure 1).

Controlling

Perhaps because the history of ADP stems from accounting and business office needs, or because a controlling function lends itself more readily to data processing capability, or perhaps for other reasons, the controlling function has received the most attention to date. We have developed computerized control systems that try to make sure we do not overspend an account, register too many students in a class, or run out of chalk. Within this scope, we have searched for more timely, more accurate, and less expensive ways to expand and enhance these systems. In many of our control systems, however, there is a lack of correspondence between what it is we control in these systems and what managers at various levels consider to be our control objectives. The consequence is a lack of correspondence between what we plan for and what we then measure.

This discrepancy deserves amplification because it is a direct result of the failure of management to become involved in the development of data systems. Historically, as we pointed out in Chapter One, the role of data processing was largely that of a service bureau, and the customers were payroll departments, registration and admissions departments, physical plant departments, and such. Not surprisingly, the outputs were mainly things like payroll checks, grade statements, and inventory control registers. No one in management suggested that they also would need such things as position control registers and reports on tenure and retirement status, achievement of program activities, and program costs. These needs have now come along as afterthoughts. But the

problems they pose for ADP are in large part avoidable. If management is involved, and if data needs are specified by the planning process and not dictated by the historical control processes, the situation can be quite different.

Planning

It is very difficult to exactly identify the strategic planners in higher education. Almost everyone--students, faculty, administrators, governing boards, legislators, governors--who influences or desires to influence the governance of an institution will have an impact on the planning process as well. But regardless of one's perspective or position in the organization, a constant cry is heard in higher education for more complex, more consistent, and more reliable data to support public policy analysis. And therefore, planning information must be considered an objective of data processing systems, regardless of which constituency ultimately uses it.

This objective is neither trivial nor profound. It surely is clear that most current data systems are oriented to process and control. It is equally clear that they need not remain so indefinitely. Many groups are working on classification schemes and on procedures for determining standard costs. In many ways, these new developments reflect an improving technology and data processing capacity. But often they do not reflect improved design for planning purposes. Designers should keep in mind these questions:

1. Does the institution have a specific information profile approved by the appropriate constituents? That is, has the institution decided what quantitative "things" it wants to record systematically in order to describe the institution for both inside and outside purposes?

2. Does it have a specific set of qualitative indices that are needed for planning?

3. Are there specific planning targets that can be described by items 1 and 2?

4. Have formal "planning centers" been described around which items 1, 2, and 3 can be organized?

If the answer to these questions is "not really," then of course it is not possible for the institution's data systems to achieve full potential. However, the development of positive answers is not as difficult as it might appear--if top-level involvement is achieved. The basic need is for management to acquire an interest in identifying and communicating its requirements to the developers of data systems and to take the time to do it on a continuing and consistent basis.

Evaluating

The same comments and arguments that apply to the function of planning also apply to evaluating. The list of guideline questions is substantially the same:

1. Have the quantitative measures been developed by the institution so as to specifically describe the achievement of the plans?

2. Have the qualitative aspects to enhance item 1 been sufficiently described so they may be used for this purpose?

3. Have formal evaluation processes been established by planning centers to use items 1 and 2?

4. Have resource allocation systems been developed that recognize the results of the evaluation process?

The answer to these questions is more generally a plain "no" than is the case for the questions on planning. If it is no, then again, quite obviously, the data systems cannot function to support or enhance the evaluation function. Management involvement must therefore be gained and even more interest and investment of time must be achieved to produce good results.

We have not in this chapter explored or sought to promote any particular process or system for control, planning, or evaluation. We have instead concentrated on three points: (1) the development and use of information systems in higher education cannot be avoided; (2) therefore, top-level managers should take seriously and get substantially involved in the development and planning of information systems; (3) executive involvement is indispensable if information systems are to be of any real use to the institution and if the problems associated with purely technocratic development are to be forestalled. We have thus made an essentially negative argument. We have not taken space to elaborate the very positive case that can be made for improving cost effectiveness in institutional administration or to dwell on the affirmative outlook for improving resource allocation through better planning and evaluation systems. We expect, however, that most of our readers are aware of at least some of the many persuasive reasons we have for believing that information systems must be properly developed and used if the quality and viability of higher education are to be preserved in coming years.

CHAPTER FOUR

THE ROLE OF PROFESSIONAL GROUPS

Top-level management, administrative computing users, data processing management, and state agencies all have roles to take if administrative data processing is to be effective in fulfilling its potential as a management support facility. In previous chapters, we discussed the possible roles for administrative data processing and expanded upon these roles as a continuum representing the degree of top-level management involvement in decision processes for planning and control. We developed the thesis that an explicit level of involvement should be chosen and that the most appropriate role for ADP today is as "an extension of the operational and top-level management of the institution." In this chapter, we discuss the roles of related professional groups when this optimum choice has been made.

The Role of Top-Level Management

Historically, top-level management has played a relatively passive role in decisions regarding administrative computing. Charles Mosmann says:

> At all but a few universities the top administrators, the president, provost and vice-presidents, have usually devoted little attention to computing affairs. Only in a crisis that threatens the well-being of the college have the president and his closest associates stepped in to restore order. At most institutions, most of the time, the administration has had little reason to take the matter any more seriously than this. Until recently, funded research projects have ordinarily paid the lion's share of the computing bill; the rest was justifiable as an administrative expense or as an experimental tool.

> The most the president could ask was that the political crises remain rare and require little of his attention and that the cost of keeping the computer not become too large a lump in the budget. In fact, if it could be hidden altogether, so much the better.[1]

But now few presidents can ignore the computer. The need for different kinds of information, generated by changes in governance and accountability in recent years at nearly all institutions, means that for better or worse, they either already are in the information systems business or soon will be. Top-level management in higher education needs this information in large part because it finds itself participating more directly in institutional planning, resource allocation, evaluation, and control. Management has recognized that many constituencies are affected by the deliberative process and has included them in deliberations. The fulfillment of these responsibilities requires systematic processes and timely, relevant data from administrative data processing. Unless top-level management stipulates clearly defined goals, objectives, and policies for administrative data processing, technocrats will dominate systems development. Systems will not be developed that serve the institution at all levels, from departments to trustees, and cost-effective processing of data will not be achieved.

Management should create an administrative structure to define objectives for administrative computing and evolve its goals and policies. The structure should make it possible for administrators to solve administrative problems and technicians to solve technical problems. To do less will

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[1] Academic Computers in Service: Effective Uses for Higher Education, (San Francisco: Jossey-Bass, 1973), pp. 56-57.

not build confidence that the administrative computing function is properly serving the institution. Crisis resolution should not be the order of the day, but rather the long-range analysis and control of the information systems that affect the institution as a whole.

Top management involved in establishing administrative computing goals and policies will understand the importance of placing administrative computing correctly in the organizational hierarchy to achieve the defined objectives. A major result of executive involvement is the recognition that diffused authority and responsibility for computing must be brought together so that decisions in the best interests of the total institution can be made.

A first step for top-level management is the selection and definition of an explicit role for administrative data processing. This creates mutual understanding between the data processing unit and management and spells out the scope of ADP activity. The role selected by management for the unit bears heavily on the degree to which management will be involved in the administration of its operation. Failures of the past have been blamed, at least in part, on a lack of management interest. If one assumes that "top management" means the president and those around him who formulate policies having a major impact on the operation of the institution, one accepts that these executives are involved in all the important processes of the institution. It follows that involvement in administrative data processing and information systems is directly related to the significance of the information systems and their priority in the overall operations and plans of the institution. High priority,

university-wide projects require continuous top-management involvement. When some or most high-priority projects involve the ADP unit, then management involvement with the unit should be very evident.

The Role of Users

In general, two management philosophies are followed in developing and implementing information systems. One is known as participative management, or the project team approach. The other is authoritarian management. The participative philosophy provides for full participation of top management and personnel from the departments affected by the system. The authoritarian approach allows only limited participation and relies mainly on simply telling heads of departments and supervisors what decisions have been made and how systems will be developed and implemented. We endorse participative management and stress that top management must set parameters within which information systems will be developed and implemented. Otherwise, system deficiencies will continue.

The participative management approach permits the ADP unit to be staffed primarily with personnel having systems and technical expertise. Systems and technical resource personnel are joined with operating department resource personnel to create project teams that design and implement particular information systems. Team members should be temporarily assigned to a project manager who provides their sole supervision for the duration of the project. If a computer-based student data system is to be developed, the project team might consist of personnel representing the office of admissions and records, the financial aid office, academic

departments, administrative data processing, and the college deans. Representatives of the user areas and a steering committee from top-level management can decide what is required of the system and what training mechanisms are necessary for successful implementation. The system specialists decide how the data should be gathered, design forms to present data required by the users, and prepare system controls that ensure the integrity of the data file system. The entire project team is then assembled for the period of time required to implement the system.

The managers of user departments have a special responsibility to participate in decisions related to data processing. They are naturally concerned about policy matters that guide the management of the ADP unit, since its operations generally have a significant impact on users. Questions of ADP resource allocation and long-range stability also should concern them. Perhaps the single most important responsibility of user management is to define systems requirements realistically. Participation in the implementation of data processing applications is so vital that without it, the application probably will be a failure. The definition of application requirements must be made with an understanding of computerized system capabilities and, of course, the user's own management and operating needs.

There is great interdependence between the administrative computing unit and those whom it serves. Users tend to bring into their organization computing personnel with whom they have had considerable interaction. The user should minimize this tendency so that a parochialism does not develop that weakens the ability of the institution to integrate applications or the ability of the administrative computing unit to act as an

agent of change. To minimize the tendency toward parochialism, a central data processing systems design group might rough out top-level management and operating user need for an application and approve the final detailed design. The final design itself could be the work of system analysts in the user department. These analysts, being most familiar with user needs, may be best able to produce the requisite system while the central design group analysts can ensure that the system will mesh with related systems.

User management should guard against changes in system requirements during the implementation stage because of the high cost. During the design phase, the cost of change is nominal, reflecting only the work necessary to change design specifications. (Similarly, changes in house plans during the design phase are relatively simple to make and inexpensive, but this is not the case after construction has begun.) During the system implementation phase, the cost of change may be fifty to one hundred times greater. Changes in computer programs may be far more complex than the original writing of the program because logic changes and the interrelationship of various computer programs are involved. Careful attention by the user to defining requirements will save money and avoid delays in the implementation program.

Internal and external concerns about the effectiveness of administrative computing must be taken into account when justifying administrative computing applications. User management shares the responsibility of justifying applications prior to implementation. They should not be implemented if there is no economic justification or if benefits do not outweigh costs.

User management responsible for important institutional operations such as student admissions or payroll rightfully expects accurate and timely information. But it is up to user management to take responsibility for data input and output controls and guard against errors. The data processing technician should help in establishing control procedures; however, user management must ensure that controls are enforced by user operating staff.

Thorough testing of a new system or program is essential to assure management that good information may be expected and to build confidence in the ability of the administrative computing organization. User management should avoid placing pressure that forces system development and implementation into a production mode. The user must participate in the testing of the system and in follow-up evaluation to assure that system objectives have been met.

Finally, user managers must be familiar with administrative computing capabilities. They are responsible for the initial training of their staffs in computer capabilities and follow-up education to keep pace with technology and equipment changes within one institution. The user often believes he cannot state his system or information requirements because he does not understand the technical problems of data processing. He should provide the analysis to define and support his requirements, rely on the data processor for technical solutions, and be in a position to verify that the system does, in fact, conform to his analysis of requirements.

The Role of Data Processing Management

The principal role of data processing management is to provide the managerial skills through which maximum benefits may be received from technical personnel and facilities in an environment in which their functions serve both as an extension of top-level management and to support operating user management. Data processing management must provide the systems development direction to assist operating managers to translate and interpret information for higher level management use. The ADP manager must have skills in planning and organization, technical and administrative expertise, and a very high aptitude for both interpersonal and man/machine relationships.

Data processing management must have the administrative skills to develop departmental goals that meet top-level management specifications. Most often goals are nonexistent; therefore it is not possible to communicate plans to management, there is no basis for management review, coordination and direction, and there are no means to monitor, control, and direct efforts.

Data processing management should develop a long-range planning program, extending three to five years. The data processing implementation process is a long-term one: equipment planning requires long lead times; human resources must be planned for the long term; and the training and upgrading cycle for personnel covers a long period.

The proper basis for planning, control, and management is an effective standards manual. Data processing management is responsible for developing

such a manual to ensure project control, to provide effective use of computing hardware, and to make equipment transitions smoothly.

Data processing management should see to it that top-level management receives a cost/benefit analysis for approval prior to the implementation of major data processing systems. The responsibility for making sure that applications are justified economically is shared with both top-level and user management.

Finally, data processing management is responsible for the day-to-day operation of an administrative system development and data processing production unit, including:

- technical analysis and design of administrative computing systems.
- computer programming and implementation and maintenance of systems.
- establishment and maintenance of production schedules.
- supervision and operation of administrative data processing facilities and resources.
- hardware evaluation, justification, and configuration recommendations to top-level management.
- software evaluation, justification to top-level management, and installation.
- technical staff education and training.
- administrative budget, personnel, and space administration.

The Role of Statewide Higher Education Agencies

The responsibilities of these agencies relating to information systems are shared by the institution. The institution is interested at a more

detailed level, but they both deal with problems of goal setting, long-range planning, establishment of operational objectives, resource allocation, and evaluation of results. Another feature that distinguishes institutions from statewide agencies is the executional phase of the management process. Statewide agencies, even those with governance responsibilities, essentially do not have operational responsibilities. In order to execute its responsibilities, the statewide agency must have information for two general purposes: (1) to assist in its own policy formulation and (2) to inform others--governors and legislators in particular.[2] Top-level management involvement can remove the buffers between internal planning processes and the needs for data, both internal and external, as we have discussed in Chapter Three. As an extension of institution management, ADP can provide the information desired by the state agencies.

Statewide agencies working with institutions should identify points of commonality existing in the various administrative computing systems. Following this identification, the agencies should encourage shared efforts among institutions. With a broader perspective of the use of data processing comes a much greater potential for shared efforts.

The formation of College and University Systems Exchange (CAUSE) as a nonprofit organization, supported by member institutions to promote the exchange of systems and the joint development of systems, is evidence

[2]Curry, Denis S., "Implementation of Planning and Management Systems in Statewide Higher Education Agencies," Paper, p. 6.

of the value of a broader perspective. Also, the efforts of college representatives on task forces of the National Center for Higher Education Management Systems in developing data element dictionaries of common terms for the student, personnel, course, facilities and financial areas have helped promote a more comprehensive approach. More recently, a few commercial entrants, particularly in the student area, have been willing to adapt their rather generalized system to the specific needs of individuals. Statewide agencies should exercise leadership in defining statewide information system requirements so they are compatible with institutional administrative computing systems.

Agencies in states that are active in the development of statewide plans for computer resources should be responsible for promoting compatibility in an evolutionary manner, so as to provide short-term cost saving while moving in a planned way toward long-range cost avoidance. If this comprehensive approach is taken, short-range methods can be applied with considerable assurance of success and, at the same time, recommendations proceeding from vague, unproven concepts that involve large capital investments and a high degree of uncertainty can be avoided. Aside from understanding the nature of administrative computing and recognizing the range of its activities, statewide planners should be able also to provide criteria against which alternatives can be evaluated. These are some:

- equal or better service to users.
- increased user productivity.
- increased availability and timeliness of data.

- increased ability to respond to change.
- manageability from the standpoint of cost and service.
- cost that is more effective than computing costs now incurred.

Statewide agencies should coordinate the development of administrative information systems that will take good advantage of the multiple uses that can be made of the same data for operational needs, institutional planning, and statewide planning. They also should establish uniform requirements for the type of information needed in statewide planning and coordination functions. A major responsibility of the agency should be to act as an effective interface between executive and legislative branches of government on one hand and institutions on the other. To effectively execute its responsibilities in these areas, the agency must of course rely on information from institutions. Information from institutions whose administrative data processing operates as an extension of management is more likely to serve statewide needs, since the principal difference in the needs of top-level management and the statewide agencies is at the level of detail.

CHAPTER FIVE

IMPLEMENTATION OF INVOLVEMENT

If the preceding chapters have convinced the reader that an active involvement by chief executives (and other appropriate constituents) in administrative computing is appropriate, the next question to answer is what specific activities or organizational changes are required to implement this approach. Over time, a number of suggestions have been advanced. These are typical:

- create a new vice-presidency for....
- identify a computer czar to organize the technology.
- create a new office for planning/analysis/budgeting, reporting to the president or the provost.
- set up an internal task force to make recommendations.
- select a consulting firm to make recommendations.
- develop a plan and commit resources within the existing administrative data processing environment.
- where they are combined, separate administrative data processing from instructional computing.
- consolidate administrative data processing and instructional computing if the two are separate.
- implement any combination of the above.

Any of those actions may be appropriate, depending on the characteristics of individual institutions. But none of them speaks to fundamental

concerns. What is really needed is a much more basic change in the very way the administrative processes and functions of an institution are perceived. The following suggestions point to both underlying principles and possible methods for achieving change. This list is not exhaustive and is clearly not arranged according to priorities of concerns--though it is likely that attitudinal changes will precede successful organizational changes.

1. Recognize the distinction between the substance of the decision process and the logistics and technology of planning/analysis budgeting control systems.

Perhaps the single most confusing aspect of information systems is the problem of distinguishing support systems from the decision process. A great deal of understandable concern is expressed in many sectors of higher education about the possibilities of inappropriate decisions coming out of a misuse of data or machines by people not sensitive to academic needs. Such concerns fuel a seemingly endless debate about who should be responsible for developing systems, and how to ensure against such systems operating with negative result. The debate inevitably results in a failure to assign responsibility and therefore creates an impasse.

This need not happen if a clear distinction is made between the responsibility for the logistics of a complicated information system and the final responsibility for the decisions about the alternatives. To

present a familiar example: there is a plain distinction between a comparative analysis of faculty compensation at various peer institutions and a decision affecting resource allocation for compensation within one institution. The same distinction exists between an analysis of the "success" of graduates of an institution and a decision affecting curriculum changes. In a more complicated but essentially similar way, the same kind of distinction should exist between the many outputs of a sophisticated planning/analysis/control system and the allocation decisions required to energize the "plan" itself.

In any given institution, there are a variety of ways to ensure such a distinction. However, specifying the procedure is not nearly as important as articulating principles before starting the process.

2. Recognize the need to reorganize administrative structures on a function-oriented rather than a process-oriented basis.

The administrative side of most universities is presently characterized by a series of departments that are largely process-oriented, and are designated by such names as Payroll, Bursar, Purchasing, Accounting, Admissions, Registration, and such. Over the years, each developed with the initially useful objective of processing "things" more expeditiously, largely because there was a growing number of things to process. Institutional needs were best served by this concentration during the time when production or output objectives were paramount. During the growth decades, the major concern was to meet the increasing demands for more programs,

buildings, and services that were posed by rapidly increasing enrollments. A corresponding increase in information about the cost, number, complexity, redundancy, and relevancy of these programs and services was not so critical, since revenues were expanding along with enrollments. The situation now, of course, is reversed, and the need for cost data most pressing.

An analogous situation exists with respect to academic programs, although the solution is not so simple. Academic departments combine function--the French department "produces" B.A.'s, M.A.'s, and Ph.D.'s in French--and process--students majoring in other disciplines may use the "services" of the French department in satisfying language requirements. This overlap of process and function causes unending confusion when one tries to unscramble the cells and isolate the cost of a program or function. Regardless of the merits of such attempts, we see a similar confusion developing: the process-oriented organization of administrative departments frustrates the development of comprehensive information systems, which must cut across the lines of responsibility of individual departments in the attempt to relate activities of each department to all others as ongoing functions rather than concentrating only on outputs.

A successful approach to the problem will require both a will to bring about fundamental changes in structure and a mechanism for doing it. If, for example, a financial data system is to be developed, one must accomplish an ordering and integration along one functional dimension that cuts across many processes, such as payroll, purchasing, accounting, contract administration, personnel benefits, patient accounting, auxiliary

enterprises, investments, bursar, operations, and student accounts receivable. Attempts to do this have revealed that these semi-autonomous, process-oriented departments do not see any benefit from but perceive many detriments in such integration. A successful program will therefore require a strategic approach to potential opposition.

3. Implement a formal long-range planning process that utilizes the information systems and relies upon the budgetary and allocation systems.

An effort that does not take into account the real environment in which objectives are determined and resources allocated is bound to fail and waste resources. The operational managers--chairmen, department heads, deans, directors, vice-presidents--have great insight into the ways in which things are accomplished. They can predict with incredible accuracy the way interpersonal relations will function to create decisions--overt or implied. As long as the operational managers skilled in the established process (the interpersonal negotiating, the intuitive decisions) do not insist upon the actual use of the developing planning processes, the entire development effort is doomed to be an exercise in futility.

But now we have the dilemma of the chicken and the egg. Which does come first: developing a comprehensive information planning system with demonstrable benefits and then institutionalizing it, or rigidly enforcing a complicated, detailed planning system before the support mechanisms are ready? Each is equally unfortunate. In the first case, the planning system will never be developed because until it is used, it cannot prove

itself better than the unsystematized process it seeks to replace. In the latter case, the expense, frustration, and anger resulting from forcing time-consuming and tedious manual efforts (which are usually obsolete before completed) upon the participants will assure abandonment of the process in short order.

Therefore the only solution, as usual, is a compromise, and one that must actively involve senior administration. The established decision process must be married to the developing process so that enough dependence is placed on systematic activities to make the effort worthwhile, but not more than the system can sustain. This means that at each point along the way, the level of decision making must be matched to the sophistication of the process at that juncture, maintaining a symbiotic relationship. This takes the skill and judgment of top-level managers. It simply cannot occur in a purely technological environment.

4. Recognize realistically the costs, the benefits, and the time needed for development.

For a number of reasons, this has been for some time one of the more visible and controversial aspects of data processing and information systems development. A major cause of difficulty is confusion about the four possible roles that administrative data processing can play. In the case of the role we recommend, an extension of management, it must be accepted that costs will be large, the time frame long, and the benefits difficult to demonstrate to internal participants in the short

run. There are discernible reasons for this. First, in the initial years of development, much of the effort (and related consumption of resources) will be redundant. Further, it must be recognized that if the three concerns previously discussed are not addressed in some meaningful way, the costs may be redundant. Much of the effort to develop system-oriented planning processes to date is in fact characterized by the retention of the process-oriented activities and departments, to which is added an "overstructure" of functional information processing that is not fundamental to the decision process. This creates a condition similar to that at the private club where it was said that "the food is bad, but the prices are high--which is fine because the service is poor!"

However, if our arguments in the preceding chapters are valid, the long run can bring positive cost/benefit results. The obvious concern is: when? There are no standard time frames or budget projections that are valid across all institutions. It is, however, fundamentally important that projections be realistic from the outset and that the pitfalls discussed in this chapter be avoided. Far too often, the benefits are oversold in order to achieve momentum and a commitment of resources. This almost always results in disenchantment and an abortive effort--which again points to the need for top-level support and direct involvement, and also to the need for understanding the nature of information systems. One does not build a quality academic program in one, two, or three years, and one cannot build a quality support organization overnight either. There are many factors to consider, such as personalities,

retirements, learning curves, attitudes, and apprehensions. Perhaps the most foolish belief is that an effort to develop a system-oriented planning process will bring about a rapid and demonstrable improvement in fundamental decision making. But surely the next most foolish belief is that such improvements can be gained by doing nothing.

5. Create wide-scale involvement at all levels and in all relevant departments.

Almost every department, division, and unit in a large or a small college or university has an interest (whether or not it is directly involved) in the support systems of the institution. A classic reason for failure of systems development in the management area is lack of awareness of this intrinsic interest and its contribution to one of the unique qualities of universities, the traditional dedication and sense of mission of people in the support departments. Literally for decades, many support departments have functioned because of the incredible perseverance of underpaid and undersupported clerical staffs. They somehow make it successfully through registration after registration--because they perceive the basic dependence of the institution on their work and have a personal identification with the institution as a whole. In this atmosphere, it is not difficult to understand why the new systems analyst from the computer center meets with some resentment, or why "snappy" new systems emanating from the center do not work. The old, old saying is all too true: No system will function, regardless of its merits, if those responsible for running it do not want it to function.

Many approaches have been tried. New people have been tacked on in various places. There are the classic cases of new and old systems functioning in parallel endlessly. There are, however, some possible improvements on this situation related to the issue of top-management involvement as well as to all of the points above. Variations on the theme that seem to work usually involve finding a way to force a marriage of the concerns of users, data processors, departments, different campuses (depending on the complexity of the institution) and management. This is almost always tedious, takes more time initially, and creates endless squabbles. But it can be surprisingly useful, usually to the extent that management (wherever it may be) consistently demonstrates that (1) changes are required, (2) support will be forthcoming, and (3) changes in personnel and/or organization will be accomplished as needed. Old-fashioned by comparison with the new systems technology it is trying to implement, this carrot-and-stick process still seems to work. Whispering wishfully in the ears of recalcitrants usually does not. The way to proceed is slowly, deliberately, at a measured pace, and only occasionally forcefully.

It seems best to achieve a multiple-department focus involving as the organizing nucleus a person or an office, such as Administrative Data Processing or Bursar, that does not appear to have a purely technological or administrative label. It also is useful to involve, where possible, an outside group--not as the developers, but as reviewers and commentators providing a different perspective. The involvement of the academic administration in the specification process also is vitally important. For a helpful conceptual frame of reference for such development, consider

that employed for construction of a new facility. The phases of preliminary design, conceptual planning, schematics, working drawings and construction, with the same formal involvement of the professional people and teams from various offices and departments, are very appropriate.

6. Create an environment for administrative units that promotes mutual interdependence rather than self-sufficiency.

The historical development of the process-oriented departments created a situation wherein each unit could best fulfill its objectives by self-reliance. Since the availability of technology that might have promoted standardization was limited at best, each unit developed unique forms, definitions, filing systems, procedures, and reports to exactly suit its needs. Improved technological support through implementation of data processing was viewed as similar to support from a print shop. Now, as we move toward a comprehensive information system and attempt to eliminate (not create) redundancy, a whole new philosophy of mutual interdependence (not self-sufficiency) is both desirable and necessary. Theoretically, each department will be responsible for maintaining only a portion of the data in a data base. Each must be able to use data entered and maintained by someone else. This concept, which to the trained analyst may seem trivial, fundamentally concerns users (as we have previously defined them). This concept is not only antithetical to previous dogma, but actually alters the traditional reward systems. In this new environment, a unit manager cannot operate independently of other managers, or the data base administrator, or the computer center.

Once again we have a clear loop back to management, and to virtually all of the organizational units that will be affected by administrative computing. In some ways, developing an information system is like trying to build a football team with a group of track and field competitors, each conditioned to take independent directions and seek individual rewards. Just as a systems-oriented decision process must by stages supplant the established "real" decision process, it must alter the traditional "real" reward process. The creation of a functional, mutually dependent organization must be a specified objective from the outset, or it will never come into existence.

Beyond those we have discussed, there are of course a number of ways to accomplish top-level management involvement in the development of systems-oriented administrative data processing. We have not addressed all the concerns posed by various constituent groups--for example, the constraints enforced and requirements made by outside agencies. At each institution, unique structures, approaches, time frames, budget frames, and procedural strategies will be needed. These differences notwithstanding, we hope that in this book we have delineated the basic principles and procedures that generally are valid in the development of information systems serving the needs of managers and decision makers in institutions of higher education.

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