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ABSTRACT

A survey was conducted to identify the patterns of academic and administrative computer services in use--or planned for the near future--in small colleges and universities as they relate to such strategic policy areas as: (1) management/governance structure; (2) personnel-staff; (3) personnel-faculty; (4) academic computing; (5) library services; (6) networking; (7) word/text processing; (8) financing; (9) computer hardware; (10) communications; (11) administrative computing; and (12) computer security. Questionnaires were sent to 271 small colleges and universities (i.e., enrollment under 5,000 students); the net usable responses totaled 103, or 38% of the institutions surveyed. Responses indicated that the majority of colleges and universities (52%) had one officer responsible for directing both academic and administrative computing; full time faculty were responsible for most computer instruction (83%); 60% reported that professional computer center staff did not serve as teaching faculty; 47% said computing was mentioned in their master plan and 48% said it was not; 73% indicated they had access to national or regional computer networks for library and other uses; 38% indicated their central computer budget had lagged; and the prevailing source for academic computing was on-campus minicomputers in 42% of the responding institutions, followed by microcomputers (27%), and the campus mainframe (26%). It is recommended that a similar study be conducted which would focus on larger institutions. A 13-page bibliography, a list of survey respondents, and a copy of the questionnaire are provided. (JB)

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About the Author

Patrick J. Coughlin has been Vice President for Finance and Management for the State University of New York at Purchase since 1979. His responsibilities include business affairs, personnel and employee relations, public safety, facilities maintenance, and academic and administrative computer services. Dr. Coughlin holds a B.A. in economics from Providence College, and master and doctoral degrees in management from Pace University. He is also a graduate of Harvard University's Institute for Educational Management, and the Business Management Institute held at Stanford University. Dr. Coughlin has been an active participant in EACUBO and other higher education organizations. He is a member of the State University of New York's Administrative Systems Advisory Council. His other writings include articles and papers on management and organization development, and financial planning in colleges and universities.

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Table of Contents

INTRODUCTION

For the remainder of the 1980s and beyond, colleges and universities in the United States face what may be the most serious challenges in their histories. This era is one in which the number of students in the traditional college-going population will decrease significantly, when competition for students will become increasingly fierce, when sources of federal and state funding will diminish, when student demands for new educational services, particularly those related to computers and information processing, will grow continually, and when demands for more and better management information will increase far beyond capabilities. Large, stable institutions will be able to meet these challenges more easily than small universities and colleges which lack vast resources, large faculties and support staffs, and in-house technological expertise. In order to survive, many small institutions must develop strategies and strategic plans to guide their decision making and operations. One of the most challenging tasks they face is developing such strategies for academic and administrative computing.

This task took on personal significance for the author when he was unexpectedly handed the sole responsibility for developing a strategic plan for computing. Early in August of 1982, the director of his college's small computer center died suddenly while on vacation. At that time, the second-in-command position happened to be vacant, there was great pressure for improved quantity and quality in both administrative and academic computing, and the college's president had publicly promised that services would be improved. The author, whose position of Vice President for Finance and Management included overseeing academic and administrative computing, but who (at that time) lacked a good understanding of computers, was forced to become the college's "expert" overnight and develop a strategic plan which would address such issues as:

- overall management structure of the computer center;
- hardware options;
- new administrative systems development decisions;
- the role of microcomputers;
- difficulty in hiring and retaining professional and technical employees;
- office space needs; and
- problems of telecommunications with the college's host, off-campus mainframe computer.

Through a process of seeking information from many informed professionals in the college's public university system (the State University of New York) and from others, within six months the author prepared a strategic plan for the next three to five years which was approved by the college president, the other senior officers of the college administration, a campus-wide computer task force, and the university system's central administration.

The preparation of the strategic plan was difficult in no small part due to the relative ignorance of the author. The process would have been easier if there had been available some strategic models for the academic and administrative computing used in other small universities and colleges. Small institutions which must face similar important computer decisions without participation in a university system such as that which helped this author are even more handicapped.

CAUSE is publishing this monograph to help fill that information gap, by making generally accessible the experiences of small institutions which have gone through the processes of planning and implementing administrative and academic computer systems.[1]

After an intensive search of published material on higher education computing, and with the help of comments from experts in the field and his own experiences, the author developed a questionnaire to elicit information about the twelve elements which research indicated are essential considerations in any computer planning process, whether academic or administrative. The survey generated usable responses from 103 small universities and colleges. Results of the survey have been set forth on a strategic decision matrix reflecting certain budget parameters as well as the total survey population.

In this monograph, the following definitions are used:

Small universities and colleges are defined as post-secondary educational institutions with 5,000 or fewer enrolled students.

Strategy refers to an action plan which requires resources (time, personnel, facilities, equipment, etc.) to achieve a major goal or objective. Strategies include scenarios (how they work or what

impact they have), action programs, and allocation of resources.[2] Strategic models refer to the structural designs of action plans.

Academic computing refers to activity which is integral to or directly related to student instruction in computer-related disciplines or in other academic disciplines which rely on the computer; computer literacy programs for students and faculty; faculty and student research support; faculty word/text processing support; and library operation support.

Administrative computing refers to business-type information processing functions such as accounting, billing, financial modeling, data base management, student records, payroll, energy management, management information systems, office word processing, and electronic mail.

The findings of this investigation may be particularly useful to presidents and other senior executives in small colleges and universities who must make important computer-related decisions but who lack technical background and information on what has occurred at other institutions. Herein are data which reflect the strategies adopted by colleges and universities according to the financial resources allocated to centrally-provided computer services. The executive, after determining the level of support available at his or her institution, can see the strategies common to that level of support elsewhere. Similarly, the professional computer manager can compare the strategies in use at comparable institutions and evaluate strategic alternatives which may be appropriate to recommend to senior management.

Data of the prevalent strategies of these institutions, which are representative of a large segment of American colleges and universities, should also be useful to those who rely on their graduates and services, and to those who provide computer-related services to the higher education community.

FOOTNOTES

[1]This monograph is based on the author's doctoral dissertation, submitted to the faculty of the Graduate School of Business at Pace University in partial fulfillment of the requirements for the degree of Doctor of Professional Studies in Management. The author wishes to acknowledge the contributions of Dr. Susan Merritt of Pace University, his dissertation advisor, as well as those of Dr. Heinz Jauch and Dr. Andrew Varanelli (also of Pace University), which substantially improved the original dissertation text and data presentation.

[2]Alfred D. Chandler, Jr., Strategy and Structure (Cambridge, Mass., The M.I.T. Press, 1982), p. 13.

CHAPTER ONE: Background

The traditional college age population will decline by 25 percent by the mid 1990s. The number of eighteen-year-olds will drop from 4.3 million in 1979 to 3.2 million in 1994. During the 1979-1994 period, the Northeast and North Central States will suffer declines of 40 percent and 32 percent respectively, the West will decline by 16 percent, and the Southeast-Southwest will decline by 13 percent.[1] The number of persons graduating from high school each year from 1981 to 1986 is expected to drop by 14 percent, from 2.9 million to 2.5 million. The number is expected to rise slightly to 2.6 million in 1988, drop to a low of 2.3 million in 1992, and then climb to almost 2.7 million by the year 2000. The number of high school graduates peaked at nearly 3.2 million in 1977.[2]

Competition throughout higher education will become more intense, and small, less selective liberal arts colleges are the most vulnerable. Among such colleges with enrollments of 700 or less, 42 percent experienced a loss of 10 percent or more in freshman enrollments in 1982. The typical college faces a loss of $5,600 for each missing student each year.[3] As of 1982, 177 loans totaling $22.8 million by the U.S. Office of Education to colleges were delinquent or in default. Most of the loans were to small, private colleges.[4] One well-known scholar of American higher education believes that between 10 percent and 30 percent of America's colleges and universities will close or merge by 1995.[5] Competition has become so fierce among institutions that student quality is no longer a significant criterion for admission: one-third of all colleges admit more than 90 percent of their applicants, and three-quarters of all colleges admit more than 75 percent of those who apply.[6]

Although the situation in publicly-supported institutions is not as bad, it is believed that those which are not academically prestigious will suffer enrollment declines.[7] These public colleges

and universities have experienced significant budget cuts throughout the United States during the early 1980s as a result of the economic recession which hit hard at state government treasuries at the same time that the federal government was cutting its aid to higher education and making student financial aid more expensive to the borrower.

At the same time that student enrollments have begun a sharp decline and that resources have become more difficult to obtain in both the public and private sectors, there have been profound changes in the demand for higher education. One such change has been in the growth of student interest in computers and computer-related courses. Concurrently, there have been significant changes in technology and the demand for computer professionals in higher education. The most comprehensive, yet concise, summary of the forces to be reckoned with in computing in higher education is that written by John McCredie:

1. The United States is fast becoming an information-based economy, and computer technology is central to this movement...information-based activities now account for almost half of the gross national product...
2. More students each year are demanding courses in the information processing fields. The number of undergraduate majors in computer science doubled between 1975 and 1981. Before the end of the decade almost every student, not just those in computer fields, will expect the full range of computer-related services to be available at colleges and universities...
3. Computer applications will grow rapidly in new areas as the relative costs of automated and human information processing continue to shift dramatically. The price of computer hardware...will continue to decline during the next ten years...at a compound yearly rate of approximately 25 percent. However, the cost of a technical person or faculty member will increase by 75 percent...
4. Trained information processing professionals (faculty, analysts, programmers, technicians, etc.) will be more expensive, harder to recruit and more difficult to retain than they are now or were in the past. Salary policies will make these problems more severe in education and non-profit sectors of the economy than in the business sector...
5. There is a current personnel and facilities crisis in academic computer science departments throughout the country. Insufficient experimental facilities on campus and significantly higher salaries in the private sector make it almost impossible to hire and retain enough faculty to teach

the courses demanded by students or to perform needed research...

6. The rapid development and spread of microcomputers is accelerating the decentralization of computing resources on campuses...students and faculty will have personal systems...These owners will require ways to link their systems to other microcomputers and to large local and campus facilities for access to data, large storage capacity, high-quality printing capabilities, and communications with other scholars...
7. Libraries and computer centers will draw closer together. Similarities in information processing functions and needs are emerging and will become more important than historical differences in organization...
8. Nationwide discipline-based networks will draw geographically dispersed academic communities together in new ways...
9. Administrative computing in general is much more difficult and costly than most university administrators believe ...about half of total academic computing expenditures are for administrative data processing applications. Ten years ago administrative computing accounted for only about 34 percent of the total. Standardized software for many important academic applications, when it exists, remains expensive and difficult to install.
10. Instructional computing is funded at an inadequate level ...large capital investments are required from an educational system that has traditionally been people, rather than capital, intensive.
11. New economic partnerships are needed to capitalize on the technological opportunities available now and in the future. The federal government provides less support for campus computing than it did ten years ago.[8]

McCredie, formerly the chief executive officer of EDUCOM, comments on the organizational implications for colleges and universities:

> Whether or not information technologies are unique, the demands they place on academic institutions are clearly proliferating at a quickening pace. Therefore, the argument as to why higher education must create new strategies for information processing activities in the next decade is, in part, a very practical one [emphasis supplied]. Such strategies are central to the convergence of several related campus activities that use new technologies (i.e., video discs, graphics, broadband cables, etc.) in instruction, research, adminis-

> tration, telecommunications, mail, printing, institutional planning, and library services. The integration of part of these activities for capital planning purposes and priority setting will be sound business policy because of the great potential for waste if they are handled separately...[9]
>
> The information processing challenges and opportunities presented by these changes are profound, particularly for higher education, because most institutions are unprepared to deal with them effectively...most seem oblivious to the challenge...Most institutions have made plans to react to the demographic changes of the 1980s, but only a few have strategies to face the inevitable technological changes on the horizon. If these changes are not planned for, the opportunity cost to all of higher education will be very large.[10]

The quality and quantity of computing in higher education is an important issue of national concern, as pointed out by Richard L. Van Horn of the University of Houston:

> As the industrial revolution brought national strength through increased productivity of blue collar workers, the computer revolution will bring national strength through increased productivity of white collar workers. An executive with a personal computer linked to a network of colleagues and information substantially outperforms the executive of the past. Here again, many bits and pieces of the future already exist; for example, many engineers with computers to design more effective computers.
>
> Certainly the existing evidence strongly suggests the vision of the future outlined above certainly is reasonable and probably is inevitable. These arguments further suggest that those nations that move most effectively and promptly in this area will create substantial advantages both for themselves and for society as a whole. One should, of course, be equally concerned with mitigating a host of possible problems that may accompany this revolution just as they accompanied the industrial revolution.
>
> If you accept what I believe is strong evidence for the world view, then a key question is how does the United States gain and hold a leadership position. History suggests that universities will play a key role. Professionals in our society are educated at universities. If universities can provide good networked, distributed personal computing environments for their students, then similar environments will develop rapidly and effectively among professionals in the workforce. We already have observed the major impact that professionals

> educated at computer intensive universities have had on the use of computers in business and government in the past three decades.
>
> In addition to computer competent graduates, society can benefit from computer intensive educational environments in a second way. With the continuing rapid growth of relevant knowledge, universities simply have run out of time in four years to turn out graduates who are both expert professionals and educated persons. Increased learning effectiveness or productivity for students has become essential. Computer enhancement of student learning must be a major goal of higher education; computer enhancement of faculty research is an equally important goal for the nation.[11]

A leading writer on American higher education, Edward B. Fiske, has described the current situation as "an electronic revolution that promises to alter some of the most fundamental structures of higher education in the United States." Referring to some of the specific concerns to be faced, Fiske states:

> The problems involved in what appears to be a headlong rush to wire academia are as monumental as the stakes. Everyone agrees that colleges must eventually agree to work with no more than a handful of computer languages, operating systems and machines for all but highly specialized activities. No one has as yet perfected the technology of "networking" thousands of microcomputers so that they can communicate with one another. Nor has anyone figured out how colleges will pay for what most experts say is the financial and academic equivalent of building an entire library system.
>
> The most aggressive universities in academic computing are hoping to position themselves at the forefront of higher education in the 1990s...
>
> Computerization on campus might be compared to the situation in a small town in the early 20th century when only five people had telephones. The new device was going to change things, but the magnitude of the change could not be grasped until everyone had a telephone. "The computer," says Richard M. Cyert, president of Carnegie-Mellon in Pittsburgh, "is the most significant addition of capital to students since the printing press."[12]

The increasing interest in computers by the general public and college students in particular is placing much greater stress on the computer resources and services of colleges. Many small institutions which lack technological missions, such as liberal arts and fine arts

colleges and seminaries, have no choice but to become involved in making complex computer decisions for which they may have little or no experience, and limited resources.

Since there is similarity among the general kinds of computer services provided by colleges and universities, readily available data on the computing models in use at comparably-sized institutions will guide campus administrators. Even if an institution has the financial resources to employ consultants, campus administrators can use such data in preparing consulting contract specifications and in assessing consultant recommendations. For those schools which do not have the funds to employ consultants, information on the models in use at other institutions may help administrators in preparing strategic plans and in dealing with computer hardware and software vendors.

USES AND TRENDS OF COMPUTING IN HIGHER EDUCATION

There exists a considerable body of information on the general subjects of academic and administrative computing in higher education sufficient to describe the basic services in each area. The major trends which may affect computing in higher education are:

- the declining cost of computer hardware
- increased demand for computer-related education
- communications between computers and computer-related equipment
- development/acquisition of computer software
- increased demand for decentralized computing
- shortage of professionals, both faculty and support staff
- financing of the demand for additional computing resources
- direction of all computer services by one individual
- increased library computerization

The literature on computing in higher education indicates that most institutions, including small universities and colleges, spend from 1 to 4 percent of their institutional budgets on administrative computing. However, there has been relatively little written about the subject of strategic planning for computing, computing in small universities and colleges, or strategic models for academic and administrative computing in such institutions. This author has found no information outlining the nature of strategic models for academic and administrative computing within the parameters of financial support allocated to centrally-provided computer services. A summary of the research the author conducted into existing literature is included in the Bibliography of this monograph.

The sections which follow describe the roles of academic and administrative computing in higher education in general, the issues and problems which confront campus planners, and the general issues which affect both branches of computing in colleges and universities, with distinctions made between the circumstances of small and large institutions. Included in this discussion is a summary of significant literature in the field.

Academic Computing

Within the general category of academic computing, issues of common concern include curricula, computer literacy, networking, library operations, and word/text processing.

Curricula

There are a variety of undergraduate computer science/data processing courses and curricula now being offered at colleges and universities in the United States. The variety can range from individual courses offered in schools which have no computer science programs to broad and complex, scientifically-oriented programs. Teagarden provides one set of descriptions for such programs:

> A variety of courses can be assembled into programs. Common are those programs which are designed to provide data entry qualifications, such as learning to operate the key board, the cathode ray tube, and the card-punch machine, and learning the general features of computer operation. Such a data entry program can be expanded or extended to various types of computer programming certificate programs depending upon the number of computer languages required to complete the certificate program. Such programs could be completed in one semester, one year, or more. Courses and/or programs in computer repair and maintenance can be presented, although these may have to be sequenced from the instruction in the basics to courses in more advanced materials. Almost any course can be presented which meets any realistic need within the less-than-degree format.
>
> Far more structured, however, are those programs which award the Associate degree upon completion...Such programs vary widely in courses offered but have as their primary goal the preparation of business and government programmers. The major emphasis in these data processing curriculums is programming techniques and programming languages. A second emphasis is usually included and is given over to areas such as computer operations, systems documentation, and business policy.

[A somewhat different Associate degree program] places more emphasis on equipment hardware and computer operations. This program...includes such areas as data representation, structure, storage processing, programming language and logic, interfacing with hardware and software, computer equipment and functions, programming models in organizations, computers in organizations, documentation, data elements and files, report requirements and forms control, and quality programming with structured approaches.

A third and somewhat different program at the Associate level [places its emphasis] on hardware and electronics. This program would include such courses as basic electricity, basic electronics, computer fundamentals, electro-mechanics, instruments and measurements, digital computer logic, telecommunications, and computer programming.

Possibly the elite program in the four-year baccalaureate curriculum is computer engineering, which concentrates on the development of computer hardware technology. Student engineers are educated in the development, design, and production of hardware components and operating systems. This program is normally taught in the departments of electrical engineering...

A model computer science curriculum has been designed to provide students with solid instruction and development of computer software, systems, and technology. Science, electronics, and mathematics are emphasized...The model curriculum for this degree...has specific courses correlated about the basic instructional areas of programming, software organization, plus data structures and file processing.

The business data processing program is primarily an extension of the two-year Community College program with additional work in programming languages, systems design and analysis, logic design and structure, and in the area of practical business courses.

A management information systems program is becoming more popular in the nation's institutions. Such programs are designed to prepare students for careers in the management and design of information systems. The primary emphasis here is on both information systems technology and on business and organizational structure and practice. Somewhat related to the program in business data processing, the course work includes topics such as organizational structures, operations research, information systems and design, data management, and information systems policy and practice.

[C]omputer information system programs are commonly found in schools of business. This program's primary concern is with

> the application of computer systems development to business organizations with computerized information systems departments. Subject matter, accordingly, includes the study of operating systems analysis, systems design, computer programming, and required or optional business and technical courses.
>
> It is possible...to have computer science/data processing options as parts of other academic areas...Academic programs such as art, music, biology, political science, and economics could have as an option, courses in computer literacy; fundamentals of computer programming; useful computer languages such as BASIC, PASCAL, and FORTRAN; microcomputer operations; and any courses particularly useful or related to the discipline concerned.[13]

Graduate programs in computer science/data processing tend to be extensions of the undergraduate programs described and are generally offered at larger universities than those upon which this study focuses.

Computer Literacy

Many colleges and universities are planning (or have already begun) programs for computer literacy for both students and faculty. Computer literacy is defined as "an awareness of computing capabilities within a discipline or profession and an ability to recognize and articulate problems that can be solved with the aid of computing technology. The definition does not necessarily imply an ability to program or operate computers."[14] Another reference to computer literacy is the analogy of learning to drive a car properly without learning how its mechanical and electrical systems operate.

Many institutions see the microcomputer as the best means of introducing students to computing. Duke University's experience was that the personal computer was found to be convenient, accessible, and "friendly" for individual experimentation and development. Individuals could satisfy their general curiosity about computers, or attempt to develop vocational skills in informal settings.[15]

Vassar College, a small but prestigious liberal arts college, found itself in 1980 to be in a position where its computer hardware facilities were becoming outdated; only a few of its faculty cared about the campus computer situation; many of its students had grown up with computers and were more knowledgeable than many of the faculty; and many students who were not familiar with computers seemed to have an innate fear of technology. Vassar's reaction was to develop what it considers to be an innovative program which it calls "A Model Program for Computer Literacy at Small Liberal Arts

Colleges." The primary goals of the Vassar program were: "1) to introduce computer resources to a broad section of Vassar's faculty and students, and 2) to give faculty and students the understanding and technical ability to make use of these resources." Vassar received support from the Fund for the Improvement of Postsecondary Education (FIPSE) and cooperation from the EDUCOM and EDUNET organizations.

In designing its program, Vassar's ad hoc computer planning committee identified the key factor for program success as faculty participation, particularly by faculty from non-quantitatively oriented disciplines. The committee felt that the cost of the wide range of software which would be required by faculty would be prohibitive and decided, therefore, to make significant use of remote software resources available from network sources and commercially-produced packages. The major component of the literacy program is a core course called "Computing as a Resource," the organization of which is described as follows:

> This course is under the direction of a "program coordinator" and requires active participation from four different faculty members each term. Prior to class registration, faculty members participating in the core course are announced with the expectation that students will register for a section with a faculty member whose academic interests the student shares. During the course, the program coordinator provides the basic computer knowledge; the participating faculty members, who are assumed to be naive regarding computers, contribute relevant expertise in their own discipline. . .
>
> The core course, "Computing as a Resource," is designed to provide students and participating faculty with an overview of the various uses of computers and to allow direct experience with microcomputers and computer networking. Five areas are covered in the course: (1) an introduction to computers and computing; (2) programming in BASIC; (3) the demonstration, use, and evaluation of various software packages in specific academic areas; (4) the study of the impact of increased computer use on society; and (5) the use of teleprocessing to access information services. . .
>
> There are two tracks within "Computing as a Resource": laboratory and lecture. The laboratory track of the course involves, at a minimum, work with microcomputers for word processing and BASIC programming. In addition, students also use microcomputers in the lab to work on a group project done in conjunction with the participating faculty...The lecture track covers the five subject areas outlined above with the addition of

a two-week segment at the end of the term when each group reports to the class on its project.[17]

Faculty participation in the core course does not allow released time from normal teaching responsibilities. Participation in the program is considered as professional development. However, there is generally a list of faculty waiting to participate. They are chosen on two criteria: relative lack of knowledge about computers, and willingness to integrate computer-based activities into a follow-up course.

An extension of the literacy program has been developed with the aid of the Sloan Foundation. All faculty are eligible for a low-interest loan, provided by Vassar, to be applied to the purchase of a personal microcomputer.

Vassar officials believe that the model should be transportable at relatively little expense to similar institutions that are without substantial computing resources. However, the model may not be transportable to less well-endowed or -equipped, less technologically sophisticated, and less well-connected institutions vis-a-vis foundation and government-supported programs.

Library Operations

College and university libraries have been a fertile field for the growth of computer applications. It is probable that institutions without some computerization are in the overwhelming minority in the United States. Libraries have been able to improve their productivity during an era of financial cutbacks, inflation, fewer funds for acquiring library materials, staff, equipment, and buildings while the volume of publications continues to grow. Libraries have met these challenges in three ways:

- computers can assume many of the repetitive tasks that are prevalent in libraries;
- information retrieval can be improved through the use of computers;
- cooperative ventures with other institutions can be entered into.

Notable among many library networks are four bibliographic utilities which provide computer services to other libraries: the Research Libraries Information Network (RLIN), the Washington Library Network, the Online Computer Library Center (OCLC), and the University of Toronto Library Automation Systems.[18]

Hugh F. Cline and Loraine T. Sinnott have written on the impact of automation on university libraries. Their research focused primarily on the operation of technical services, for most of the

automation in university libraries has been centered there thus far. They state that:

> Automation has led to significant changes in the practice of librarianship and has fundamentally modified the role of at least one library figure, the cataloger...Computers greatly facilitated the sharing of bibliographics information. In many cases, these records can be remotely accessed by libraries via telecommunications systems. These systems have encouraged the proliferation of library networks...Acquisition, cataloging, circulation, and reference services have had some automation...
>
> Institutions have access to both commercial bibliographic search services and local or regional holdings information. Automated acquisitions systems produce reorganization of work flow and functional units within the library...Formerly independent search and order units can be combined in a single unit...
>
> In cataloging, computer-aided systems are dramatically reducing backlogs in university libraries. However, automated cataloging is creating a new problem, a backlog of the unfiled catalog cards are produced at a much higher rate by the new system...Before the installation of automated circulation systems, many university libraries anticipated significant reductions in personnel and operating costs. Rather, their circulation activities have expanded. With respect to reference, libraries are troubled by having to pass on direct charges for these services to users. Moreover, there is concern that normal reference suffers because automated services are so time consuming. . .
>
> Automation has caused many changes in traditional personnel management areas, including hiring, job assignment, evaluation, and the like. The requirement for new skills, expertise, and training are changing personnel policies in university libraries.[19]

Glyn T. Evans, a State University of New York library administrator, has described the benefits of participation in OCLC as: improved processing efficiency of library materials with elimination of uncataloged backlogs, reduction of technical processing staff, reallocation of staff from technical to public services, increased interlibrary loan traffic, improved internal inventory control, and wider range of library and curricular materials brought into coherent bibliographic control.[20] Others, such as Goldstein and Dick, believe that collection control is unlikely to be achieved without automation.[21]

Evan Ira Farber has written on the differences between college and university libraries:

> College libraries are different from university libraries. That is basic and must be recognized. Their resources are limited and less specialized. The nature of their mission--to support undergraduate teaching rather than graduate research--is also an important difference. But...the most significant difference is the size of the professional staff...
>
> Larger universities are concerned with how technological changes will affect the traditional organization structure, a structure that is based on function, activity, subject matter, format of material, type of clientele, location, or some combination of these...
>
> In college libraries there is not a clear difference of function and very little structure...everyone has to be a generalist...Probably no one on the staff has the expertise to have really good judgment on the new technology. The typical college library staff has difficulty judging even what factors should be considered, let alone how or when the library should become involved or even what the choices are in automation or on-line searching...
>
> New, younger faculty, accustomed to on-line services in graduate schools or previous positions will create a demand for them...Change will help to revive faculty members for whom creativity has become barren...a special problem at smaller colleges because the quality of teaching is so crucial...
>
> We have, then, on the one hand, limited resources, inadequate personnel, and resistance to change, and on the other, changing circumstances and responsibilities that demand a new approach...More and more librarians are involved with continuing and self-education. Library staffs must take advantage of every opportunity to find out about the new technology...College librarians and administrators need to reorder their priorities to provide development opportunities for their staffs...State, local, or regional networks provide the best way of meeting this educational need.[22]

Networking

Within the general framework of academic computing, networking has become an issue of major interest. Each computer system is usually a network in that remote data entry units are tied to a central processing unit. Networks aid in administrative data processing and in instructional applications where use of centralized processing and software is an objective. A particular computer may

belong to more than one network, and its users may each belong to more than one networking group.

In writing on computer networks in colleges and universities, McCredie and Timlake have said:

> Most higher education networks are based on the diverse needs of many individuals rather than on one underlying large system required to support the "business" of the institution. Such academic networks stand in sharp contrast to the high transaction rates and tight control structures of many commercial networks designed to support an organization's need for reservation, order entry, and/or electronic fund transfer facilities...
>
> Scholars tend to identify with their own disciplines rather than with their own department or college/university. Often only a small group of individuals share common research interests within a department, and these people want to communicate with peers located throughout the country, or the world.[23]

Academicians work in communities which have strong traditions of free and open interchange of information, and where a significant amount of academic activity exists outside the traditional workday and outside the traditional office locale. Computer-based networks, if well designed, can support many of these needs and traditions.[24]

In addition to the library networks already mentioned, there are a number of computer networks which support scholarly activities among colleges and universities, such as ARPAnet and CSNET which serve computer scientists, and BITNET and USENET which provide store-and-forward and electronic mail features. In 1979, EDUCOM formed EDUNET, a computer network founded to serve the general networking needs of higher education. EDUNET provides access to the specialized programs, services, and data bases of seventeen leading university computer centers in the United States. It also provides such services as electronic mail and conferencing, access to unique computer hardware, data base management, modeling, and hundreds of programs in topical subject areas. Its services are used by administrators, faculty, and students in more than 150 participating institutions.[25]

Small universities and colleges may encounter difficulties, however, in obtaining and using network resources. Some of the barriers they face are lack of knowledge about available resources, inter-institutional red tape, high data communications costs, and lack of financial resources to purchase the services. Many small institutions have no central computer facility of their own, rely on

service bureaus and other outside agencies for administrative computing, and, consequently, have limited specialized resources for teaching and research purposes.[26]

Another type of network, the local area network (LAN), poses both possibilities for greater coordinated use of campus computing resources and significant technological problems. Local area networks may involve the tying together of computers of similar or diverse capability, such as microcomputers and/or mainframes.

Substantial network research has been undertaken, including major projects at universities such as Carnegie-Mellon and M.I.T. America's two largest computer manufacturers have committed up to $50 million to develop a network over a five-year period at M.I.T. Although the M.I.T. "Project Athena" is not likely to be emulated at small institutions, the research may benefit all sizes of universities and colleges, as well as industry.[27]

Word/Text Processing

Increasingly, faculty in non-technical disciplines are knowledgeable about the capabilities of computer systems and microcomputers to serve their interest and need for word processing and text preparation in instruction and research functions. This has become particularly true since many such faculty have obtained their own personal computers with word processing software.

Most of what has been written about word processing in higher education is related to office automation, not to meeting the needs of individual faculty (or as is increasingly the case, students) for access to word/text processing equipment. Meeting such demands will pose significant problems to administrators who must evaluate the capabilities of computer systems, microcomputers, or stand-alone units to meet diverse word processing applications. The problems will be more difficult where resources are sparse, such as in small colleges. Also, as Coughran points out with respect to document preparation on a college campus, "problems associated with word processing tend to be humanistic and political, not technical."[28]

Few institutions can give the attention to addressing word/text processing problems and concerns that Stanford University has. However, the results of a Stanford study are worth noting, even among institutions with far fewer resources. An in-house study group recommended that the institution:

1. enforce the policy that limits the number of models of commercial word processing systems that may be purchased, in order to limit the investment required to connect these systems to a campus-wide network;
2. continue the investigation of new products designed for large scale use;

3. continue supporting such activities as would make the text system services already established at Stanford more compatible with each other and more widely available to faculty, staff, and students;
4. move forward on the recommendation to provide a digital network and connect all major text-handling systems to the network.
5. publicize Stanford's work on text systems and explore possibilities for cooperation and joint ventures with other universities, research institutions, and vendors.[29]

A current problem for many institutions is the demand by students for access to computers for their personal word processing needs. Many students have discovered that the computer "is the single greatest boon to writing, rewriting, and editing since the blue pencil." According to computer manufacturers, more computers are used for word processing than for any other purpose.[30]

Many campuses fear that too many students writing papers on computers will overtax limited resources since most still rely on large, central computers and have not acquired massive numbers of microcomputers for student use. The limitations imposed by many colleges have raised conflict between the traditional computer users, mathematicians and scientists, and those in the humanities over "whose time is more valuable." Many institutions see the placement of microcomputers in central facilities as the way to remove the heavy student demand from main computer facilities.[31]

Administrative Computing

Administrative computing includes all those information processing services which provide college and university management with the data necessary to make decisions, record data, and carry out the day-to-day operations which are required to keep complex institutions functioning.

The importance of administrative computing in higher education was noted by Rourke and Brooks in 1966:

> In place of the loose, unstructured, and somewhat casual methods practiced in colleges and universities in the past, we have seen a growing commitment to the use of automation in the routine processing of administration, an increased resort to data gathering and research as a basis for policy making, and an expanding effort to develop objective criteria for making decisions on the allocation of resources instead of leaving matters entirely to the play of campus pressures or the forces of tradition...

> In cumulative effect, these innovations will certainly be regarded by historians of higher education as giving an entirely new character to university administration...From now on the government of these institutions will reflect a much more conscious effort to plan the course of their development, to relate means to ends, and to seek a maximum return from university resources...A new world of computer management and control lies ahead in higher education.[32]

Among the issues to be considered in administrative computing are the findings of earlier research, particularly that on administrative information systems, information systems management, and computer security.

Administrative Information Systems (AIS)

A comprehensive summary of administrative information systems in higher education, based on the results of a Member Institution Profile Survey, was published in 1980 by CAUSE, The Professional Association for Computing and Information Technology in Higher Education.* Over 350 CAUSE member campuses, or over 10 percent of the total higher education institutions in the United States, responded to the survey. The study dealt only with administrative computing and did not describe academic computing activities. Responses were grouped by size of institution enrollment: Small = 0-1,999 (63 in group), Medium = 2,000-7,999 (142), Medium-Large = 8,000-17,999 (85), and Large = 18,000 and over (60). Respondents were also broken down by status as public, private, and all institutions; and as university, four-year, two-year, and all. The 63 small college responses amounted to 3 percent of all U.S. colleges of comparable size.[33]

The results of the 1980 CAUSE study for total small institutions and total medium-sized institutions are as follows:

Separate vs. Combined Academic/Administrative Computing. Among small colleges, 68 percent had a combined installation and 32 percent had separate installations; among medium-sized institutions the percentages were 75 and 25, respectively.

AIS Reporting. The AIS function in small colleges reported to the following officer at the indicated percent rate: president--13

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* EDITORIAL NOTE: CAUSE conducts a Member Institution Profile Survey bi-annually, and plans to publish a monograph in 1986 showing trends from 1980-1985, based on data collected over that time.

percent; executive vice president--13 percent; administrative vice president--17 percent; academic vice president--14 percent; business vice president--24 percent; and other officer--19 percent.

For medium-sized institutions, the results were: president--11 percent; executive vice president--10 percent; administrative vice president--23 percent; academic vice president--8 percent; business vice president--22 percent; and other officer--27 percent.

Average AIS Staff and Distribution by Category. Small and medium-sized institutions had the following average full-time equivalent staff and percent distribution:

	SMALL		MEDIUM	
Type of Position	FTE	Percent	FTE	Percent
Management	1.1	15%	1.9	13%
Analyst/Programmer	2.1	28%	5.0	35%
Systems Programmer	.4	5%	.8	6%
Operations	2.9	39%	4.6	32%
Clerical	.9	12%	1.8	13%
Total Staff	7.5	100%	14.2	100%

Average AIS Annual Budget By Function. The allocation of budget to small and medium-sized AIS functions was:

	SMALL		MEDIUM	
Function	Amount	Percent	Amount	Percent
Staff	$155,334	54%	$242,339	48%
Hardware	89,560	31%	154,161	31%
Software	9,139	3%	18,648	4%
Communications	5,220	2%	7,759	2%
Other	28,727	10%	77,085	15%
Total (average)	$287,979	100%	$499,992	100%

AIS Budget as a Percent of the Institutional Budget. The AIS budget for small and medium-sized institutions as a percent of the total institutional budget was:

	SMALL	MEDIUM
Less than 1.0%	0	5%
1.0% thru 1.9%	45%	30%
2.0% thru 2.9%	29%	21%
3.0% thru 3.0%	10%	24%
4.0% and above	16%	19%
Total	100%	100%

AIS Operating Cost Recovery. Were AIS costs fully or partially billed back to users?

	SMALL	MEDIUM
Costs are billed	8%	19%
Partially billed	44%	37%
Cost not billed	48%	44%
Total	100%	100%

Computer Hardware and Communications. The average number of computers reported by institutional size was 1.27 for small institutions and 1.61 for medium-sized institutions. Small institutions had an average of 20 interactive devices (terminals) and one remote job entry (RJE) site. Medium-sized institutions had an average of 38 interactive devices and two RJE sites.

Administrative Software Applications. Small institutions were found to have an average of 33 applications with the heaviest concentrations in admissions and records and financial management. Medium-sized institutions had an average of 46 applications with the same areas of heaviest concentration.

A majority of all institutions responding to the CAUSE survey reported using proprietary software (that owned and developed by an outside vendor). The percentage of administrative computing applications in an on-line (as opposed to batch processing) mode had generally doubled from 1976 to 1980.

The 1980 CAUSE survey did not attempt to measure the use of integrated data bases nor the ability of any system to serve multiple applications.

Information Systems Management

Until recently, batch processing of administrative computing applications has been prevalent throughout higher education institutions. Such processing permits the uninterrupted processing of different applications, grouping together programs and data to update files and print reports. Batch processing is usually less costly to develop and operate but is also slower. Recent technological improvements have increased the attractiveness of on-line processing whereby the user can input or access data directly from a computer system without advanced batching of information.

Data base management systems are computer programs which can be developed in-house but normally are obtained commercially. They are designed to support the development and use of management

information systems. Generally, they:

1. provide for the creation and maintenance of complex files in a flexible manner, allowing new data elements to be added or deleted as required;
2. support a directory of common terms that can be applied to all like data items throughout the data base, regardless of application;
3. are capable of accessing related data from different files to facilitate complex data inquiries;
4. provide for relatively easy access to high-level languages directly by the user.

If a data base approach is used, there must be control of all the data in the data base. Therefore, it becomes necessary to have someone administratively responsible for the data base, and for major elements within the base. The central administrator must be able to determine which user is responsible for which data element which may eventually be used by all the system users. Users can update the elements they are responsible for but not those which are the responsibility of others.

Recent advances in computer technology have made distributive information systems possible. Such a system is a computer application (or group of applications) which can be processed on a computer separate from the institution's central facility, yet still communicate with the central computer, thereby sharing the processing for various information systems. Distributive systems have the potential advantages of reducing the need to develop large central computer facilities, allowing users to stay in operation even if the main computer is down, and permitting users to have more direct control over their data without competing with other users who are accessing a central computer facility.[34]

Computer Security

The popular press has carried many stories about computer crime, i.e., the penetration of computer systems for purposes of illegal gain, vandalism, or curiosity. The public's interest in computers contributed to the commercial success of a major motion picture, Wargames, which dealt with computer crime and national defense. The risk of criminal activity involving college and university computing operations, particularly administrative systems, is an important element of sound computer center operations. McCredie and Timlake refer to both academic and administrative data:

> For academic systems it is useful to divide data that should receive special protection into two classes. First, there is data

> owned by the university whose loss would be financially injurious or embarrassing to the university...Commercial enterprises face a similar exposure. For either...the remedies could include stand-alone systems, data encryption, secure operating systems, or network non-participation...
>
> Because of the nature of university work, a second class of data should be considered. An example is data that represents ideas prior to publication...but the theft of an idea whose publication could lead to a tenured position might have clear financial implications. Perhaps a clearer example of financial loss would be a loss of a patent because confidential information is widely circulated over a network too long prior to filing a patent application.[35]

Others have spoken of the need for "owners" of information to be responsible for computer security. College and university officials should not leave computer security up to their computer center directors, who are no more than a resource in setting up a secure computer system.

According to Dominic Stavola, the senior security administrator for information protection at I.B.M., the person responsible for insuring security should be its "owner" (e.g., the registrar for student records, the financial vice president for financial information).[36] The role of the computer center director is to take the requirements established by the managers of various areas and implement them in the security system.

Richard C. Koenig, the manager of computer and data security at Union Carbide Corporation, agrees, stating that only managers can set requirements for computer security as only they know the true value of the information.[37] He differentiates between information that is necessary for an institution to continue functioning, and information that is confidential. To some extent they need to be protected differently. Security measures may involve both "backing up" data and software and/or limiting access to such information.

Donn B. Parker of S.R.I. International has recommended the following steps to improve security and counteract the efforts of "hackers" (people who break into computers electronically):[38]

- set an example (such as action against illegal copiers of software)
- conduct periodic reviews to determine if software is running on machines for which it was purchased
- establish a code of conduct for computer use
- lock doors to computer rooms when they are not in use
- minimize dial-up access to the computer system

- identify "hackers" and reason with them
- don't let the system prompt a user who is logging on
- treat an initial computer break-in seriously.

STRATEGIC PLANNING FOR COMPUTING

In developing strategies for computing in colleges and universities there are a number of issues which influence both academic and administrative planning. Among them are personnel, financing, technological trends, and organizational structure.

Personnel

A major problem facing all higher education is the shortage of faculty and other professionals in the computer field.

John Hamblen of the Center for Applied Mathematics, National Bureau of Standards, has estimated the supply/demand situation through the remainder of the 1980s. He estimates that the supply of bachelor's degree holders will begin to overlap demand by 1985-86. The consequences of that overlap will be:

1. Starting salaries for four-year graduates may tend to level off or even drop.
2. Weaker graduates of four-year programs will be in more competition with graduates of associate degree programs.
3. Master's degrees will be more rewarding, i.e., starting salary differentials will be greater.
4. Graduate enrollments will increase because better graduates will have fewer choices for employment.[39]

Hamblen believes the situation at the master's degree level will be different, however:

> [E]stimates of production fall far short of even the low end of the demand estimates for master's degrees. If the same factors influencing the demand side remain in effect throughout the 80s, there will still be an extreme shortage of master's graduates in the computer related fields in the '90s. The majority of these master's level people will be needed in the information systems field which should be located in schools of business. I believe that these graduates will eventually replace the traditional MBA in popularity unless the MBA programs incorporate more work in the area of computer information systems...

> Colleges and universities with huge undergraduate enrollments in computer-related courses must find ways of utilizing more first- and second-year graduate students if we can expect graduate enrollments to increase even at the modest levels needed to produce the estimated growth in Master's degrees... [B]ecause of the extreme shortages of faculty in the computer-related fields, colleges and universities may be forced to utilize more master's degree people for instructor-level positions and, as a result, get more students interested in pursuing the doctorate.[40]

The situation with respect to doctorate-level production is more bleak, according to Hamblen. He believes the lag in production is even more critical than at other levels because the doctorate-level lag hurts the quality of the other programs and also holds back research activities. Hamblen estimates that between 8500 and 9000 master's degrees will be granted in 1988-89, but only approximately 317 doctorate degrees will be granted in 1988-89.[41]

According to the Snowbird report, there were 1300 jobs advertised for only 200 graduates with Ph.D. degrees in 1980. Of those 200 graduates, 100 were hired by industry, which potentially can offer better salaries and facilities. To contribute to the problem, the number of Ph.D. graduates in computer science dropped from 256 in 1975 to 200 in 1980. University computer science departments are having difficulty in attracting students to graduate programs because of the availability of jobs with good starting salaries for bachelor's degree holders. Obviously, the lack of advanced degree holders contributes to the inability to train new students to meet market demands.[42]

Even large, prestigious institutions have difficulty in computer science supply/demand. For every computer faculty member at Massachusetts Institute of Technology there are sixteen students, either undergraduate or graduate, compared to an average of one faculty member for every eight to nine students for the institution as a whole, with each faculty member supervising an average of eight theses.[43] Nationally, the percent of freshmen planning to enter the computer science field has tripled since 1979, going from 3.3 to 10.1 percent.[44]

Exacerbating the problem in higher education is what George Keller calls "the faculty conundrum," i.e., faculty are getting older, mandatory retirement is now at age 70, and institutions may have difficulty in moving resources (positions) to meet areas of student interest such as computer science.[45]

Another problem faced by colleges and universities in the personnel area is compensation. Salary administration in higher education is not governed by the general free market due to

constraints imposed by government agencies for public institutions, and internal equity problems with faculty and staff from other disciplines within the same institution.[46]

Chachra and Heterick recommend some strategies to cope with problems of increasing software and personnel costs:

> First, and perhaps foremost, lies the need to make the salaries available to computer professionals in higher education more competitive...Failure to do this will simply make our institutions the training grounds for those able to offer more attractive compensation packages...
>
> Second, we must reexamine the jobs of our computer professionals to determine what portion of their present assignments does not require any computer-related talents...
>
> Third, training and retention programs should be revamped. Institutions can offer special educational opportunities to its [sic] employees at marginal costs...
>
> Fourth, efforts should be made to reduce or eliminate labor intensive tasks...
>
> Fifth,...there will be a continuing trend for vendors not to locate software support staff at user sites but rather provide the services through a centralized response center... Hence a systematic plan must be developed to review all local [modifications] with a view of eliminating them...
>
> Finally, an environment should be created in which users can do more of their own computer-related work.[47]

Financing

In developing strategies for computing in colleges and universities, administrators must grapple with the problem of financing institutional needs. According to McCredie:

> Recent studies show that budgets for all types of computing services are now more than two billion dollars per year, which is slightly more than 2 percent of total higher education budgets; that approximately 90 percent of colleges and universities have access to some form of computing capability; and that about half of total academic computing expenditures is for administrative data-processing applications. Ten years ago administrative computing accounted for only about 34 percent of the total. Standardized software, when it exists, remains expensive and difficult to install.
>
> Instructional computing is funded at an inadequate level. In 1967, the President's Science Advisory Committee submitted Computers in Higher Education (the Pierce Report), which

estimated that about 30 hours per year of instructional computing, averaged over all students, would be required for undergraduate use. Recent studies indicate that only a very few schools are now achieving this level of support, and they spend $100 to $200 per student per year for instructional computing. Most provide less than one-third of this amount. During the past ten years, instructional computing dropped from 30 percent of computing budget to 25 percent. To improve this situation, large capital investments are required from an educational system that has been traditionally people, rather than capital, intensive.

New economic partnerships are needed to capitalize on the technological opportunities available now and in the near future. Federal support for campus computing is less than it was ten years ago. New relationships among institutions of higher learning, government, foundations, and industry must be developed...[48]

Van Horn also believes that higher education faces serious financing problems in the near future:

The most critical unresolved issue is how universities faced by stable enrollments and increasing costs will find the capital to invest in network-distributed computing systems. The capital investment per student for a reasonable 1985-1990 system ranges from a minimum of $1,000 at a liberal arts college up to as much as $6,000 at a high-technology school. At Carnegie-Mellon, with only 4,000 undergraduates and 1,500 graduate students, we expect to spend in excess of $20 million for equipment over the next five years. For any school, these investments are enormous. Parents and students already are strained with the tuition cost to keep universities operating. Financial and human resources are stretched to the limit. Universities, regardless of their level of commitment, are unlikely to be able to generate all the capital required. Even worse, they may not try.

A thoughtful program of federal matching grants for computing equipment can provide both the incentive for universities to commit additional capital of their own and the hope that the job is tractable...If done well, the program should contribute greatly to our national welfare.[49]

Support from industry is also an important element. According to Lewis M. Branscomb IBM vice president and chief scientist, "Considering that 60 percent of all basic scientific research is done

at universities, industry must offer research support in the form of financial help and equipment."[50]

The CAUSE 1980 survey of administrative information systems referred to earlier found that 70 percent of the responding institutions spend between 1 and 4 percent of their annual operating budget on administrative computing. Only 5 percent of those institutions report spending less than 1 percent, and about 25 percent report spending four percent or more. The differences are generally due to institutional size and the current state of development of computing systems at the institution.[51]

Gregory Jackson of Harvard University describes five modes for the internal financial management of computer resources within the organizational structure:

- Free access to computer resources to everyone within the organization. Has the advantage of encouraging use and ease of administration. Primary disadvantage is that service eventually deteriorates from overuse.
- Constrained free-access. Limits are placed on use such as hours per week. Major disadvantage is the introduction of administrative overhead.
- Funny money. A charging system which starts with a credit. No money changes hands. Use is controlled by allocation of resources to users.
- Machine cost chargeback. All hardware costs are charged directly to users.
- Full recovery of all computing costs including those charged to external users.[52]

Technological Trends

Strategic planning for computing in colleges and universities must take into account the technological changes which affect academic and administrative functions.

The trends identified by Stanford University apply to most institutions regardless of size:

> In general, the cost of computer components has been declining an average of 20-30 percent per year over the past two decades. This trend is expected to continue at least through this decade and is likely to continue well beyond that. However, the declining cost of the hardware has been, and will be, offset to some extent by the increasing cost of both software development and hardware maintenance. Processors are getting smaller, less expensive per instruction executed, and more reliable...

> Storage of data and information on a computer will soon be less costly than storage in paper files. The ability to rapidly search vast amounts of information and retrieve only what is needed will make this the preferred form of storage in most situations.
>
> Computer terminals have declined in price for given levels of functions but remain, on the whole, poorly designed for general use.
>
> Printers that provide letter-quality output with multiple character fonts and reasonable speed (500-1,000 lines per minute at office-copier prices are beginning to appear...
>
> Communications between terminals and computers have been improved in recent years, primarily through the more efficient use of conventional telephone lines...Local area networks using coaxial cables will permit very high speed information transmission rates on campus...
>
> Program development aids are emerging that lessen the need for trained specialists to act as intermediaries between the computer and the consumer...[53]

Chachra and Heterick believe that hardware costs will continue to decrease at the rate of 20 percent a year, but software and personnel costs will continue to increase at 8 percent a year.[54] If these trends continue, by 1989 the cost of hardware will be about 5 percent of total computing costs, and software and personnel 95 percent. They also recommend that university computing facilities directors maintain a very flexible position on installed equipment, which should be leased (not purchased) on short-term bases. They believe that the useful life of computer equipment should never be taken to be more than five years, with three years being a more accurate period.[55]

Organizational Structure and Management

An important element of a general campus computing strategy is the placement of the computer center within the organization and the leadership it receives. Jackson defines seven management modes for computer resources:

1. Students--in this mode students, through the strength of their political organization and demands for services, are in the key position to force the institution's allocation and direction of resources.
2. Decentralized faculty--a mode whereby faculty, who are removed from the nominal administrative hierarchy, have

sufficient power over the administration to sway policy and allocation of resources.

3. Pure kicker--a situation where someone outside the administrative structure "kicks" to get computer resources.
4. Low-level committee of faculty and/or administrators--reports up to others within the institution.
5. Manager reporting up--an individual with overall operating responsibility but who reports to someone higher up in organization.
6. Czar--a mode wherein one person has ultimate operations and policy responsibilities.
7. High-level committee--usually highly placed administrators (vice presidents, deans) who function as the main policy-setting body for computing decisions.[56]

Actual day-to-day management of campus computing resources can take a variety of forms. One model has one officer responsible for both academic and administrative computing. That officer may report upward to one person, usually either the chief academic officer or the chief business officer. Some institutions may have the computing director reporting to the academic vice president on academic computing matters and the business vice president on administrative computing.

Another model would involve one officer responsible for academic computing and another responsible for administrative computing. These officers might in turn report to one senior officer responsible for all computing or separately to the academic and business vice presidents. Another version of this model is to have a chief computing officer, responsible for all computing, at the vice president level reporting directly to the president of the institution. The responsibilities for managing computer resources may also be affected by whether the institution uses one large computer for both its administrative and academic computing, or has separate facilities to serve its administrative and academic users.

Technological change can place serious pressures on existing organizations, as Thomas points out:

> The organization of institutions is one of the first areas affected by technological change. The design and integration of administrative information systems will become more complex as institutions consider information to be a corporate resource necessary for planning and decision making in addition to supporting day-to-day operational needs...
>
> The proliferation of mini and microcomputers in departments other than traditional computer centers has created a great deal

> of organizational strain on some campuses. In some cases the cost of these "computer installations" is below the level requiring budgetary approval, so the central administration on many campuses does not even know how many computers are on campus...
>
> To receive maximum benefits from new technologies, many of the leading colleges and universities are assigning the responsibility for computing and other technological areas to a single administrative office or officer...it is most important for institutions to develop a "central focus for technology" and that this function report to the highest non-parochial level.[57]

Chachra and Heterick believe that at least for the next decade or two, top management will desire "to centralize, focus on, and attempt to capitalize on, information-related activities across the entire spectrum of the educational institution. In such an environment we would expect to see amplification and consolidation of information-related activities, resulting in a re-alignment of vice presidencies and the creation of a Vice Presidency for Information Systems."[58]

ADDITIONAL SIGNIFICANT LITERATURE

A review of literature in higher education on computer resources management, strategic planning for computing, and strategic models, yielded relatively few references. If any single work can be cited as seminal, it is Campus Computing Strategies, which grew from an EDUCOM staff study undertaken in 1981-82. This study is discussed below, followed by a discussion of a guide for computer planning developed by the American Association of Community and Junior Colleges and the Association of Community College Trustees.

EDUCOM's Study

EDUCOM decided to undertake its study because it felt that most colleges and universities are not organized to take advantage of the technological changes which are occurring in computing and computer-related fields. The study was structured as a set of case studies and a small set of comparative data. It was not intended to be statistically significant. The ten participating institutions were selected in a nonrandom way from a subset of innovative schools actively planning to face the "information revolution" affecting higher education and society in general. Participating institutions were not chosen to be representative of typical colleges and universities.[59]

The participating institutions were: the California State University System, Carnegie-Mellon University, Cornell University, Dartmouth College, Hamilton College, University of Iowa, University of Minnesota, Pepperdine University, Rensselaer Polytechnic Institute, and Stanford University. The only "small" institution in the group is Hamilton College.

The study identifies a set of assumptions which were common to all the participants and which shaped the plans and strategies of each:

- Creation, storage, retrieval, processing, use, and dissemination of information are the core of academic effort, and computer-based information processing activities are central to that effort.
- Information processing technology is fundamentally different, particularly in the academic environment from other technologies...Advanced systems today...are helping scholars discover new knowledge.
- The academic tradition is often viewed as antagonistic to strategic planning. However...planning for [information processing activities] is an important institutional activity in which leading faculty members and administrators must be involved.
- The costs of computer hardware capable of performing at a specified level will continue to decline...However, institutions in higher education must be prepared to make large incremental capital investments...
- Regardless of their area of expertise, faculty members, students, and administrators should have opportunities to learn about the capabilities of modern information processing systems.
- The convergence of computing and communications technologies will cause academic departments and activities that have not had much in common in the past to work together closely in the near future.
- ...the greatest future growth in computing will be in support of individuals who have not been represented in the traditional community of computer users.[60]

Much of the EDUCOM study dealt with the planning procedures and structures within each institution. These varied considerably with major differences appearing to depend on the type and duration of an institution's involvement with computing and the size of the organization. Technologically more mature institutions appeared more evolutionary in their approach than those moving rapidly into a computer-intensive environment from non-technical bases. Schools in

the former category strove for more consensus about future directions of computing than those in the latter group, where high-level advocacy seemed to be more important. Task forces to get exceptions from diverse constituencies were used within each institution.[61]

Although there existed significant differences among the institutions in size, missions, and management style, a number of common strategies were identified:

Organizational Structure. Eight of the institutions had a single administrative office or one individual to coordinate information-processing related issues. Of the remaining two, one was actively considering the creation of such a position.

Decentralization. All of the organizations were moving to a more decentralized information-processing environment. This trend does not necessarily imply that centralized facilities will cease to exist, or even get smaller, but that an increased amount of this processing activity will occur outside of the centralized facility.

Personal Computers. All of the organizations had, or were formulating, plans related to the growing potential of personal workstations for students, scholars, and administrators...

Networking. All ten campuses were involved with both local and national networking activities...Many faced major investments in telephone systems and were seeking to make sure investments would serve more than one purpose.

Library Automation. Once again, all of the schools had plans to deal with the convergence of computing and communications to help provide access to library resources.

Information Processing Literacy. Groups or task forces in each of the colleges and universities were studying what level of literacy for computing and communications activities is required of a well educated graduate in the 1980s...

Text Processing. In all ten institutions, text processing services were seen as important to academic computer literacy and to administrative support...

Electronic Mail. Several of the campuses had extensive electronic mail systems in operation, and most were actively considering how to provide this service in the future...[62]

Hamilton College, a prestigious liberal arts college in upstate New York, has a student enrollment of approximately 1600. As the only small institution participating in the EDUCOM study it provides an interesting contrast to the larger schools, if not a model for small colleges.[63]

Within the context of a small liberal arts college, barriers exist to supplying computing services which are more severe than in larger schools. Among them are: inability to take advantage of economics of scale; stiff competition from universities and industry for qualified employees; and a more limited financial environment within which to operate.

Hamilton does not have its own mainframe computer. Cornell provides it with access to computer resources found only on large computer systems, such as five different statistical packages, and five programming languages. More important than access to Cornell's hardware and software is access to its staff of computer professionals. Personnel sharing has strong economic incentives, especially for small institutions. It is not possible for a small liberal arts college to acquire enough in-house expertise to stay abreast of the changes in information processing. By maintaining a close relationship with Cornell, Hamilton benefits from its host's frequent capital investments in computing. Such exchanges also encourage scholarship among both faculties.

Hamilton is an EDUNET participant and utilizes the EFPM financial modeling system and other specialized resources which enable it to provide a wide range of services without having to wait for enough users to cost-justify the acquisition of resources locally.

In dealing with the problem of attracting competent staff, Hamilton uses cooperative arrangements which enable computer specialists to take on part-time teaching assignments.

Hamilton has acquired a number of microcomputers for academic computing, but it has also encountered some problems with them. The major problem is the need for hardware and software support for a variety of potential users. Also, users themselves must be willing to take greater responsibility for hardware problem recognition if equipment is to remain usable. Additionally, there will be new costs for maintenance and servicing, and space for groups of machines is often difficult to obtain.

In its library operation, Hamilton has identified five areas amenable to computerization. These are: original cataloging, maintenance of the catalog, inter-library lending, on-line data base searching for reference services, and circulation. Hamilton has access to over 200 data bases, and its reference librarians can conduct nationwide searches through the Telenet network. The

college expects to replace its manually updated catalog with a fully computerized on-line catalog.

Hamilton places great store in the quality of its administrative software. Since it is common to hire inexperienced personnel for vacant positions, it is important that their software tools be facile enough for effective use by such employees. Hamilton trades sophistication of software for experience of personnel.

Hamilton did not see itself as sophisticated in the field of office automation. Word processing had been used on microcomputers for several years at the time of the EDUCOM study, but the software had not been found sufficiently user-friendly for general office use. Hamilton believes that the integration of word and data processing will be important.

Hamilton has one officer in charge of both academic and administrative computing and believes this arrangement results in significant benefits for any small institution. Hamilton spends slightly more than 1 percent of its institutional budget on computing.

A Guide to Strategic Planning for Computing

This guide, developed by the American Association of Community and Junior Colleges and the Association of Community College Trustees's, is applicable to any type of institution. Its components are:

Assessing Present Conditions and Future Needs. Are users satisfied; do resources function up to par; how are peer institutions doing; is processing batch or on-line? How might computers improve efficiency; what services are needed and should be offered; how realistic is the budget?

Planning. Establish computer goals and priorities; consider all administrative software requirements; decide what priorities mean to budget, functions, and organization structure; specify who will make ultimate decisions; project personnel needs.

Priorities. Which will take precedence, academic or administrative; if administrative, which applications are most important; if academic, how much support will be provided to students? What budget restrictions exist?

Personnel/Organization. Do existing staff have expertise to upgrade and run system; how should computer organization function to respond to priorities; does quality and quantity of staff need to be upgraded; who will train employees; are present staff ready to train on a new system; does a user-liaison function exist; can

present staff handle enhancements; how will new resources be managed and governed?

Management/Governance. What does current governance structure look like; who sets user priorities; who is responsible for software development planning; is the computer center director a manager or a technician; to whom will he/she report; who will make basic personnel decisions; how can stability of senior management be maintained?

Hardware. What will new equipment do that old cannot; what new software will be needed/available; is on-line or batch processing best, and what impact on hardware will that choice have? Who can operate and program new equipment for maximum efficiency?

Budget. Can it be afforded; what is the opportunity cost; what are controls on overruns?[64]

SUMMARY

In all of these discussions, recurrent themes appear, suggesting major trends which will affect computing in higher education: the declining costs of computer hardware, the increased demand for computer-related education, communications between computers and computer-related equipment, sources of useful software, increased demand for decentralized computing, the serious shortage of professionals (both faculty and support staff), the need for library computerization. These issues will have significant impact on all of higher education, and must be particularly carefully considered by small institutions which do not have the resources to do much experimenting.

The survey summarized in the next chapters was designed to identify the pattern of computer services in use, or planned for the near future, in small colleges and universities. The strategic decision matrix created from the results of the survey should be a useful resource for any institution of limited means which is planning or implementing a computer services program.

FOOTNOTES

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CHAPTER TWO: Methodology

On the basis of his own experience and the comprehensive search of existing literature described in the preceding chapter and the Bibliography, the author was able to identify twelve strategic elements as the key issues in academic and administrative computing: (1) management/governance structure, (2) personnel-staff, (3) personnel-faculty, (4) academic computing, (5) library services, (6) networking, (7) word/text processing, (8) financing, (9) computer hardware, (10) communications, (11) administrative computing, and (12) computer security. An institutional strategy, whether overtly stated or not, is a mosaic of these twelve generic elements.

With these twelve issues in mind, the author developed a questionnaire to be sent to chief computing officers at small universities and colleges throughout the United States. The responses to the survey were used to construct a matrix of the prevailing computing strategies in use throughout the total survey population, according to budgetary groups determined by the total funds allocated to central computer services.

DELIMITATIONS OF THE STUDY

The subjects of the study were small public and privately supported universities and colleges. Larger institutions were not included because the need for both academic and administrative computing services was assumed to have been more integral to their operations in the past. Also, larger institutions were assumed to have made strategic computing decisions (and adopted strategies) as a result of economy-of-scale decisions necessitated by heavy demands for computer services. Larger institutions were also assumed to have greater absolute capital resources than small institutions and

thus to be in positions to adopt hardware, personnel, and facilities strategies which are beyond the resources of small universities and colleges, such as the acquisition of mainframe computers and in-house development of all administrative computing applications.

Small institutions were also thought to be more in danger of going out of business or of being forced to change their missions substantially, as a result of the declining traditional student enrollment base through 1994. Strategic computing decisions within the near future are assumed to have more profound influences on the mission, resources, and viability of small institutions than on larger ones.

The study was limited to small universities and colleges whose involvement with a professional association implied knowledge of and/or interest in computing. There are probably some postsecondary institutions with no involvement with computing. However, data from such schools would misleadingly skew those from others whose policies and practices can be analyzed for identification of prevailing strategies. In other words, this study was not intended to reflect all universities and colleges with enrollments under 5,000, but only those involved in computing.

IDENTIFICATION OF SURVEY POPULATION

There were a total of 3,150 colleges and universities in the United States in 1979. Of those, 1,208 had enrollments of under 1,000 students, and 1,257 had enrollments between 1,000 and 4,999. The total number of institutions with enrollments under 5,000 was 2,465.[1]

The survey population was determined by a non-random selection of those member institutions of CAUSE and EDUCOM with student enrollments of less than 5,000. CAUSE, the Professional Association for Computing and Information Technology in Higher Education, is a nonprofit service organization in higher education whose purpose is to promote effective management, use, and development of academic computing, administrative computing, and information technologies in colleges and universities. Its offices are located in Boulder, Colorado. EDUCOM is a nonprofit consortium of higher education and related institutions founded to facilitate the introduction, use, and management of information technology. Its offices are in Princeton, New Jersey.

In further determining the survey population, analyses were made of the 1983 membership lists of CAUSE and EDUCOM. These lists were compared with the enrollment information in the 1983 Higher Education Directory. The two lists were found to have 271 universities and colleges with enrollments under 5,000 students

among their approximately 900 member institutions. The survey was sent to all 271 institutions. The person to whom it was addressed in each case was the institutional representative to EDUCOM or CAUSE. When the name of the institutional representative was not known, the survey was addressed to the Chief Computing Officer.

A non-random selection method was used in order to identify a population of colleges and universities interested in computing. Their membership in the two leading computing organizations in higher education implies that interest. The non-random selection method may restrict the transportability of this study to other populations. Again, the study is not intended to reflect all universities and colleges, or all with enrollments under 5,000, but only those involved in computing.

PREPARATION OF THE SURVEY

The survey instrument was prepared in draft form on the basis of information obtained on the major strategic issues in higher education computing (see Chapter One), as well as the author's five years of experience as a college administrative vice president whose responsibilities include overseeing all campus computer services.

In order to validate the content of the survey instrument, a draft survey was sent to three senior higher education computing officers for review: John Phillippo, Stewart Irvin, and Nancy Yang. John Phillippo, of the State University of New York Central Administration, assists in and coordinates all major computer hardware, systems, and software decisions among the 64 universities and colleges of the State University of New York system--the largest higher education system in the world. He is the former chief computing officer of Hudson Valley Community College. Stewart Irvin is the Director of the Computer Center of the SUNY College of Technology at Utica/Rome and the former presiding officer of the SUNY computer officers' association. Nancy Yang is the Director of the Computer Center of the State University of New York at Purchase.

One of the reviewers responded by telephone and by letter with comments on the survey contents. The other two reviewers provided comments by telephone, and in person. All agreed on the twelve major strategic elements and all made suggestions for changes in the questions to be asked. The areas in which they made suggestions were: management or governance structure, financing, personnel (staff), personnel (faculty), networking, word/text processing, communications, administrative computing, and computer security. One suggestion resulted in the inclusion of the question on a Code of Ethics, a subject which had been overlooked by the author. The

original survey questionnaire had included boxes on the administrative computing applications matrix for respondents to indicate which systems shared integrated data bases. All the reviewers suggested that they be deleted as not usable, and not particularly relevant. They were deleted.

Although all three officers are in positions which would make them aware of strategic computing issues throughout higher education, they were advised that the population to be investigated was small universities and colleges. That awareness may have influenced their thinking on the content of the survey instrument. Therefore, the author believes that the findings of this study should be juxtaposed with data on other populations only after serious examination. The unique nature of higher education computing, particularly its academic component, makes comparison with strategic models in other industries difficult, if not impossible.

TREATMENT OF THE DATA

The survey instrument and an accompanying letter of explanation were sent to the 271 small universities and colleges previously identified on March 19, 1984. A total of 105 responses were received. Of that number, one college responded by letter indicating that they did not have time to complete the survey; another answered the survey but indicated that its enrollment exceeded 5,000--it was not included in the survey response data. The net usable responses totaled 103, representing 38.0 percent of the colleges and universities surveyed.

The survey response data were grouped within parameters of total dollars of institution budget allocated to centrally-provided computing services. The groupings (budget parameters) are:

- $0 through $200,000
- $200,001 through $400,000
- $400,001 through $600,000
- $600,001 through $800,000
- Over $800,000
- All responses

  (NOTE: This figure is not the same as the sum of the responses in individual categories. Some responses omitted budgetary information.)

The author decided on the total budget for centrally-provided computer services as the most easily obtainable data not subject to individual interpretation. It was believed that the chief computing officer at each college and university would know his/her

own budget and would probably know the institution's operating budget as well. Consideration was given to using a different parameter, computing support per student. However, this was eliminated because there are several ways in which student statistics can be defined, i.e., by headcount or by full-time equivalency (FTE). Since it is possible that there might be a great disparity between student headcount and FTE from institution to institution, and the respondents might not be aware of the difference between the two definitions, the author felt that cost-per-student was not a viable measurement.

The parameters used provide the reader with a means of comparing any institution to the survey population on the basis of dollars spent on centrally-provided computing services. In addition, these parameters allow comparison with other data on computing in higher education, such as the CAUSE study referenced in Chapter One. The author believes that no other parameter(s) would allow comparison of the results of this study with those of previous studies, and that other measures such as cost-per-student would be affected by questions of definition.

The data from each survey response were collated within ranges of total dollars spent on central computing services, and among all responses. An analysis was made of the responses to each question within each group to determine the most prevalent strategy in use or planned for administrative and academic computing. (The prevalent strategy is that which is used more frequently than any other within each budgetary group and among the total population.) A similar analysis was made from all the responses to determine the prevalent strategy on each point by all the small universities and colleges within the responding population. The prevalent strategies thus identified are included in the Strategic Decision Matrix which begins on page 83. Where other data are available, or expert commentary exists on particular strategies, reference is made to them in Chapter Four, which also includes appropriate conclusions and recommendations.

CHAPTER THREE:
Survey Results

The survey questionnaire was sent to 271 colleges and universities with student enrollments of 5,000 or less. A total of 104 survey responses were returned, although one was not included in the results as the institution indicated its current enrollment to be above 5,000. The net usable responses (103) represented 38.0 percent of the survey population. A list of institutions which responded may be found in the Appendix. Responses in each of these categories are summarized below.

SUMMARY OF RESPONSES

The questionnaire, a sample of which is included after the list of survey respondents in the Appendix, was composed of eighty-three questions on institutional profile, management/governance structure, personnel-staff, personnel-faculty, academic computing, library, networking, word/text processing, financing, hardware, communications, administrative computing, and computer security.

Institutional Profile of Respondents

The survey of responses indicated that 40 percent of the institutions were publicly supported (i.e., by state or local government unit), and 60 percent were independent or privately-supported.

With respect to the highest degree granted by the college or university, the responses indicated that the associate's degree was awarded at 18 percent, the bachelor's degree at 41 percent, the master's degree at 33 percent, and the doctoral degree was the highest degree awarded at 8 percent of the responding institutions.

Student enrollment ranged from a low of 400 to a high of 5,000. The mean enrollment of the respondents was 2,226. The total insti-

Table 1. Institutional profile of respondents by percent of budget allocated to computing, by total dollars allocated to computing, and for all respondents.

Range and (Mean)	N	Status		Highest Degree				Enrollment			Total Budget (Millions)			Computer Budget (000)		
		Public	Ind	A	B	M	D	Low	High	Mean	Low	High	Mean	Low	High	Mean
Percent of Budget																
0-1.00 (0.88%)	7	1	6	1	4	2	0	800	1300	1060	3.5	16.3	8.55	55.0	151.1	75.3
1.01-2.00 (1.66%)	31	8	23	3	16	10	2	400	5000	1869	4.0	43.5	15.01	20.0	581.0	248.7
2.01-3.00 (2.61%)	20	7	13	2	10	4	4	635	5000	2797	5.0	60.0	20.14	120.0	1500.0	508.4
3.01-4.00 (3.58%)	11	8	3	4	2	5	0	670	5000	2750	5.9	40.0	12.77	200.0	1000.0	450.6
4.01-5.00 (4.73%)	6	5	1	2	1	2	1	900	3100	2733	5.3	28.0	12.85	230.0	1500.0	501.7
Over 5.00 (5.56%)	9	6	3	4	1	3	1	2200	4300	2988	3.5	23.0	12.46	180.0	1200.0	697.8
Computing Budget ($000)																
0-200 (158.4)	30	7	23	6	16	8	1	620	3800	1368	3.5	16.3	7.67	20.0	200.0	120.3
200-400 (264.1)	30	17	13	7	11	9	3	400	4200	2458	5.3	33.0	12.69	218.0	400.0	314.0
400-600 (514.6)	15	9	6	2	8	5	0	1350	5000	2600	6.0	43.5	20.81	413.0	600.0	514.6
600-800 (725.0)	4	1	3	0	1	2	1	2890	5000	4097	13.6	26.6	22.48	700.0	750.0	725.0
Over 800 (1193.8)	8	1	7	1	0	4	3	2600	5000	3687	15.0	60.0	32.38	900.0	1500.0	1193.8
All Responses (2.61%)	103	42	61	19	42	34	8	400	5000	2226	3.5	60.0	14.90	20.0	1500.0	389.1

FIGURE 1: Scatter Diagram

Relationship of Total Operating Budget
to Total Computing Budget

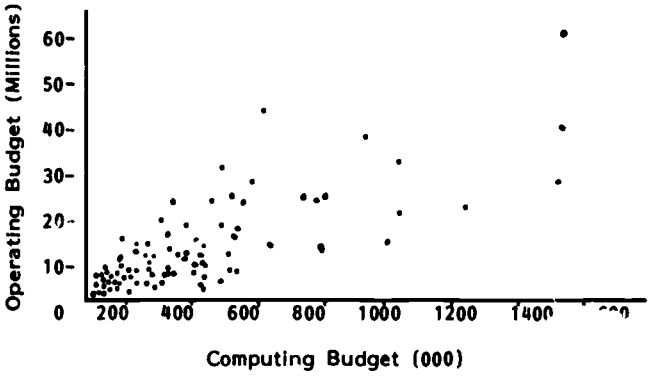
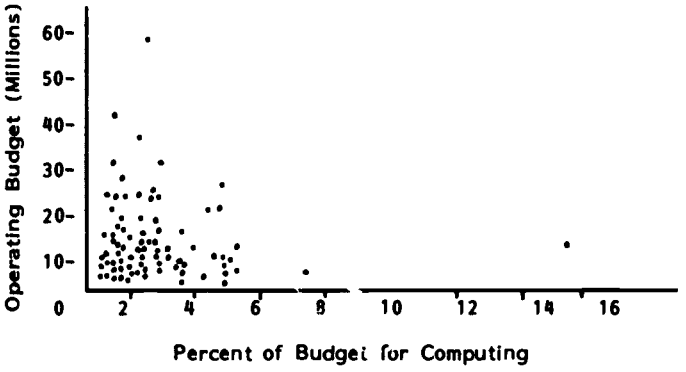


FIGURE 2: Scatter Diagram

Relationship of Total Operating Budget
to Percent of Budget Allocated to Computing



tutional operating budget ranged from $3.5 million to $60 million with the mean being $14.90 million. The total computer center operating budget for administrative and academic computing ranged from a low of $20,000 to a high of $1,500,000. The mean was $389,100. The percent of total operating budget allocated to computing varied from 0.70 percent to 15.80 percent with the mean being 2.61 percent. Table 1 indicates the profile of responses in each of the percentage and total dollar ranges used in this study. In the following tabulations, the sum of responses in each grouping does not equal the total responses received due to some responses omitting data on total operating budget or computer center budget.

Management/Governance Structure

This section of the survey asked 12 questions (numbers 8-19) about the decision-making structure in each institution, how that structure functioned at the time of the survey, and whether any changes were planned. The responses to each question are broken down by total funds allocated to computing, and by all respondents.

QUESTIONS 8 and 9 sought to determine whether the two main functions of computing in colleges and universities--academic and administrative--are unified or split.

8. Is one officer responsible for directing both academic and administrative computing?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	48	52
$200,001-$400,000	29	67	33
$400,001-$600,000	14	57	43
$600,001-$800,000	4	50	50
Over $800,000	8	50	50
All Respondents	100	52	48

9. Are you aware of any plans to separate or unify the two functions?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	7	93
$200,001-$400,000	30	7	93
$400,001-$600,000	15	13	87
$600,000-$800,000	4	25	75
Over $800,000	8	13	87
All Respondents	100	8	92

QUESTIONS 10 and 11 related to the reporting relationship of the chief computing officer. Respondents were asked to indicate to whom they respond: the President (P), the Chief Academic Officer (CAO), the Chief Business Officer (CBO), or Other (O). A number of those indicating Other listed a split (S) reporting relationship, most frequently with the academic function reporting to the Chief Academic Officer and the administrative function reporting to the Chief Business Officer. Number of responses (N) for QUESTION 10 and the number reporting to each officer follow:

Budget Parameters	N	P	CAO	CBO	O	S
0-$200,000	31	8	8	11	4	0
$200,001-$400,000	29	6	6	10	2	5
$400,001-$600,000	16	2	3	8	2	1
$600,001-$800,000	4	0	1	2	0	1
Over $800,000	7	0	2	1	1	3
All Respondents	103	22	28	34	7	12

11. If any change in reporting is planned, who will the chief computing officer report to?

Budget Parameters	N	P	CAO	CBO	O	S
0-$200,000	3	1	0	1	1	0
$200,001-$400,000	3	1	0	1	0	1
$400,001-$600,000	3	2	1	0	0	0
$600,001-$800,000	0	0	0	0	0	0
Over $800,000	0	0	0	0	0	0
All Respondents	12	5	1	6	0	0

QUESTIONS 12 and 13 were intended to identify the individual or group of persons responsible for setting overall computing policy, and for making major computer resource decision recommendations to the chief executive officer of the college community. Since some institutions were presumed to use committees to consider such matters, the respondents were asked to indicate either the officer or type of committee with such responsibility. The choices were: Faculty Committee (FAC); Staff (or non-faculty) Committee (STAFF); Mixed (both faculty and staff, or President's cabinet) Committee (MIX); Computer Center Director (CCD); Chief Academic Officer (CAO); Chief Business Officer (CBO); or Other.

12. What group or individual is responsible for setting overall institution computing policy, i.e., making final recommendations to the President?

Budget Parameters	N	FAC	STAFF	MIX	CCD	CAO	CBO	O
0-$200,000	30	2	1	10	6	3	6	2
$200,001-$400,000	28	0	3	14	2	2	5	2
$400,001-$600,000	15	1	1	5	6	0	2	0
$600,001-$800,000	4	0	0	1	0	0	2	1
Over-$800,000	8	0	0	2	3	1	0	2
All Respondents	102	3	6	38	26	8	13	8

13. Who is responsible for making major computer resource decisions, such as major hardware acquisition or software development/acquisitions?

Budget Parameters	N	FAC	STAFF	MIX	CCD	CAO	CBO	O
0-$200,000	31	1	1	9	11	3	3	3
$200,001-$400,000	30	2	1	9	12	0	3	3
$400,001-$600,000	13	0	1	5	3	0	2	2
$600,001-$800,000	3	0	0	1	2	0	0	0
Over-$800,000	8	0	0	2	3	1	0	2
All Respondents	100	3	3	28	38	7	11	10

QUESTIONS 14 through 17 were intended to determine how the respondents dealt with decisions regarding the acquisition of computer resources (such as microcomputers) for decentralized use, i.e., outside the central campus computing center.

14. Is there centralized control over acquisition of computer resources for decentralized use, such as microcomputers?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	30	67	33
$200,001-$400,000	30	83	17
$400,001-$600,000	14	93	7
$600,001-$800,000	4	75	25
Over $800,000	8	88	12
All Respondents	103	81	19

15. If Yes (to QUESTION 14), who exercises such control?

Budget Perameters	N	FAC	STAFF	MIX	CCD	CAO	CBO	O
0-$200,000	23	1	0	6	7	6	1	2
$200,001-$400,000	26	0	0	10	13	0	3	0
$400,001-$600,000	14	1	0	5	8	0	0	0
$600,001-$800,000	3	0	0	1	2	0	0	0
Over $800,000	7	0	0	3	2	1	0	1
All Respondents	83	2	0	26	39	9	4	3

16. Does your institution plan to decentrelize microcomputer acquisition decision making to users?

Budget Perameters	N	YES(%)	NO(%)
0-$200,000	27	7	93
$200,001-$400,000	26	19	81
$400,001-$600,000	15	27	73
$600,001-$800,000	4	0	100
Over $800,000	7	29	71
All Respondents	96	16	84

17. Is the computer center consulted on decentralized computer services?

Budget Perameters	N	YES(%)	NO(%)
0-$200,000	27	67	33
$200,001-$400,000	27	93	7
$400,001-$600,000	13	85	15
$600,001-$800,000	4	100	0
Over $800,000	8	88	12
All Respondents	95	84	16

QUESTIONS 18 and 19 were intended to determine where the survey respondents had placed the greater priority, on academic or administrative computing, to date. Also, they were asked to indicate if their institution had any plan to change the emphasis.

18. To date, in which area have computer resources been more emphasized?

Budget Parameters	N	ACADEMIC(%)	ADMINISTRATIVE(%)	EVENLY DISTRIBUTED
0-$200,000	30	10	50	40
$200,001-$400,000	30	10	23	67
$400,001-$600,000	15	13	27	60
$600,001-$800,000	4	0	25	75
Over $800,000	8	25	13	62
All Respondents	103	15	30	55

19. Does your institution plan to change the emphasis? Which area will receive more emphasis, less emphasis, no change?

Budget Parameters	ACADEMIC More	ACADEMIC Less	ADMINISTRATIVE More	ADMINISTRATIVE Less	NO CHANGE IN EMPHASIS
0-$200,000	13	0	3	1	16
$200,001-$400,000	10	0	2	2	15
$400,001-$600,000	4	0	1	0	10
$600,001-$800,000	2	0	0	1	2
Over $800,000	2	0	1	1	5
All Respondents	37	1	11	6	55

Personnel-Staff

This section of the survey asked ten questions about staff (non-faculty) employees in campus computer centers. The questions were intended to determine staffing levels, plans to change current levels, recruiting practices, use of part-time employees, and salary structure changes.

20. Please indicate the number of FTE (full-time equivalent) computer center staff by classification: Management; Analyst/Programmer; Systems Programmer; Operations; Secretarial/Clerical; and Total Staff. (Number shown below is mean number.)

Budget Parameters	N	MANAGEMENT	ANALYST/ PROGRAM	SYSTEMS ANALYST	OPERATIONS	SECRETARIAL/ CLERICAL	TOTAL
0-$200,000	31	1.15	.58	.19	.76	.37	3.09
$200,001-$400,000	29	1.29	2.04	.89	1.72	.95	6.96
$400,001-$600,000	15	1.73	2.77	.67	2.51	1.09	8.77
$600,001-$800,000	4	2.50	2.75	1.75	2.50	3.50	13.00
Over $800,000	8	2.62	6.06	1.19	4.13	2.00	16.00
All Respondents	102	1.40	1.99	.67	1.90	.94	6.82

21. If your institution plans to increase/decrease staff in the next year, please indicate FTE change: Management; Analyst/Programmer; Systems Programmer; Operations; Secretarial/Clerical; and Total.

NUMBER OF INSTITUTIONS (N) WHICH PLAN TO INCREASE OR DECREASE STAFF IN THE NEXT YEAR

Budget Parameters	N	MANAGEMENT	ANALYST/ PROGRAM	SYSTEMS ANALYST	OPERATIONS	SECRETARIAL/ CLERICAL	TOTAL
0-$200,000	11	3.50	3.00	1.25	+4.50 -1.00	0	11.25
$200,001-$400,000	13	1.00	+11.50 -1.00	5.00	3.00	1.50	24.00
$400,001-$600,000	6	4.00	3.00	1.00	4.85	1.00	12.85
$600,001-$800,000	3	1.00	6.00	3.00	0	0	10.00
Over $800,000	5	3.00	8.00	1.00	6.00	1.00	19.00
All Respondents	43	13.50	36 .50	13.25	21.35	6.50	91.10

QUESTION 22 was intended to find out how computer center staff were allocated between academic and administrative functions. The percents listed below are the means by group.

22. What percent of total computer center positions are predominately academic support, and administrative?

Budget Parameters	N	ACADEMIC(%)	ADMINISTRATIVE(%)
0-$200,000	28	25	75
$200,001-$400,000	24	38	62
$400,001-$600,000	14	18	82
$600,001-$800,000	4	33	67
Over $800,000	8	44	56
All Respondents	92	30	70

QUESTIONS 23-25 were intended to determine if the respondents had had difficulty in recruiting computer center staff within the past year, the most difficult position classification(s) to recruit for, and the best source(s) for recruiting professional staff. Respondents were asked to rank by number (1-5 and 1-4) the most difficult classification to recruit for (QUESTION 24) and the best recruitment source (QUESTION 25). The number of responses in each group is N. The lower the accompanying number the more important.

23. Have you had difficulty in recruiting computer center staff within the past year?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	28	18	82
$200,001-$400,000	29	34	66
$400,001-$600,000	15	27	73
$600,001-$800,000	4	50	50
Over $800,000	8	63	37
All Respondents	101	29	71

24. If Yes (to QUESTION 23), please indicate by the order of difficulty, most difficult = 1, least difficult = 5.

	MANAGEMENT		ANALYST/ PROGRAM		SYSTEMS ANALYST		OPERATIONS		SECRETARIAL/ CLERICAL	
Budget Parameters	N	Rating	N	Rating	N	Rating	N	Rating	N	Rating
$0-$200,000	1	2.00	4	1.00	-	-	-	-	2	4.00
$200,001-$400,000	8	1.75	8	1.88	8	1.88	7	2.86	5	4.60
$400,001-$600,000	4	2.25	4	2.50	3	2.00	4	3.50	4	4.00
$600,001-$800,000	1	1.00	2	1.00	1	2.00	-	-	-	-
Over $800,000	2	2.00	5	2.20	3	2.67	3	3.67	2	5.00
All Respondents	17	1.88	23	1.87	27	2.15	14	3.21	15	3.80

25. Please indicate your best source of recruiting professional staff (best=1): National Searches; Regional Searches; Alumni; Professional Contacts.

	NATIONAL SEARCHES		REGIONAL SEARCHES		ALUMNI		PROFESSIONAL CONTACTS	
Budget Parameters	N	Rating	N	Rating	N	Rating	N	Rating
$0-$200,000	1	4.00	11	1.36	7	1.57	13	1.23
$200,001-$400,000	7	2.00	18	1.39	11	1.92	12	1.42
$400,001-$600,000	2	2.00	10	1.10	3	1.33	3	2.00
$600,001-$800,000	2	1.00	4	1.50	1	4.00	1	3.00
Over $800,000	2	2.50	7	1.71	2	2.50	4	1.50
All Respondents	16	2.13	53	1.49	25	2.00	39	1.38

QUESTIONS 26 and 27 were asked to find out if institutions have attempted to solve professional staffing problems by hiring

part-time employees, and if the respondents had any plan to begin to use or increase the use of part-time professionals.

26. Do you employ part-time professional staff?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	38	62
$200,001-$400,000	30	43	57
$400,001-$600,000	15	20	80
$600,001-$800,000	4	75	25
Over $800,000	8	63	37
All Respondents	103	41	59

27. Do you plan to begin to use or increase use of part-time professionals?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	28	29	71
$200,001-$400,000	29	24	76
$400,001-$600,000	15	13	87
$600,001-$800,000	4	50	50
Over $800,000	8	25	75
All respondents	100	25	75

QUESTIONS 28 and 29 were asked to identify whether the survey participants had altered (or plan to alter) their salary structure to aid the recruitment/retention of professional computer staff. The answers to both questions are combined below.

28. Has the institution's professional salary structure been altered to recruit/retain computer staff?

29. If No (to 28), is such a change planned in the near future?

	STRUCTURE HAS BEEN ALTERED			PLAN TO ALTER STRUCTURE		
Budget Parameters	N	YES(%)	NO(%)	N	YES(%)	NO(%)
0-$200,000	28	21	79	23	9	91
$200,001-$400,000	30	30	70	20	15	85
$400,001-$600,000	14	43	57	8	14	86
$600,001-$800,000	4	50	50	2	50	50
Over $800,000	8	63	37	2	50	50
All respondents	98	32	68	63	13	87

Personnel-Faculty

QUESTIONS 30-37 were asked to determine institution personnel policies with respect to faculty. Specifically, the intent was to explore the full-time, part-time nature of the faculty, the academic standards used for employing computer-related faculty, the use of staff and non-technical faculty to teach computer courses, faculty retraining practices, alteration of faculty salary structures, and plans for the hiring of additional computer-related faculty.

30. What percentages of computer-related courses are taught by full-time, part-time faculty?

Budget Parameters	N	FULL-TIME(%)	PART-TIME(%)
0-$200,000	28	79	21
$200,001-$400,000	28	83	17
$400,001-$600,000	11	89	11
$600,001-$800,000	4	86	14
Over $800,000	7	84	16
All respondents	91	83	17

31. Do all faculty have advanced degrees in computer science, information science, engineering, mathematics, or related disciplines?

Budget Parameters	N	YES(%)	NO(%)	DON'T KNOW
0-$200,000	27	37	59	4
$200,001-$400,000	30	47	33	20
$400,001-$600,000	14	64	29	7
$600,001-$800,000	4	50	25	25
Over $800,000	8	75	25	0
All Respondents	98	49	41	10

32. Do computer center professional staff also serve as teaching faculty?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	30	47	53
$200,001-$400,000	29	38	62
$400,001-$600,000	14	21	79
$600,001-$800,000	4	75	25
Over $800,000	10	20	80
All Respondents	102	40	60

QUESTIONS 33 and 34 were intended to determine whether non-teaching faculty have been retrained (or whether there is any plan to retrain faculty) so that they could teach computer-related courses. The responses to both questions appear below.

33. Have any non-technical faculty been retrained to teach computer-related courses?

34. Does your institution plan to retrain any/more faculty for such teaching?

	HAVE RETRAINED FACULTY			PLAN TO RETRAIN		
Budget Parameters	N	YES(%)	NO(%)	N	YES(%)	NO(%)
0-$200,000	29	38	62	26	35	65
$200,001-$400,000	29	45	55	26	42	58
$400,001-$600,000	13	15	85	12	9	91
$600,001-$800,000	4	100	0	4	75	25
Over $800,000	10	30	70	8	63	37
All Respondents	95	42	58	91	36	64

QUESTIONS 35 and 36 were intended to find out if faculty salary structures had been altered or if such changes were planned among the participating colleges and universities. Responses to both questions are combined below.

35. Has the institution's faculty salary structure been altered to recruit/retain technical faculty?

36. If No, is such a change planned in the near future?

	STRUCTURE HAS BEEN ALTERED			PLAN TO ALTER STRUCTURE		
Budget Parameters	N	YES(%)	NO(%)	N	YES(%)	NO(%)
0-$200,000	29	14		23	9	91
$200,001-$400,000	30	30	70	17	18	82
$400,001-$600,000	13	7	93	10	10	90
$600,001-$800,000	4	50	50	2	0	100
Over $800,000	8	50	50	3	0	100
All Respondents	95	22	78	65	9	91

QUESTION 37 was asked to find out if the respondent institutions planned to hire additional faculty to meet the student interest in computer-related courses.

37. Does your institution plan to hire additional computer-related faculty?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	26	62	38
$200,001-$400,000	27	78	22
$400,001-$600,000	13	62	38
$600,001-$800,000	4	100	0
Over $800,000	8	100	0
All Respondents	91	71	29

Academic Computing

QUESTIONS 38-46 were asked to identify the importance given to academic computing within the overall mission of the respondents, plans to increase current computer-related course offerings, size of such enrollments, expectations of offsetting negative demographic factors through computer-related enrollments, computer literacy programs,and computer-related degree programs and majors.

38. Is computer-related instruction mentioned as a high priority in your college/university mission statement? (Comparable to statement of goals and objectives.)

Budget Parameters	N	YES(%)	NO(%)	DONT'T KNOW(%)
0-$200,000	30	37	56	7
$200,001-$400,000	30	60	40	0
$400,001-$600,000	14	57	43	0
$600,001-$800,000	4	50	50	0
Over $800,000	8	50	50	0
All Respondents	94	47	48	5

QUESTIONS 39-41 were intended to find out if the survey participants planned to increase computer-related courses; if so, by what percentage; and the current number of computer-related enrollments each semester. The combined responses are shown below.

39. Does your institution plan to increase the number of computer-related course offerings?

40. If Yes (to 39), by what percent will such offerings increase?

41. Approximately how many enrollments are there in computer-related courses each semester?

	PLAN TO INCREASE COMPUTER-RELATED COURSE OFFERINGS			IF YES PERCENT INCREASE		CURRENT SEMESTER ENROLLMENTS	
Budget Parameters	N	YES(%)	NO(%)	N	%(MEAN)	N	MEAN
0-$200,000	29	90	10	14	33	26	245
$200,001-$400,000	30	93	7	12	48	25	499
$400,001-$600,000	14	86	14	5	14	9	651
$600,001-$800,000	4	100	0	3	9	4	813
Over $800,000	6	100	0	3	17	7	779
All Respondents	95	91	9	42	41	85	450

QUESTION 42 was intended to determine if the colleges and universities believed that increased computer-related enrollments would substitute for enrollment declines caused by other factors, such as demographics.

42. Does your institution believe that increased computer-related enrollment will offset other enrollment declines, such as those caused by the decreased number of traditional college-age students?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	27	52	48
$200,001-$400,000	26	50	50
$400,001-$600,000	12	42	58
$600,001-$800,000	4	50	50
Over $800,000	8	63	37
All Respondents	90	56	44

QUESTIONS 43 and 44 were asked to find out if the respondents had instituted formal computer literacy programs for faculty, staff, and students; and if they planned to institute or enhance such efforts. The responses are shown below.

43. Do you have formal computer literacy programs for Faculty, Staff, Students?

44. Do you plan to institute or enhance such programs?

	FOR FACULTY			FOR STAFF			FOR STUDENTS			PLAN TO INSTITUTE OR ENHANCE		
Budget Parameters	N	Yes	No	N	Yes	No	N	Yes	No	N	Yes	No
0-$200,000	30	43%	57%	28	32%	68%	28	64%	36%	29	69%	31%
$200,001-$400,000	29	59%	41%	29	52%	48%	28	54%	46%	26	77%	23%
$400,001-$600,000	13	31%	69%	13	31%	69%	13	31%	69%	13	92%	8%
$600,001-$800,000	3	100%	0	4	100%	0	4	100%	0	3	100%	0
Over $800,000	8	50%	50%	8	37%	63%	8	63%	37%	8	75%	25%
All Respondents	97	51%	49%	94	43%	57%	97	57%	43%	93	80%	20%

QUESTIONS 45 and 46 were intended to find out the extent to which the respondents had computer-related degree programs and the degree to which they planned to offer new majors. The responses are indicated below, and N equals the total number of respondents in each grouping.

45. Do you have degree programs in any of the following areas? Computer science, computer engineering, information science, management information systems, and data processing. (More than one response per institution possible.)

46. Does your institution plan to offer any new computer-related majors?

Budget Parameters	N	COMPUTER SCIENCE	COMPUTER ENGINEERING	INFO SCIENCE	MIS	DATA PROCESSING	NEW MAJORS Yes	No
0-$200,000	28	17	1	2	4	7	8	22
$200,001-$400,000	31	20	0	5	5	8	9	20
$400,001-$600,000	15	10	0	0	0	3	5	9
$600,001-$800,000	4	4	2	1	3	1	1	3
Over $800,000	8	6	5	1	4	1	5	3
All Respondents	102	68	9	10	19	19	33	66

Library

The survey asked two questions (47-48) about library services to determine the extent to which the respondents have computerized, and plan to computerize or enhance within the next year. The operations mentioned in the survey were cataloging, circulation, bibliographic search, serials control, and interlibrary loans. The responses to the survey appear below, and N equals the number of respondents in each group. The number in each column represents actual responses, not percentage.

Budget Parameters	N	CATALOGING Now	CATALOGING Planned	CIRCULATION Now	CIRCULATION Planned	BIBLIOGRAPHIC SEARCH Now	BIBLIOGRAPHIC SEARCH Planned	CONTROL Now	CONTROL Planned	INTERLIBRARY LOANS Now	INTERLIBRARY LOANS Planned
$0-$200,000	31	10	6	2	9	11	3	4	5	10	3
$200,001-$400,000	29	13	4	3	9	17	3	9	4	11	0
$400,001-$600,000	15	5	7	3	2	8	0	4	0	8	0
$600,001-$800,000	4	2	0	2	0	2	2	1	0	1	1
Over $800,000	8	4	1	3	1	5	1	2	1	6	0
All Respondents	102	39	23	16	25	45	12	24	14	40	7

Networking

QUESTIONS 49 and 50 ask for information on college and university access to national or regional computer networks for library and other uses, and plans to obtain initial or additional access to networks.

49. Do you have access to national or regional computer networks for Library, Other Uses?

50. Do you plan to obtain initial or additional network access within the next year?

Budget Parameters	LIBRARY ACCESS Yes(%)	LIBRARY ACCESS No(%)	OTHER USES Yes(%)	OTHER USES No(%)	PLAN NEW/ ADDITIONAL ACCESS Yes(%)	PLAN NEW/ ADDITIONAL ACCESS No(%)
0-$200,000	63	37	40	60	28	72
$200,001-$400,000	72	28	67	33	52	48
$400,001-$600,000	86	14	62	38	62	38
$600,001-$800,000	100	0	33	67	50	50
Over $800,000	86	14	86	14	50	50
All Respondents	73	27	54	46	44	56

Word/Text Processing

QUESTIONS 51-55 were intended to determine the types of equipment in use for both academic and administrative word/text processing at small universities and colleges, the types of equipment they expect to increase or decrease in importance, policies with respect to student use of institution equipment and facilities for such use, and whether students will be required to obtain computers or computer time for their personal use.

51. Please check the types of equipment your institution uses for administrative and academic word/text processing. (Actual responses, not percentages, are indicated below. More than one type of equipment may be used by an institution.)

Budget Parameters	N	MAINFRAME	MINI	MICRO	SINGLE-PURPOSE WP	NONE OF ABOVE
0-$200,000	30	7	15	25	20	0
$200,001-$400,000	30	7	18	26	20	0
$400,001-$600,000	15	8	6	11	11	0
$600,001-$800,000	4	2	2	2	2	0
Over $800,000	8	6	6	8	7	0
All Respondents	103	35	56	81	72	0

52. Please indicate types of equipment you expect to increase (+) or decrease (-) in importance for administrative and academic word/text processing. (Actual responses, not percentages, indicated.)

		MAINFRAME		MINI		MICRO		SINGLE-PURPOSE WP	
Budget Parameters	N	+	-	+	-	+	-	+	-
0-$200,000	30	4	1	9	1	21	0	5	7
$200,001-$400,000	30	6	0	12	2	23	1	6	2
$400,001-$600,000	15	5	2	4	1	10	0	6	2
$600,001-$800,000	4	0	1	3	0	2	0	2	0
Over $800,000	8	2	2	3	2	8	0	2	1
All Respondents	103	18	7	36	5	72	2	24	12

53. Do you permit student use of mainframe/minicomputer resources for word processing of papers, reports, etc.?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	31	35	65
$200,001-$400,000	30	53	47
$400,001-$600,000	15	60	40
$600,001-$800,000	4	75	25
Over $800,000	8	63	37
All Respondents	101	49	51

54. Are you planning to install initial or additional microcomputers for student word processing?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	38	62
$200,001-$400,000	28	68	32
$400,001-$600,000	15	73	27
$600,001-$800,000	4	75	25
Over $800,000	8	87	13
All Respondents	100	63	37

55. Will students be required to purchase central computer time or microcomputers for personal use?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	3	97
$200,001-$400,000	30	7	93
$400,001-$600,000	13	7	93
$600,001-$800,000	4	0	100
Over $800,000	8	13	87
All Respondents	98	5	95

Financing

Ten questions (56-65) were asked to identify small college and university financing policies with respect to computing. The intent was to determine the institutional priority given to computing and whether increased support to computing had a high priority. In addition, questions were asked to determine policies with respect to the recovery (charge-back) of computing costs from users, the presence of mechanisms to "sell" computing time to students, and the sale of computing resources to off-campus users.

56. Has the total central computing budget growth in recent years matched, exceeded, or lagged behind the inflation rate?

Budget Parameters	N	MATCHED(%)	EXCEEDED(%)	LAGGED(%)	DON'T KNOW(%)
0-$200,000	30	13	33	44	10
$200,001-$400,000	28	7	39	50	4
$400,001-$600,000	14	21	29	43	7
$600,001-$800,000	4	0	50	25	25
Over $800,000	8	0	62	25	13
All Respondents	100	12	39	38	11

57. Has it done better, worse, or the same as the college/university as a whole?

Budget Parameters	N	BETTER(%)	WORSE(%)	SAME(%)	DON'T KNOW(%)
0-$200,000	30	53	13	28	7
$200,001-$400,000	29	48	24	28	2
$400,001-$600,000	15	20	7	67	6
$600,001-$800,000	4	50	25	25	0
Over $800,000	7	86	0	0	14
All Respondents	97	56	8	27	8

58. Has increasing the computing budget been given a high priority by the institution's administration?

Budget Parameters	N	YES(%)	NO(%)	DON'T KNOW
0-$200,000	31	48	52	0
$200,001-$400,000	29	79	21	0
$400,001-$600,000	15	60	27	15
$600,001-$800,000	4	75	25	0
Over $800,000	8	63	25	12
All Respondents	103	63	33	4

QUESTIONS 59 and 60 addressed current practices on charging computer service expenditures back to users, and asked if there were any plans to change current practice. The responses are shown below.

59. Are computer service expenditures charged back to users partially, fully, not at all, or on an internal cost accounting ("funny money") basis?

Budget Parameters	N	PARTIALLY(%)	FULLY(%)	NOT AT ALL(%)	FUNNY MONEY(%)
$0-$200,000	31	26	3	58	13
$200,001-$400,000	30	17	10	47	27
$400,001-$600,000	15	20	0	65	15
$600,001-$800,000	4	25	0	50	25
Over $800,000	8	25	0	37	38
All Respondents	102	22	4	52	22

60. If any change is planned in charging back, please indicate the practice to be adopted.

Budget Parameters	N	PARTIALLY(%)	FULLY(%)	NOT AT ALL(%)	FUNNY MONEY(%)	NO CHANGE(%)
$0-$200,000	24	8	4	0	8	80
$200,001-$400,000	22	14	0	5	9	73
$400,001-$600,000	13	8	0	8	8	76
$600,001-$800,000	3	0	0	0	0	100
Over $800,000	8	13	25	0	0	62
All Respondents	82	10	4	2	10	74

QUESTIONS 61 and 62 dealt with institutional policy permitting students to buy additional computer time after they had used up their initial allocation; and if no such policy existed, whether the respondents planned to institute one. From the responses it is clear that many schools provided unlimited computing time to students taking computer-related courses. Although QUESTION 61 was written to elicit a Yes or No answer, a number of respondents indicated students had unlimited access. The following tabulation indicates the percent of respondents which replied Yes, No, or Unlimited.

61. Do you have a mechanism whereby students can purchase additional computing time after they use up their original allocation?

62. If No, do you plan to institute such a policy?

	ADDITIONAL TIME CAN BE PURCHASED				PLAN SUCH A POLICY		
Budget Parameters	N	Yes(%)	No(%)	Unlim(%)	N	Yes(%)	No(%)
0-$200,000	27	7	93	0	26	12	88
$200,001-$400,000	26	8	77	15	21	5	95
$400,001-$600,000	13	8	84	8	9	11	89
$600,001-$800,000	4	50	50	0	2	0	100
Over $800,000	6	33	67	0	100	0	100
All Respondents	82	12	83	5	71	7	93

QUESTIONS 63-65 were intended to find out the extent to which the responding institutions sold their computing resources to off-campus users, either as a source of revenue generation or to offset some expenses. Responses to these questions appear below.

63. Are computing resources sold to off-campus users?

64. If Yes, approximately what percentage of total computing costs are recovered?

65. Do you plan to begin or to increase such sales in the future?

Budget Parameters	RESOURCES SOLD TO TO OFF-CAMPUS USERS N	Yes(%)	No(%)	PERCENT RECOVERED (%=MEAN) N	%	PLAN TO SELL RESOURCES N	Yes(%)	No(%)
0-$200,000	29	24	76	8	25	28	18	82
$200,001-$400,000	30	23	77	7	40	24	13	87
$400,001-$600,000	14	36	64	6	34	13	23	77
$600,001-$800,000	4	75	25	3	12	4	25	75
Over $800,000	7	72	28	4	3	8	13	87
All Respondents	98	29	71	29	29	84	15	85

Hardware

QUESTIONS 66-73 were intended to find out how the responding small universities and colleges carried out their computing, i.e., on what kinds of equipment; their plans to increase or decrease reliance on these sources; and policy with regard to acquisition, facilities management firms (service bureaus), and hardware standardization.

66. Approximately what percent of academic computing is done on the resources listed below?

Budget Parameters	N	ON-CAMPUS MAINFRAME	ON-CAMPUS MINI	MICRO	SERVICE BUREAU	OTHER COLLEGE
0-$200,000	29	12	51	40	2	4
$200,001-$400,000	29	20	54	18	1	7
$400,001-$600,000	13	33	38	24	5	0
$600,001-$800,000	4	60	33	7	0	0
Over $800,000	6	39	49	12	0	0
All Respondents	98	26	42	27	2	3

67. Please indicate if you plan to increase (+), decrease (-), or maintain reliance on the resources listed for academic computing. (Maintenance of effort responses [0] are omitted. Only increase/decrease responses are indicated.)

Budget Parameters	ON-CAMPUS MAINFRAME +	-	ON-CAMPUS MINI +	-	MICRO +	-	SERVICE BUREAU +	-	OTHER COLLEGE +	-
0-$200,000	3	0	7	4	15	0	0	0	0	1
$200,001-$400,000	4	2	12	2	18	2	0	0	2	5
$400,001-$600,000	3	2	4	0	12	0	1	0	0	0
$600,001-$800,000	1	0	2	0	2	0	0	0	1	0
Over $800,000	1	0	2	1	4	1	0	0	0	0
All Respondents	12	8	26	11	57	4	1	1	5	7

68. Approximately what percent of administrative computing is done on the resources listed below?

Budget Parameters	N	ON-CAMPUS MAINFRAME	ON-CAMPUS MINI	MICRO	SERVICE BUREAU	OTHER COLLEGE
0-$200,000	31	36	55	3	5	5
$200,001-$400,000	29	38	51	2	0	8
$400,001-$600,000	14	66	26	1	7	0
$600,001-$800,000	4	75	25	1	0	0
Over $800,000	8	64	29	7	0	0
All Respondents	99	47	45	2	2	4

69. Please indicate if you plan to increase (+), decrease (-), or maintain reliance on the resources listed for administrative computing. (Maintenance of effort responses (0) are omitted. Only increase/decrease responses are indicated.)

Budget Parameters	ON-CAMPUS MAINFRAME +	ON-CAMPUS MAINFRAME -	ON-CAMPUS MINI +	ON-CAMPUS MINI -	MICRO +	MICRO -	SERVICE BUREAU +	SERVICE BUREAU -	OTHER COLLEGE +	OTHER COLLEGE -
0-$200,000	5	1	9	1	9	0	0	0	1	1
$200,001-$400,000	3	1	2	2	12	0	0	0	1	2
$400,001-$600,000	3	2	1	1	9	0	0	0	0	0
$600,001-$800,000	1	0	1	0	0	0	0	0	1	0
Over $800,000	0	0	2	0	5	0	0	0	0	0
All Respondents	13	6	18	4	38	0	1	0	3	3

QUESTIONS 70 and 71 addressed college and university strategy with regard to the actual acquisition of equipment in the past and for the future.

70. If you have on-campus mainframe or minicomputers, is current practice to own or lease equipment? (Responses are actual, not percentages.)

Budget Parameters	OWN	LEASE	LEASE/ PURCHASE	NOT APPLICABLE
0-$200,000	20	2	8	1
$200,001-$400,000	22	1	6	1
$400,001-$600,000	12	0	3	0
$600,001-$800,000	1	0	3	0
Over $800,000	7	1	0	0
All Respondents	73	4	21	3

71. Is any change in mainframe or minicomputer acquisition policy planned? Please use (+) for increase or (-) for decrease.

	OWN		LEASE		LEASE/ PURCHASE		NOT
Budget Parameters	+	-	+	-	+	-	APPLICABLE
0-$200,000	5	0	2	0	2	0	9
$200,001-$400,000	10	0	1	0	4	0	3
$400,001-$600,000	11	0	0	0	3	0	0
$600,001-$800,000	3	0	0	0	1	1	0
Over $800,000	1	0	0	0	0	0	1
All Respondents	23	0	3	0	10	1	18

72. Do you now use or plan to use a facilities management firm (service bureau) to run your computer services?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	31	0	100
$200,001-$400,000	30	3	97
$400,001-$600,000	15	0	100
$600,001-$800,000	4	25	75
Over $800,000	8	0	100
All Respondents	102	2	98

73. Has any overt institutional decision been made to standardize on a specific vendor or architecture?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	31	32	68
$200,001-$400,000	30	43	57
$400,001-$600,000	15	60	40
$600,001-$800,000	4	25	75
Over $800,000	8	75	25
All Respondents	101	44	56

Communications

QUESTIONS 74-76 were intended to find out if the responding campuses planned to make major improvements in their telecommunications systems to improve data transmission, and to determine their plans with regard to electronic mail which has been much written about among large colleges and universities.

74. Do you plan any major changes in your intra-campus telecommunications systems to improve data transmission?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	29	41	59
$200,001-$400,000	29	90	10
$400,001-$600,000	14	64	36
$600,001-$800,000	4	75	25
Over $800,000	8	100	0
All Respondents	98	65	35

75. Do you have an intra-campus electronic mail system?

76. Do you plan to install electronic mail in the near future?

	HAVE EM			PLAN TO INSTALL EM		
Budget Parameters	N	Yes(%)	No(%)	N	Yes(%)	No(%)
0-$200,000	29	17	83	25	36	64
$200,001-$400,000	30	20	80	25	44	56
$400,001-$600,000	15	47	53	10	60	40
$600,001-$800,000	4	75	25	3	67	33
Over $800,000	8	13	87	7	57	43
All Respondents	101	24	76	84	43	57

Administrative Computing

QUESTION 77 was a matrix on which the respondents indicated the administrative computing applications their institutions used, the sources of computer resources on which the applications run, and the sources of software. The question was intended to identify the prevalent administrative applications in use at small universities and colleges and how those applications were supported.

The responses are shown in Tables 2a through 2f. Since some respondents did not indicate the source of software for some of their applications, the number of responses to Sources of Software does not total the Sources of Computer Resources in all the tables. (N = the number of responses to QUESTION 77.)

QUESTION 78 was intended to find out if the responding small universities and colleges plan any major strategic changes in administrative applications in the near future. They were asked to indicate changes with respect to: purchase of adcitional proprietary software; in-house development of major applications; shared development of applications with another college or university;

Table 2a. Administrative computing applications with sources of computer resources and software: $0 - $200,000 group.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 30	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other instn/ Agency	Micro	Total	In-House	Vendor	Shared
General Fund Accounting	31	9	17	2	1	2	27	8	18	1
Payroll	31	8	14	7	2		25	7	17	1
Personnel Records	22	7	12	1	2		19	10	8	1
Financial Aid	22	7	14		1		16	8	8	
Alumni/Development	26	8	14	1	1	2	23	14	8	1
Facilities/Space Inventory	10	3	5		2		7	4	3	
Equipment Inventory	14	5	6		2	1	11	6	4	1
Admissions	26	9	16		1		24	14	10	
Registration	29	9	18		1	1	25	10	15	
Student Records/Reports	29	10	18		1		26	11	15	
Student Accounts	24	9	13	1	1		22	8	13	1
Student Housing	15	7	8				13	10	3	
Purchasing	11	4	6		1		11	3	7	1
Stores Inventory	9	3	5		1		8	4	3	1
Budget Control	24	7	15		1	1	19	9	9	1
Faculty Activity/Cost	6	3	2		1		6	3	2	1
Energy Management	4		1			3	3		3	
Financial Modeling	11	2	4			5	10	4	6	
Mailing Lists	32	9	15	1		6	27	14	12	1
Institutional Research	22	7	10			5	20	14	5	1
Other	1		1							
TOTAL	399	126	215	13	19	26	342	161	169	12

Table 2b. Administrative computing applications with sources of computer resources and software: $200,001 - $400,000 group.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 30	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other instn/ Agency	Micro	Total	In-House	Vendor	Shared
General Fund Accounting	25	5	16		4		21	4	10	7
Payroll	27	5	13		8	1	24	5	15	4
Personnel Records	25	9	12		4		23	8	11	4
Financial Aid	27	10	14		2	1	24	14	7	3
Alumni/Development	26	8	13		2	3	22	15	5	2
Facilities/Space Inventory	15	3	5		5	2	10	3	6	1
Equipment Inventory	19	3	10		6		17	7	6	4
Admissions	27	9	16		2		25	12	8	5
Registration	27	9	16		2		24	13	8	3
Student Records/Reports	27	9	16		2		24	13	8	3
Student Accounts	23	9	12		2		20	8	7	5
Student Housing	19	7	9		2	1	14	8	3	3
Purchasing	18	3	9		5	1	14	5	5	4
Stores Inventory	14	5	5		4		11	7	2	2
Budget Control	27	6	14		5	2	24	7	10	7
Faculty Activity/Cost	14	4	7		3		14	6	4	2
Energy Management	19	2	9		1	7	13	2	11	
Financial Modeling	13	2	5		1	5	10	1	6	3
Mailing Lists	28	7	13		3	5	26	17	7	2
Institutional Research	30	6	16		4	4	27	15	9	3
Other										
TOTAL	433	114	220		67	32	375	160	148	67

Table 2c. Administrative computing applications with sources of computer resources and software: $400,001 - $600,000 group.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 15	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other Instn/ Agency	Micro	Total	In-House	Vendor	Shared
General Fund Accounting	14	7	5	1	1		10	6	3	1
Payroll	15	8	5	1	1		11	5	4	2
Personnel Records	13	7	4	1		1	8	3	2	3
Financial Aid	15	7	7		1		10	8	2	
Alumni/Development	13	7	6				12	7	4	1
Facilities/Space Inventory	11	6	4		1		8	5	1	2
Equipment Inventory	10	6	3			1	7	6	1	
Admissions	17	9	6	1	1		11	9	2	
Registration	15	8	6	1			11	9	2	
Student Records/Reports	15	8	6	1			11	9	2	
Student Accounts	15	8	6	1			10	8	2	
Student Housing	13	6	5	1		1	9	7	2	
Purchasing	12	7	3	1	1		6	3	2	1
Stores Inventory	11	7	2	1		1	7	4	2	1
Budget Control	14	7	5	1		1	10	7	2	1
Faculty Activity/Cost	10	6	2	1		1	6	6		
Energy Management	5	1	3			1	3	1	2	
Financial Modeling	7	2	2			3	7	3	4	
Mailing Lists	16	8	6	1		1	8	5	3	
Institutional Research	11	4	3	1	1	2	8	6	2	
Other	2	2								
TOTAL	254	131	89	14	7	13	173	117	44	12

Table 2d. Administrative computing applications with sources of computer resources and software: $600,001 - $800,000 group.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 4	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other Instn/ Agency	Micro	Total	In-House	Vendor	Shared
General Fund Accounting	4	4					4	2	2	
Payroll	4	3			1		4	2	2	
Personnel Records	4	3			1		4	3	1	
Financial Aid	3	3					3	2	1	
Alumni/Development	4	4					4	2	1	1
Facilities/Space Inventory	2	2					2	2		
Equipment Inventory	3	3					3	3		
Admissions	4	4					4	3	1	
Registration	4	4					4	3	1	
Student Records/Reports	4	4					4	3	1	
Student Accounts	3	3					3	3		
Student Housing	4	4					4	4		
Purchasing	2	2					1	1		
Stores Inventory	1	1					1	1		
Budget Control	4	4					4	2	1	1
Faculty Activity/Cost	2	2					2	1	1	
Energy Management							1		1	
Financial Modeling	2		1			1	1	1		
Mailing Lists	4	4					3	3		
Institutional Research	3	2				1	4	4		
Other										
TOTAL	61	56	1		2	2	59	44	13	2

Table 2e. Administrative computing applications with sources of computer resources and software: Over $800,000 group.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 8	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other Instn/ Agency	Micro	Total	In-Hou	Vendor	Shared
General Fund Accounting	7	6	1				6	2	3	1
Payroll	7	5	1	1			6	3	2	1
Personnel Records	5	4	1				5	3	1	1
Financial Aid	6	5	1				5	4	1	
Alumni/Development	6	4	2				5	2	3	
Facilities/Space Inventory	2	2					2	1		1
Equipment Inventory	5	3	2				4	2	1	1
Admissions	7	6	1				6	5	1	
Registration	7	6	1				6	3	2	1
Student Records/Reports	7	6	1				6	3	2	1
Student Accounts	7	6	1				6	4	1	1
Student Housing	2	2					2	2		
Purchasing	3	3					4	2	1	1
Stores Inventory	2	1	1				2	1	1	
Budget Control	7	6	1				5	4		1
Faculty Activity/Cost	3	2	1				2	1	1	1
Energy Management	2	1					2	1	1	
Financial Modeling	2		1				2	1	1	
Mailing Lists	7		2				5	4	1	
Institutional Research	4	2	1			1	2	2		
Other										
TOTAL	98	77	19	1		1	84	50	23	11

Table 2f. Administrative computing applications with sources of computer resources and software: All groups.

ADMINISTRATIVE COMPUTING APPLICATIONS N = 103	SOURCE OF COMPUTER RESOURCES						SOURCE OF SOFTWARE			
	Total	Main-frame	Mini	Service Bureau	Other Instn/ Agency	Micro	Total	In-House	Vendor	Shared
General Fund Accounting	91	36	44	2	8	1	74	24	37	13
Payroll	90	31	38	6	14	1	76	24	43	10
Personnel Records	74	31	33	2	9		68	32	26	10
Financial Aid	79	33	41		5		71	39	27	5
Alumni/Development	77	31	37		5	4	70	41	23	6
Facilities/Space Inventory	34	14	16		10	4	32	16	9	7
Equipment Inventory	58	20	25		9	4	50	29	15	6
Admissions	86	37	44	1	4		70	43	21	6
Registration	87	37	45	1	4		78	40	32	6
Student Records/Reports	90	38	49	1	4		82	40	35	7
Student Accounts	78	36	37	1	4		70	36	28	6
Student Housing	55	26	25	1	1	2	48	32	13	3
Purchasing	49	18	22	1	8	1	44	19	19	6
Stores Inventory	37	14	15	1	6	1	36	24	9	3
Budget Control	77	27	38	1	7	4	69	34	26	9
Faculty Activity/Cost	41	20	13	1	6	1	36	19	13	3
Energy Management	32	5	16			12	29	9	20	
Financial Modeling	41	8	15		3	15	33	14	16	3
Mailing Lists	87	33	40	1	3	10	78	44	30	4
Institutional Research	83	23	37	1	7	15	67	39	21	7
Other	4	1	1		1	1	2	2		
TOTAL	1363	509	631	21	118	76	1288	706	462	120

movement of applications to larger on-campus processors, smaller on-campus processors, and off-campus processors. The responses to QUESTION 78 are shown below.

	PURCHASE ADDIT'L SOFTWARE			IN-HOUSE DEVELOPMENT			SHARED DEVELOPMENT		
Budget Parameters	N	Yes	No	N	Yes	No	N	Yes	No
$0-$200,000	23	74%	26%	27	78%	22%	20	30%	70%
$200,001-$400,000	28	54%	46%	24	71%	29%	24	50%	50%
$400,001-$600,000	14	71%	29%	14	86%	14%	12	50%	50%
$600,001-$800,000	4	50%	50%	4	75%	25%	4	25%	75%
Over $800,000	7	100%	0%	7	57%	43%	6	33%	67%
All Respondents	87	61%	39%	86	74%	26%	78	38%	62%

	TO LARGER ON-CAMPUS			TO SMALLER ON-CAMPUS			MOVE OFF-CAMPUS		
Budget Parameters	N	Yes	No	N	Yes	No	N	Yes	No
$0-$200,000	19	42%	58%	19	26%	74%	18	0%	100%
$200,001-$400,000	23	26%	74%	22	59%	41%	23	17%	83%
$400,001-$600,000	11	18%	82%	10	20%	80%	11	0%	100%
$600,001-$800,000	3	0%	100%	4	25%	75%	4	25%	75%
Over $800,000	5	0%	100%	5	60%	40%	3	0%	100%
All Respondents	73	23%	77%	71	15%	85%	73	7%	93%

Computer Security

QUESTIONS 79-83 were asked to determine if the respondents had experienced computer-related crime or vandalism and the extent to which they have taken measures to improve computer security.

79. Have you experienced electronic crime or vandalism?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	31	10	90
$200,001-$400,000	29	19	81
$400,001-$600,000	15	40	60
$600,001-$800,000	4	50	50
Over $800,000	8	37	63
All Respondents	101	22	78

80. Are computer equipment rooms given extra security protection?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	32	53	47
$200,001-$400,000	30	90	10
$400,001-$600,000	15	93	7
$600,001-$800,000	4	100	0
Over $800,000	8	75	25
All Respondents	102	76	24

81. Is access to microcomputer laboratories controlled/monitored?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	30	77	23
$200,001-$400,000	29	86	14
$400,001-$600,000	13	92	8
$600,001-$800,000	4	100	0
Over $800,000	7	71	29
All Respondents	93	83	17

82. Do you plan to improve current security measures?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	26	69	31
$200,001-$400,000	26	42	58
$400,001-$600,000	14	79	21
$600,001-$800,000	4	50	50
Over $800,000	8	87	13
All Respondents	99	60	40

83. Have you instituted (or do you plan) a Code of Ethics for computer users?

Budget Parameters	N	YES(%)	NO(%)
0-$200,000	31	52	48
$200,001-$400,000	30	67	33
$400,001-$600,000	14	57	43
$600,001-$800,000	4	25	75
Over $800,000	8	63	37
All Respondents	97	57	43

ADDITIONAL COMMENTS/REMARKS

Space was provided at the end of the survey (following QUESTION 83) for respondents to make any additional comments or remarks they wished. Ten surveys were returned with remarks. No major focal point or concern was discernible. The comments ranged from a statement on the "critical and controversial area of higher education computing" addressed by the survey, to descriptions of changing policies and practices at several institutions, to the nature of personnel funding, a description of one attempt at computer crime, and a comment on the difficulty in completing the survey.

SUMMARY

The foregoing survey data were reviewed and the major strategic elements were identified for inclusion in the strategic decision matrix which follows on the next eight pages.

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
One officer for academic & administrative computing	Yes	Yes	Yes	Yes	Yes	Yes
Plan to separate/unify the two functions	No	No	No	No	No	No
Chief computing officer reports to	Business Officer	Business Officer	Business Officer	Business Officer	Split	Business Officer
Reporting arrangement to be changed to	None Prevalent	None Prevalent	President	No Response	No Response	Business Officer
Group/person responsible for setting institutional computing policy	Mixed Committee	Mixed Committee	Comp Ctr Director	Business Officer	Comp Ctr Director	Mixed Committee
Group/person responsible for major resource decisions	None Prevalent	Comp Ctr Director	Mixed Committee	Comp Ctr Director	Comp Ctr Director	Comp Ctr Director
Control over resources for decentralized use	Central	Central	Central	Central	Central	Central
Person responsible for such control	None Prevalent	Comp Ctr Director	Comp Ctr Director	Comp Ctr Director	Mixed Committee	Comp Ctr Director
Plan decentralized micro purchase decision making	No	No	No	No	No	No
Computer center consulted on decentralized services	Yes	Yes	Yes	Yes	Yes	Yes

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
Academic or administrative computing priority	Admin	Even	Even	Even	Even	Even
Changes in emphasis planned	No	No	No	None Prev	No	No
Personnel/staff mean position FTE	3.09	6.96	8.77	13.00	16.00	6.82
Plan to increase/decrease staff in next year	38%	42%	42%	75%	63%	42%
% allocation of position academic/administrative	25/75	38/62	17/83	33/67	44/56	30/70
Difficulty in recruiting staff in last year	No	No	No	50/50	Yes	No
Most difficult position to recruit for	Analyst Program	None Prevalent	Systems Analyst	None Prevalent	Manage-ment	Analyst Programmer
Best source for recruiting professional staff	Profess Contact	Regional Searches	Regional Searches	National Searches	Profess Contact	Profess Contact
Plan to use/increase part-time professionals	No	No	No	50/50	No	No
Salary structure altered for computer staff	No	No	No	50/50	No	No
Plan change in salary structure	No	No	No	50/50	50/50	No

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
% computer courses taught by full/part-time faculty	72/28	82/18	88/12	86/14	84/16	83/17
All computer faculty have advanced related degrees	No	Yes	Yes	Yes	Yes	Yes--49% Unknown--10%
Computer center professional staff also teach	No	No	No	Yes	No	No
Non-tech faculty retrained to teach computer courses	No	No	No	Yes	No	No
Plan to retrain any/more faculty for such teaching	No	No	No	Yes	Yes	No
Faculty salary structure altered for tech faculty	No	No	No	50/50	50/50	No
Plan to alter faculty salary structure	No	No	No	No	No	No
Plan to hire more computer-related faculty	Yes	Yes	Yes	Yes	Yes	Yes
Computer instruction has high priority in mission	No	Yes	Yes	50/50	50/50	Almost 50/50
Plan to increase computer related courses	Yes	Yes	Yes	Yes	Yes	Yes
% such courses will increase	35	48	14	9	17	41

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
Number of computer-related enrollments per semester	245	499	651	813	779	450
Think added such enrollments will offset losses	No	50/50	Yes	50/50	Yes	Yes
Have computer literacy programs for faculty	No	Yes	No	Yes	50/50	No
Have computer literacy programs for staff	No	Yes	No	Yes	No	No
Have computer literacy programs for students	Yes	Yes	No	Yes	Yes	Yes
Plan to institute/enhance such programs	Yes	Yes	Yes	Yes	Yes	Yes
Most prevalent computer-related degree program	Comp Sci	Comp Sci	Comp Sci	Comp Sci	Comp Sci	Comp Sci
Plan to offer new computer-related major	No	No	No	No	Yes	No
Most prevalent computerized library services	None Prevalent	Bibliog Search	None Prevalent	None Prevalent	Interlib Loans	Bibliog Search
Plan to add/enhance in next year	Circ	Circ	Cata	Bib Srch	None Prev	Circ
Have access to national/regional networks	Yes	Yes	Yes	Yes	Yes	Yes
Plan to obtain or add access in next year	No	Yes	No	50/50	50/50	No

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
Most prevalent word processing equipment	Micros	Micros	Micros	Micros	Micros	Micros
Plan to increase word processing on	Micros	Micros	Micros	Micros	Micros	Micros
Permit students to use resources for word processing	No	Yes	Yes	Yes	Yes	No
Plan micros for student word processing use	Yes	Yes	Yes	Yes	Yes	Yes
Require students to buy computer time or micros	No	No	No	No	No	No
Computing budget compared to inflation rate	Lagged	Lagged	Lagged	Exceeded	Exceeded	Exceeded
Computing budget compared to institutional budget	Better	Better	Same	Better	Better	Better
Increase in computing budget has high priority	No	Yes	Yes	Yes	Yes	Yes
Computer services charged back to users	No	No	No	No	Fun money	No
Plan change in charge-back policy	No	No	No	No	No	No
Permit students to buy more computer time	No	No	No	No	No	No

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION \ INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
Plan to institute such a policy	No	No	No	No	No	No
Sell computer resources to off-campus users	No	No	No	Yes	Yes	No
% computer resources recovered from off-campus	25	40	34	12	3	29
Plan to begin/increase off-campus sales	No	No	No	No	No	No
Prevalent hardware resource academic computing	Mini	Mini	Mini	Main	Mini	Mini
Plan to increase academic computing reliance on	Micros	Micros	Micros	Main/Micr	Micros	Micros
Prevalent hardware resource administrative computing	Mini	Mini	Main	Main	Main	Main
Plan to increase administrative computing reliance on	Micros	Micros	Micros	Mini	Micros	Micros
Acquisition policy for on-campus hardware	Own	Own	Own	Lease/Pur	Own	Own
Plan change in acquisition policy to	Own	Own	Own	Own	Own	Own
Plan/use facilities management firm	No	No	No	No	No	No

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
Vendor or architecture standardization	No	No	Yes	No	Yes	No
Plan intrecampus telecommunications improvement	No	Yes	Yes	Yes	Yes	Yes
Have intrecampus electronic mail	No	No	No	Yes	No	No
Plan to install electronic mail	No	No	Yes	Yes	Yes	No
Most prevelent administrative computing applications	See responses to QUESTION 77					
Most prevalent source of administrative software	In-house	In-house	In-house	In-house	In-house	In-house
Plan to purchase additional administrative software	Yes	Yes	Yes	50/50	Yes	Yes
Plan in-house development of major applications	Yes	Yes	Yes	Yes	Yes	Yes
Plan shared development of applications with others	No	50/50	50/50	No	No	No
To move applications to larger on-campus machine	No	No	No	No	No	No
To move applications to smaller on-campus machine	No	Yes	No	No	Yes	No

STRATEGIC DECISION MATRIX--PREVAILING STRATEGIES BY INSTITUTION GROUPING

STRATEGIC DECISION / INSTITUTION GROUPING	FUNDS ALLOCATED TO CENTRAL COMPUTING SERVICES					All Institutions
	$0-$200,000	$200,001-$400,000	$400,001-$600,000	$600,001-$800,000	Over $800,000	
To move applications to off-campus machine	No	No	No	No	No	No
Experienced electronic crime or vandalism	No	No	No	50/50	No	No
Computer rooms given extra protection	Yes	Yes	Yes	Yes	Yes	Yes
Access to micro labs controlled/monitored	Yes	Yes	Yes	Yes	Yes	Yes
Plan increase in security	Yes	No	Yes	50/50	Yes	Yes
Have a computer users code of ethics	Yes	Yes	Yes	No	Yes	Yes

CHAPTER FOUR:
Findings and Recommendations

The basis for this study of computing strategies in small universities and colleges was the identification of twelve areas where policy and practices need to be examined in order for an institution to formulate a comprehensive computing strategy. The discussion which follows begins with an overview of the institutional profile with respect to computing budget, then summarizes the findings of the study in each of the twelve areas, including any significant variations reflecting the level of financial support for computing. A delineation of the standard model is then provided, followed by recommendations for further study.

INSTITUTIONAL PROFILE

The mean percent of institutional budget allocated to computing for all respondents was 2.61 percent. This data is comparable to the EDUCOM report which stated that slightly more than 2 percent of total higher education budgets were spent on all types of computing services. The 1980 CAUSE study indicated that 54 percent of small institutions (enrollment under 2,000), and 56 percent of medium institutions (enrollment 2,000-7,999) spent between 2.0 and 2.9 percent of the institutional budget on administrative information systems. However, it is possible that some small institutions in the CAUSE study may not have segregated their administrative and academic computing components and reported total computing support rather than just administrative support.

The mean amount spent on support to all computing by the respondents in this study was $389,100. The CAUSE study indicated that small institutions in its survey spent an average of $287,979 on administrative information systems support, and that medium-sized institutions spent an average of $499,992. Valid comparisons cannot be made as the two studies represent data from different years.

TWELVE STRATEGIC AREAS

The twelve strategic areas, once again, which are necessary parts of a comprehensive computing strategy for any institution are: (1) management/governance structure, (2) personnel-staff, (3) personnel-faculty, (4) academic computing, (5) library, (6) networking, (7) word/text processing, (8) financing, (9) hardware, (10) communications, (11) administrative computing, and (12) computer security.

Management/Governance Structure

The majority of the universities and colleges in this study (52 percent) had one officer responsible for directing both academic and administrative computing. However, this was not the case for those providing the least institutional support to computing. In the case of institutions which spent more than $600,000 on computing there was an even distribution between those which had one officer responsible and those which did not.

The majority of the institutions in the EDUCOM study had one officer responsible, and EDUCOM identified this as a major trend in higher education. In the case of small institutions, the lack of resources rather than adherence to an organizational trend probably determines this personnel policy.

It can be assumed that the pattern of responsibility among the responding institutions is stable. Only 8 percent of respondents indicated any awareness of plans to separate or unify the academic and administrative computing functions within their institutions.

The survey data indicate that the chief computing officer reports most often to the institution's chief business officer (33 percent), to the chief academic officer second most frequently (27 percent), and third most often to the president (21 percent). Nineteen percent of the respondents indicated that they reported to some other officer or combination of officers, usually the chief business and academic officers. It is assumed that such dual reporting reflects an organizational split of the responsibilities for administrative and academic computing, respectively. Most of the institutions which indicated that the chief computing officer reported to the president were those with low percent and dollar allocations for computing. No institution with a computing budget over $600,000 had its computing officer reporting directly to the president. The frequency of reporting to the chief business officer may reflect the fact that most higher education computing originally supported administrative functions, before the growth in importance of academic computing.

The findings of this study are not significantly dissimilar to the 1980 CAUSE study with respect to the reporting relationship of the chief administrative information (AIS) officer. The CAUSE study indicated that in small colleges the administrative/business vice president was reported to in 41 percent of the cases, the executive/academic vice president in 27 percent, the president in 13 percent, and other officers in 19 percent. Among medium-sized institutions 51 percent of the AIS officers reported to the administrative/business vice president. It is probable that the AIS officer is also the chief computing officer in small institutions, while the AIS officer's responsibilities may not extend in all cases to academic areas for medium-sized schools.

The respondents in this study were asked to indicate if they were aware of any planned change in the reporting relationship of the chief computing officers in their institutions. The responses indicated stability, i.e., only 12 percent indicated they were aware of any planned change. Most of those indicating a planned change were on the low side of support provided to computing, and the chief business officer was named most frequently as the position to which the reporting relationship would move.

The responses on reporting relationship indicate no major move among small universities and colleges to amplify and consolidate information-related activities, or to realign vice presidencies and create a vice president for information systems, as Chachra and Heterick expected. However, their expectations may be more applicable to larger institutions.

The responding institutions indicated that the concept of collegiality was prevalent in the setting of overall computing policy, i.e., the making of final recommendations to the chief executive officer. In 38 percent of the cases, mixed committees composed of faculty and staff or the president's cabinet were responsible for the presentation of policy recommendations. The second most prevalent model was the chief computing officer, in 25 percent of the cases. The use of mixed committees may be reflective of higher education culture where committees abound, particularly on matters of importance to the total institution. Also, since computing is bifurcated between the academic and administrative in higher education, unlike most industries where computing is exclusively administrative, the use of mixed committees draws on collective wisdom and may serve to mitigate demands for disproportionate resource distribution to either function. The second most prevalent model, the chief computing officer, may reflect institution confidence in an "expert" to make the final policy recommendations, and may be more similar to that found in other industries. To use Jackson's terms, the most prevalent model among small universities and colleges is the "high-level committee" with the "czar" model employed second most often.

Although the survey indicated that mixed committees were prevalent in making policy (strategic) recommendations, this was not the case for making major computer resource decisions, such as hardware acquisition and software development/acquisition (tactical) decisions. The most prevalent model used had the chief computing officer making such decisions in 38 percent of the institutions, and mixed committees in 28 percent. The total amount of funds allocated to computing seemed to have no bearing on the prevalent models. It is probable that higher education institutions differ from other industries in tactical decision-making as the chief computing officer elsewhere would probably be making decisions in more than 38 percent of the population.

Thomas stated that the proliferation of mini and microcomputers outside traditional computer centers has created strain on many campuses, particularly where the central administration was not aware of what was occurring. Also, the data processing popular media have frequently written, as a generic concern, about the need to control the acquisition of computer resources obtained for decentralized use. The respondents in this study indicated overwhelmingly (81 percent) that their universities and colleges did have centralized control over acquisition of computer resources for decentralized use, such as microcomputers. The case may be different at larger institutions which employ a decentralized approach to acquisition, or which use a system under which acquisitions are not scrutinized by central administrative officers.

The survey participants were asked to indicate which officer or group is responsible for exercising centralized control over purchases for decentralized use. The most prevalent model was the chief computing officer, in 39 percent of the responses. The next most frequently used was the mixed committee, in 26 percent.

The small universities and colleges responding to the survey were asked if they planned to decentralize microcomputer acquisition decision making to users. Overwhelmingly (84 percent), they indicated no plans to decentralize decision making. Maintenance of a centralized policy will permit institutions to standardize equipment, enhance local networking capability, reduce software/systems acquisition costs, lower maintenance expenses, and make user training easier--if compatible acquisitions for decentralized use are institution policy. If no effort at standardization is made, the major advantage of centralized purchasing is lost, with the primary benefit becoming probable savings from volume purchasing without regard to long-term consequences.

To a related question, the respondents indicated that their computer center was consulted on the great majority (84 percent) of decentralized computer services. Thus, the computer center director is in a key position to guide institution acquisition activity even if

the responsibility for decision making rests elsewhere within the university or college.

The survey respondents were asked to indicate whether computer resource support had been more emphasized in academic or administrative areas to date, or whether the emphasis had been evenly distributed between the two functions. In 55 percent of the cases the emphasis had been evenly distributed, 30 percent indicated the emphasis had been on administrative support, and the remaining 15 percent on academic support. The exceptions were those institutions providing the least total support to computing, i.e., less than $200,000 of budget, where the emphasis has been on administrative computing. The even distribution of emphasis implies an understanding of the importance of both functions to the overall enterprise. Although in a significant minority, the institutions indicating more emphasis on administrative than academic may be reflective of schools with few computer-related academic offerings or where the administrative officers have been more persuasive in maintaining computer support than their academic colleagues.

The survey asked if the universities and colleges planned to increase/decrease their current emphasis. A majority, 55, indicated no change in emphasis. However, 37 indicated that there would be an increase in academic emphasis; one indicated a decrease. In administrative support, 11 indicated an increase while 6 indicated a decrease. Although the data indicate no prevalent change in emphasis across the total population, academic computing will receive greater incremental support than administrative, probably as a result of the increased demand for computer-related instruction nationwide.

Personnel-Staff

The institutions in this study were asked a number of questions about their non-faculty computer personnel, i.e., the persons who manage and staff central computer services for both academic and administrative users.

The respondents were asked to indicate the number of full-time equivalent (FTE) positions by five major job classifications (and total) which corresponded to the classifications used in the 1980 CAUSE study. The mean FTE positions of the respondents are compared in Table 3 with the CAUSE findings for small and medium-sized universities and colleges.

Since this study was intended to identify all computer staff serving both academic and administrative functions, the data, when compared to the CAUSE findings, would seem to indicate that the latter measured total staffing and not just administrative information systems (AIS) staffing as indicated in the CAUSE report. The data from this study indicate that FTE positions generally increase in all job classifications as the total funds allocated to computing increase.

Table 3. Comparison of 1980 and 1984 data on FTE positions.

	ALL RESPONDENTS 1984	CAUSE Small	CAUSE Medium
Management	1.40 (20%)	1.1 (15%)	1.9 (13%)
Analyst/Programmer	1.99 (29%)	2.1 (28%)	5.0 (35%)
Systems Analyst	.67 (10%)	.4 (5%)	.8 (6%)
Operations	1.90 (27%)	2.9 (39%)	4.6 (32%)
Secretarial/Clerical	.94 (14%)	.9 (12%)	1.8 (13%)
Total	6.82	7.5	14.2

This survey also attempted to measure the extent to which the respondents planned to increase or decrease their computer staff in the next year. Implicit in this question was an indicator of the degree to which colleges and universities, as a whole, would be recruiting for additional staff in the immediate future. Of the 103 institutions in the study, 43 indicated that they planned to increase staff by a net of 91.1 FTE positions. The greatest demand indicated was for analyst/programmers at 40 percent of total and operations personnel at 23 percent of total. The data imply that the demand for computer staff will be strong and that a competitive "sellers market" will face small universities and colleges in the near future. This situation may add strain to other strategic concerns, such as compensation policy.

The respondents were asked to indicate the percent of total computer center positions that were predominantly academic support and the total that were predominantly administrative support. The mean distribution for all responses was 70 percent administrative and 30 percent academic. These findings add to the questionable nature of the CAUSE data on AIS positions in small institutions since comparison of the data reveals a significant difference. Again, there is some evidence to believe the CAUSE study measured total computing staff rather than only administrative computing staff.

A major concern raised by a number of experts on computing in higher education (McCredie, Hamblen, Denning, Chachra, and Heterick) was the ability of colleges and universities to recruit professional employees. The survey findings contained a surprise here in that 71 percent of the respondents indicated that they had not had difficulty in recruiting computer center staff within the past year. In addition, the institutions which indicated they had the most difficulty were those with the largest computing budgets. The

general lack of recruiting difficulty by the small schools may be reflective of their not having full in-house computer service operations which require highly-trained staff, or it may be a result of their being located in geographic areas where there are not competitive recruiting conditions and where employee turnover is low.

The respondents were asked to indicate the most difficult positions to recruit for among the five major job classifications. The most difficult positions to recruit for are analyst/programmers, followed very closely by management positions. There followed, in descending order of difficulty: systems analyst, operations, and secretarial/clerical positions. The last were the least difficult to recruit for in each group.

The study made an effort to identify the most effective sources for recruiting professional staff to small universities and colleges from among national searches, regional searches, alumni, and professional contacts. The best source of recruiting among the aggregate population was professional contacts. Not far behind was regional searches. Alumni and national searches were rated almost equally at the bottom of the list. These findings imply that small universities and colleges which mount expensive national recruiting efforts to fill professional computer center positions may not be making the most effective use of their resources, and that local recruiting efforts may be more productive. Higher education institutions have a built-in source of recruiting which most other employers lack, their students and alumni. The relatively low use of alumni as a recruiting source may reflect the fact that few computer-related academic programs exist within the respondent schools, or that no significant effort is made to train student employees before their graduation, and then to keep them on as professional employees afterwards. A more in-depth study of the recruiting policies and practices of college and university computer center operations may provide information on how higher education can offset its disadvantages in salary compensation by using its built-in resources more effectively.

The respondents were asked to indicate if they employed part-time professional staff. The majority (59%) indicated that they did not. Part-time professional employment occurred more frequently in universities and colleges which allocated over $600,000 to computing. The use of part-time professionals is one possible means of ameloriating recruitment problems. This is particularly true for college computer centers which operate beyond the normal business day to serve student demand for the use of facilities, and for some programmer/analyst work which may require solitary systems analysis, writing, and coding of programs, on or off the premises. The use of part-time professionals, particularly women who are

interested only in work which does not conflict with family responsibilities, may ease workload and recruiting problems and may provide a dependable pool from which pre-trained, full-time professionals can be drawn.

The survey respondents do not appear to agree with such a conclusion for future use of part-time professionals, however. A substantial majority, 75 percent, indicated that they did not plan to begin to use or increase use of part-time professionals. Such planning is prevalent in all groups except the $600,000-$800,000 category, which was evenly divided between those who plan to begin/increase use of part-time staff and those who do not.

One method of improving chances for recruiting and retaining professional computer staff is to make adjustments in the institution's salary structure. The survey participants indicated that the salary structure had not been altered in 68 percent of the cases. The same policy occurred in all groups except those in the $600,000-$800,000 category where 50 percent indicated such salary structure alterations had been made, and the over-$800,000 group where 63 percent had altered the structure.

The respondents were asked to indicate if their institutions had plans to alter their salary structure in the near future. A substantial majority, 87 percent, indicated that they had no such plans. The exceptions were the colleges and universities which allocated over $600,000 to computing, where 50 percent indicated they planned such changes.

Personnel-Faculty

Although there is major concern about the availability of professionals to staff college and university computer centers, there is even greater concern about the shortage of faculty capable of providing computer-related instruction. The lure of responsible, well-paying jobs draws many qualified bachelor's and master's degree holders away from possible graduate education where they might develop the skills to teach others. The lack of trained computer educators is a serious problem in higher education and a national concern since it has great impact on both the quality and quantity of computer-trained graduates entering all areas of our economy.

Small universities and colleges face greater problems than larger, more prestigious institutions which have more resources to offer the few available faculty in computer-related disciplines. Yet small schools must be able to provide computer-related instruction if they are to remain competitive in the quest for students who, in greater and greater numbers, are demanding such education. Strategies to identify, develop, and maintain essential faculty are

vital to the long-range viability of many small universities and colleges.

The survey participants were asked to indicate what percentages of computer-related courses are taught by full-time and part-time faculty. Throughout the total population and within each group there was a heavy reliance on full-time faculty with the mean at 83 percent of instruction. Part-time faculty, particularly those employed in computer-related work in commerce, industry, and government, are a potential source to supplement or substitute for full-time instructors. However, they are not a very significant part of the total enterprise as yet. This may change as the demand for full-time faculty increases.

The respondents were asked to indicate the extent to which faculty have advanced degrees in computer science, information science, engineering, mathematics, or related disciplines. The intent here was to attempt to determine, albeit superficially, the quality of the computer instruction provided at small universities and colleges. A minority, 49 percent, indicated that their faculty had such credentials; 41 percent indicated that they did not, and 10 percent did not know. The greater proportion with such advanced degrees were those institutions which spent over $800,000 on computing. The presence on the faculty of persons with advanced degrees in computer-related disciplines should be an important criterion in the selection of a college or university to attend for those who are placing significance on computer-related learning.

The participating institutions were asked if their professional computer center staff also served as teaching faculty. The majority (60 pe cent) indicated they did not, with those schools allocating over $800,000 to computing being the least likely to use professional staff as faculty. The advantage to such a practice is that students are introduced to working professionals with day-to-day involvement in computing and information science work. The major disadvantages are that other important work may not be properly attended to and the quality of instruction may not be as good as that provided by full-time, properly trained and experienced teachers.

Many colleges and universities have had to reduce their faculties in recent years as a result of demographic changes, and others have had to shift faculty positions from low-demand to high-demand disciplines to satisfy student interests. The human fallout of such resource shifts are highly educated, well trained, and dedicated persons who wish to continue teaching but for whom there is little or no demand. The survey participants were asked if any such persons, i.e., non-technical faculty, had been retrained to teach computer-related courses. Of those responding, the majority (58 percent) indicated their institutions had not done such retraining. Only in the $600,000-$800,000 group did more than 50

percent indicate that such training had occurred. An even larger proportion, 64 percent, indicated that they had no plans to retrain any/more faculty for such teaching. Willingness to undertake such retraining was most prevalent among institutions with computing budgets of $600,000 or more. The general disinterest in faculty retraining in computer-related fields may represent a significant loss of potential contributors to the academic enterprise which could be accomplished at far lower cost than competing in the highly competitive "sellers market" of computing professionals.

Several of the references cited earlier (McCredie, Chachra, and Heterick) mention low salaries as a problem in the recruitment and retention of computer-related faculty. The survey participants were asked if their institutions had altered their salary structures to recruit/retain technical faculty. Seventy-eight (78) percent indicated that no such change had been made. Only among those institutions with computing budgets of $500,000 or more did 50 percent indicate salary structure alterations had been made. The schools which responded negatively were asked if they had plans to alter their salary structure in the future; 91 percent indicated they had no such plans.

The survey participants were asked if their institutions planned to hire additional computer-related faculty. Of the total, 71 percent indicated they had such plans. Only the group spending less than 1 percent of their budgets on computing indicated no such prevalent plans.

The plans of the small universities and colleges to hire more computer-related faculty appear to face a number of significant hurdles: the low supply relative to demand for advanced degree holders throughout the economy; their preference for full-time faculty over part-time instructors; their relatively low-credentialed current faculties; lack of interest in retraining available-but-surplus faculty to teach computer-related courses; and their disinterest in changing their salary compensation policies and practices to improve recruitment/retention of technical faculty. The personnel strategies of the small universities and colleges appear to put them at a competitive disadvantage to other employers, while making their plans to hire more computer-related faculty seem at best naive.

Academic Computing

With the greatly increased demand for computer-related instruction in higher education, institutional policy with respect to academic computing may be the single most important element of any strategic plan, particularly for those colleges and universities which plan to increase computer enrollments.

The respondents were asked to indicate if computer-related instruction is mentioned as a high priority in their college/university mission statement. A mission statement is comparable to a statement of goals and objectives and is indicative of stated institutional priorities. Responses indicated that 47% stated that academic computing was mentioned in their master plan and 48% stated it was not, while the remaining 5 percent did not know if it was or was not. However, with the exception of the institutions spending less than $200,000 on computing, at least 50% of all groups indicated that their master plans included mention of computer-related instruction. It is possible that those schools providing the least absolute and percentage support to computing are primarily oriented toward administrative computing.

The survey respondents were asked several questions about institutional plans to increase computer-related course offerings, the percent increase, and the current level of activity. An overwhelming percentage (91) indicated that they planned to increase computer-related course offerings. This was true of all groups, with all the institutions allocating over $600,000 to computing having such plans. The mean increase among those schools whose respondents were aware of growth plans was 41 percent. Mean current semester enrollments were 450. The low was the 0-$200,000 group with 245 semester enrollments as mean; the high was the $600,000-$800,000 group with a mean of 813 enrollments.

The survey participants were asked whether their institutions believed that increased computer-related enrollments would offset other enrollment declines, such as those caused by the decreasing number of traditional college-age students. A small majority (56 percent) indicated that computer-related enrollments were seen as such a panacea. The most optimistic groups were those allocating the most to computing. The data indicate a generally moderate expectation as to the likelihood that computing courses will boost enrollments where negative demographics may be an insurmountable problem for the whole of higher education during the next five to ten years. Increased computing enrollments may be offsetting losses in other disciplines intramurally. The optimism of the more lavishly supported institutions may result from their anticipated gain at the cost of those small institutions which cannot or will not provide computer-related instruction sufficient to meet student interest or demand.

Computer literacy programs have drawn considerable attention in higher education in recent years. Most of the attention has been focused on efforts to introduce students to the computer as a basic tool which supports many intellectual disciplines. Many institutions have also placed a high priority on computer literacy for faculty so that they will have the knowledge and confidence to incorporate the

computer as a learning tool or productivity aid into their disciplines. Less attention has been given to computer literacy for staff members who may use the computer as a means of improving effectiveness and efficiency in the day-to-day work which is indispensable to any college or university.

In 57 percent of the responses, the most frequently offered computer literacy programs were those offered for students. The schools most likely to have such programs were those which provided the greatest support to computing, i.e., over $600,000. A slight majority (51 percent) of institutions had faculty computer literacy programs. Such programs were found least frequently for staff, in 43 percent of the responses. However, 80 percent indicated that they planned to institute or enhance such programs, thus indicating that computer literacy is generally accepted as an important element in overall institution computing strategy.

The study population were asked to indicate which computer-related majors they offered among computer science, management information systems, and data processing. The major occurring most often was computer science, in 68 percent of the responses. The major occuring least often was computer engineering. Computer science was offered more than three times more frequently than the second most popular major, MIS, which was offered in 19 percent of the responding schools. The prevalence of computer science programs which are based on foundations in electronics, mathematics, computer software, systems, and technology imply the presence of scientific and technically trained and oriented faculty, more so than those programs which can function with faculty with more generalized backgrounds who serve MIS and business data processing majors. The widespread existence of computer science programs and the plans to increase enrollment and hire more faculty will add to the problems faced by small institutions in acquiring competently prepared instructors.

The respondents were asked to indicate whether their institutions planned to offer any new computer-related majors; 66 percent indicated they had no such plans. The only group which showed plans for such growth was that with the greatest computing resource base--schools which allocate $800,000 or more to computing.

Library

The quality of colleges and universities is measured in large part by their libraries, by both accrediting agencies and prospective students. Often, the major criterion in such evaluations is the number of volumes, periodicals, or microforms a library possesses. As important as the size and nature of the library collection is, it is also important to weigh the ability of the library to meet the service

needs of students and faculty. Computing support has helped many libraries improve their level of service while contending with budget and staffing restrictions. With funding for collection acquisition and personnel costs becoming more difficult to obtain, the move toward greater library productivity and service enhancement through computing becomes more and more important.

The small universities and colleges participating in this study were asked to indicate the computerized library services they provided among cataloging, circulation, bibliographic search, serials control, and interlibrary loans. The service found most often was bibliographic search in 45 percent of the institutions; it was followed by interlibrary loans in 40 percent, cataloging in 39 percent, serials control in 24 percent, and circulation in 16 percent.

The respondents were also asked to indicate among the same services those which they planned to computerize or enhance in the next year. The area indicated most often was circulation (in 25 percent of the responses), followed closely by cataloging (23 percent). Serials control was named by 14 percent, bibliographic search by 12 percent, and interlibrary loans by 7 percent.

Networking

Networking in higher education can refer to two very different functions. Much has been written in the popular press about the first type, local area networks (LANs), which enable computer users at a campus to share such resources as storage, software processing time, and inter-machine communication. The second type of networking is access to national and regional computer networks which provide data base and computer software services to members. LANs are not a part of this study, as the area is highly technical and experimental and the communications services which are now available may be evolving into very different forms.

The respondents in this study were asked to indicate if they had access to national or regional computer networks for library and other uses. Seventy-three (73) percent of the total indicated they had library access and the majority of every group indicated they had such access. (These data may be in conflict with earlier findings on computerized library services where the lack of such access is implied. The answers to the library services questions may be skewed if the responding chief computing officers were not familiar with library operations. Further study of this apparent anomaly may be worth pursuing.) Most of the respondents (54 percent) also indicated that they had access to national or regional networks for other uses. Such access was most prevalent in those schools with the greatest computer resources, those allocating over $800,000 to computing.

Initial or additional computer network access within the next year was not prevalent among the respondents; 44 percent planned such action. The groups least likely to increase such activity were those with the least computing resources, i.e., those spending less than $200,000 on computing.

Word/Text Processing

There is widespread interest and concern about the ability of institutions to meet the needs and demands of their administrative offices and faculty for office automation, particularly word and text processing. Compounding this issue is the presence on campus of many students with microcomputer familiarity who want the same kind of service available to meet their needs, or who are required by the rigors of their academic programs to seek help from central campus resources or on separate equipment. The manner in which small universities and colleges choose to meet such demands and their policies regarding student use of central campus resources are important strategic issues.

The study participants were asked to indicate the types of equipment their institutions used for administrative and academic word/text processing from among mainframes, minicomputers, microcomputers, and single-purpose word processing machines. They were also asked to indicate if they used no word processing equipment. In the total population, the equipment used most often was microcomputers in 81 percent, followed by single-purpose word processors in 72 percent, minicomputers in 56 percent, and mainframe computers in 35 percent of respondents. None indicated that they had no word processing equipment. The reliance on decentralized word/text processing (the microcomputer and single-purpose word processor) is also prevalent through most of the groups, and may be reflective of a preference for decentralized equipment, or the lack of mainframe or minicomputer hardware, or unsatisfactory word/text processing software and peripheral equipment on the larger computers.

The respondents were also asked to indicate the types of equipment they expected to increase or decrease in importance for administrative and academic word/text processing. The responses indicated that all types of hardware were expected to grow in importance, but the microcomputer, mentioned 72 times, was twice as frequently cited as the second source, the minicomputer, which was mentioned 36 times; single-purpose machines and mainframes followed at 24 and 18, respectively. There were relatively few responses about equipment which would decrease in importance, with single-purpose machines mentioned most frequently (12 times), followed by mainframes (7), minicomputers (5), and microcomputers (2).

An attempt was also made to determine the extent to which students were permitted to use mainframe/minicomputer resources for their own word processing of papers, reports, and other work. The survey responses were evenly divided between schools which permitted such student use and those which did not. However, the only group in which a majority did not permit such use were those which allocated $200,000 to computing. The majority in all other groups allowed student use of central computer resources for personal word/text processing.

The respondents were asked if their universities and colleges planned to install initial or additional microcomputers for student word processing. A substantial majority (63 percent) indicated they had such plans. The only group in which a majority did not plan such additional equipment were those spending less than $200,000.

The popular media have written about some universities and colleges, particularly engineering schools, which require their students to purchase microcomputers for personal use. The respondents were asked to indicate if their policy was to require students to purchase central computer time or microcomputers for personal use. Ninety-five percent of the responses indicated no such policy. Thus, institutions which require such purchases are the rare exception rather than the rule, at least among small universities and colleges.

Financing

With the demand for computing in higher education growing steadily, the strains on institutional financial planning assume serious proportions. With the exception of limited grant and gift opportunities the only way in which colleges and universities can obtain extramural support for computing is by selling their surplus computer resources to outside consumers. Thus, internal priorities and financial strategies for computer center resources become key elements in the overall health of the computing enterprise. With the exception of the 1980 CAUSE study, which assembled data on the recovery of administrative information systems support, there is no evidence of any data being collected and published on the internal financing of computer operations in colleges and universities.

The survey participants were asked if their total central computing budget growth in recent years matched, exceeded, or lagged behind the inflation rate. The responses were mixed: 38 percent stated that the central computer budget had lagged, 39 percent indicated it had exceeded the inflation rate, 12 percent stated it had matched inflation, and 11 percent did not know how it had done compared to inflation. The best performance against inflation was in the group which allocated over $800,000 to

computing; the groups that did most poorly were those which provided the least support, i.e., under $600,000 of budget. The mixed responses to this question indicate that the small universities and colleges generally gave computing a high priority since most suffered losses in real value during the high inflation period of the 1970s and early 1980s.

The respondents were asked if the central computing budget had done better, worse, or the same as their college/university as a whole. Fifty-six percent of the total indicated that computing had done better than the institution as a whole; 27 percent stated that computing had been treated the same; in 8 percent computing had done more poorly, and 8 percent did not know. In no group did computing do more poorly than the school as a whole. The improvement of computing resources during an era of high inflation and stable or contracting enrollments indicates a probable net transfer of resources away from other academic and administrative areas within the institution to support the increased demand/cost of computing. Thus, the improvement in computing support was given a high institutional priority among the small universities and colleges in this study.

An effort was made to confirm the preceding statement: the survey participants were asked if increasing the computing budget had been given a high priority by their institution's administration. Sixty-three percent of all responses indicated that increasing the computing budget had been given a high priority by institution administrators. The only group in which a majority did not give it a high priority were those in the 0-$200,000 budget category.

The 1980 CAUSE study examined the extent to which administrative information services (AIS) operating costs were recovered, i.e., billed back to users. Among small colleges (0-1,999 enrollment) 8 percent billed back full costs, 44 percent billed back partially, and 48 percent did not bill back at all. Among meduim-sized institutions (2,000-7,999 enrollment), 19 percent billed back fully, 37 percent partially, and 44 percent not at all.

The participants in this study were asked if computer services expenditures were charged back to users partially, fully, not at all, or on an internal cost accounting (funny money) basis. The responses indicated that 22 percent charged back partially, 4 percent charged back all costs, 52 percent did not charge back in any fashion, and 22 percent used an internal cost accounting system. The data were relatively consistent through all budget support categories. These findings cannot be compared exactly to the CAUSE findings as that study asked only about AIS cost recovery and did not consider internal cost accounting as an alternative.

The participants in this study were also asked to indicate if they planned any change in their charge-back policy. A great majority (74 percent) indicated that they planned no change. The majority in all budget categories also indicated no change was planned.

The general absence of any charge-back mechanism to account for computer resource use, whether in real dollars or "funny money," may contribute to situations in which academic and administrative users demand more and more service without concern for the cost to the institution. Charge-back or cost accounting systems also provide data which can aid management in making strategic priority decisions which affect many users, and the institution's financial status.

The universities and colleges in this study were asked if they had any mechanism whereby students can purchase additional computer time after they use up their original allocations. This question assumed that institutions made computer time allocations and that students were not granted unlimited access to computer resources. The responses indicated that the assumption was not entirely accurate as some schools provided unlimited access. Among the total responses, 83 percent indicated that no mechanism existed to allow students to purchase more computer time, 12 percent did have such a mechanism, and 5 percent provided unlimited computer time. The majority in each budget category had no policy permitting additional purchases.

The universities and colleges which had no such policy were asked if they planned to institute one. A majority in each budget group and 93 percent of the total indicated they had no plans to permit students to purchase additional time. These responses imply that the small universities and colleges in the study apply tighter controls to academic (student) use than they do to administrative use as indicated by the prevailing absence of charge-back and cost accounting systems.

A possible source of income to colleges and universities to offset computing costs is the sale of surplus computer resources (machine time) to off-campus users. Twenty-nine percent of the respondents in the study indicated they made such sales. The only groups in which a majority participated in such sales were those with computing budgets of over $600,000. Those schools which sold computing resources to others were asked what percent of total computing costs were recovered. The mean recovery was 29 percent.

The respondents were also asked to indicate if they planned to begin to sell or to increase such sales in the future. Eighty-four percent of the total and a substantial majority within each budget group indicated they had no such plans. The findings with respect to the sale of surplus computer resources to off-campus users

indicate that small universities and colleges do not see such sales as a significant source of income. Their attitude may result from a shortage of resources, concerns about the administration of such programs, or oversight of it as a possible revenue source.

Hardware

A major strategic decision (or group of decisions) which every college and university which has computer services must face is the type of computer hardware on which its administrative processing will be run. This decision may drive or be driven by such strategic concerns as finance, personnel management issues, software acquisition/development decisions, specialized academic or administrative applications, availability and quality of off-campus services, acquisition financing alternatives, and equipment or systems standardization.

Colleges and universities have different alternatives available to meet their total computer services needs and may rely on more than one type of computer hardware or resource supplier. The 1980 CAUSE study found that among small colleges 68 percent had a combined adacemic/administrative computing installation and 32 percent had separate installations. Among medium-sized institutions the percentages were 75 and 25, respectively. CAUSE also found that small institutions had an average of 1.27 computers and medium-size schools had an average of 1.61 computers. The author's study took a different approach in seeking to determine on what type of hardware or from what source administrative and academic computing needs were met as discrete functions. Hardware was also described in generic terms since the CAUSE data implied a computer definition which has changed since 1980 with the proliferation of microcomputers and decentralized processing throughout educational institutions.

This study asked the participants approximately what percent of academic computing was done on on-campus mainframe computers, on-campus minicomputers, and microcomputers, or was obtained from service bureaus or from other colleges or universities. The prevailing source for academic computing was on-campus minicomputers in 42 percent of the responses, followed by microcomputers in 27 percent, the campus mainframe in 26 percent, other colleges or universities in 3 percent, and service bureaus in 2 percent. The on-campus minicomputer was not prevalent in only one budget group: in the $600,001-$800,000 group the mainframe was the prevalent source of academic computing.

The survey respondents were also asked to indicate plans to increase or decrease reliance on the academic computing hardware resources listed above. Fifty-seven indicated increased reliance on

microcomputers for academic computing was planned; mentioned second most frequently were minicomputers at 26, followed by on-campus mainframes at 12, other colleges and universities at 5, and a service bureau mentioned once. Among those which indicated plans to decrease reliance on hardware sources, minicomputers were mentioned most often at 11, on-campus mainframes at 8, other institutions at 7, microcomputers at 4, and a service bureau once.

The shift toward increased reliance on microcomputers for academic use complements public interest in small computers. Whether the microcomputer is better than a mainframe terminal or a minicomputer as an instructional device can only be determined at the campus level. However, small universities and colleges which lack local area networks may find that the microcomputer is more expensive to purchase and maintain than the terminal; software may be more expensive to buy and prone to copyright violation, and instructors may not be able to teach as effectively. The relative value of the microcomputer compared to the terminal has yet to be determined in the higher education environment, particularly in non-technical disciplines and at the small university or college.

The survey participants were asked what percent of administrative computing is done on on-campus mainframes, minicomputers, or microcomputers, or obtained through service bureaus or other colleges or universities. The most prevalent source for administrative computing was the on-campus mainframe computer at 47 percent, closely followed by on-campus minicomputers at 45 percent. Four percent obtained computing primarily from other colleges and universities, and 2 percent each used microcomputers and service bureaus. The on-campus mainframe was the prevalent source of administrative computing in all groups which allocate over $400,000 to computing. The minicomputer was the prevalent source in groups which allocate less than $400,000 of budget to computing.

The participants were also asked if they planned to increase or decrease reliance on the resources listed for administrative computing. Thirty-eight planned to increase the use of microcomputers, next was minicomputers at 18, followed by mainframes at 13, other colleges and universities at 3, and one service bureau. Increased reliance on micros was characteristic of all groups, and minicomputers were second in most groups. With respect to planned decreases in reliance, minicomputers were mentioned 4 times, mainframes 6 times, other colleges and universities 3, and microcomputers once.

The major strategic trends toward decentralized computing and increased use of personal computers mentioned in the EDUCOM study is confirmed for both academic and administrative computing in small universities and colleges. Few such institutions have chosen to employ the strategy successfully used by Hamilton College and cited

in the EDUCOM study--reliance on a major university to provide a substantial part of its computing needs. Since most higher education institutions are similar in the administrative applications they all must have, and since there are also great similarities in academic applications, it is possible that some institutions could make better use of their limited resources by collaboration rather than by each going its own way. Although colleges and universities compete against each other for students, higher education in America has a tradition of exchanging information freely among individuals and institutions. The sharing of information, common systems work, and the consortium approach to the use of surplus computer resources should benefit all involved.

Chachra and Heterick recommended that university computing facilities directors maintain a very flexible position on installed equipment, which should be leased (not purchased) on short-term bases. The survey participants with on-campus mainframe or minicomputers were asked to indicate their current practices with regard to owning or leasing equipment. The responses were overwhelmingly contrary to the strategy recommended by Chachra and Heterick: 73 indicated they owned their own computers, 21 were involved in lease/purchase programs, and 3 leased their equipment. The preference for ownership was prevalent in all budget categories.

Chachra and Heterick's advice is based on the rapid technological changes which have swept the computer industry in recent years and which are likely to continue into the future. These changes have reduced substantially the cost of computer hardware which must be amortized at annual rates which exceed that of new equipment regularly coming on the market. While Chachra and Heterick's non-ownership strategy is sound, it has been countered successfully by the pricing and marketing strategies of the computer manufacturers who encourage ownership and lease/purchase arrangements through large discounts. The findings of this study indicate that small universities and colleges have found the manufacturers' pricing plans to be compatible with their own strategic goals and objectives.

The survey participants were also asked if they planned any change in mainframe or minicomputer acquisition policy. Of those responding, 23 indicated ownership, 10 lease/purchase, and 3 lease. These answers indicate no change in the near future in the current preference for owning computer hardware rather than leasing it.

The study asked if the institutions in the survey used or planned to use a facilities management firm or service bureau to run their computer services. The advantage of such arrangements, at least in theory, is that the university or college is free of difficult hardware acquisition decisions and personnel problems. The responses indicated that 98 percent did not use or plan to use such

services. The respondents were not asked why, but the probable reasons are lack of control over the resource, concerns about service levels and responsiveness, and cost.

The survey participants were asked if their institutions had made any overt decisions to standardize on a specific vendor or architecture. The majority (56 percent) indicated they had made no such decision. The institutions least likely to have made standardization decisions were those which allocated less than $400,000 to computing services. Those most likely to have made such decisions provided the greatest support to computing, over $800,000 of budget. The advantages on settling on a particular computer architecture or vendor are: better staff knowledge of equipment and software, lower service and software costs, better positioning for local area network and other communications services which are or may become available, and less management and staff time spent in assessing computer alternatives. The disadvantage of standardization is that the college or university may not be in a good position to take advantage of favorable price/product opportunities.

Communications

As mentioned earlier, this study did not attempt to measure small university and college involvement and plans with respect to local area networks, the area which has received the most media attention in the computer communications field of late. Networking was omitted because it is still highly developmental and experimental and a subject of much uncertainty among computer professionals. However, there are two other major strategic issues with which colleges and universities must be concerned, intra-campus telecommunications for data transmission and electronic mail service.

Judicial and legislative decisions in the telecommunications industry have opened up strategic alternatives to colleges and universities which did not exist a few years ago. Institutions have their choice of continuing to get their telecommunications services from the local telephone company or they can acquire their own telecommunications systems for intra-campus voice and data transmission

The survey participants were asked if they planned any major changes in their intra-campus telecommunications systems to improve data transmission. Sixty-five percent of the total responses indicated they planned to make major changes in intra-campus systems. The only group which predominantly did not plan such changes was that which allocated less than $200,000 to computing. The responses imply that small universities and colleges believe significant opportunities now exist to improve their data transmissions and that they plan to take advantage of them.

One of the major trends identified in the EDUCOM study was the movement toward electronic mail services in higher education. Such services have been available for some time through intercampus, national, and regional networks; however, they are a relatively new presence as intra-campus communications systems. The survey institutions were asked if they had intra-campus electronic mail. Seventy-six percent indicated that they did not. The only group in which a majority had it was the $600,001-$800,000 segment.

The survey participants were also asked if they planned to install electronic mail in the future. Fifty-seven percent indicated they had no such plans. Those institutions which spent less than $400.000 on computing were least likely to have plans for electronic mail systems.

Administrative Computing

The study participants were asked to indicate the administrative computing applications their institutions had from among twenty generic descriptors (plus Other), and the computer resource used to run each application (from among the hardware resources mentioned earlier), and to indicate the source of the software for each application.

The responses from the total survey population indicated that the on-campus minicomputer was the predominant administrative computing resource with 46 percent of all applications, followed by the on-campus mainframe at 38 percent. other institution or agency at 9 percent, microcomputer at 5 percent, and service bureau at 2 percent.

The 1980 CAUSE study asked its participants to indicate from among 144 descriptors. including those for library and hospital, the number of applications each institution had. They found that small institutions had an average of 33 applications, with admissions, records, and financial management occurring most often. Medium-sized colleges and universities had an average of 46 applications with the same three functions appearing most often. The CAUSE study also indicated that a majority of its respondents used proprietary software, but it did not attempt to determine the extent of that use. The 144 application descriptors were quite specific, and in a number of areas a broad application could serve to cover multiple applications as described by CAUSE. An example is the admissions and records area which had 28 descriptors in the CAUSE survey. Since this study used 21 possible descriptors, a detailed comparison to the CAUSE work is not possible.

The responses to this study indicated that the mean number of administrative computing applications was 13.2. The most common

applications, in order, were general fund accounting, payroll, student records, mailing lists, registration, and admissions.

The responses to this study indicated a substantial reliance on in-house development of software with 56 percent of all applications being so developed; 35 percent had been obtained from proprietary sources, and 9 percent represented shared development with other institutions. In-house developed software was predominant in all groups. The applications predominantly obtained from proprietary sources were general fund accounting, payroll, energy management, and financial modeling.

Chachra and Heterick state that software and personnel costs are expected to increase by 8 percent a year into the near future and will represent the substantial portion of all higher education computing costs. If small colleges and universities continue to rely on in-house software development, in an era of declining professional staff in relation to demand, they may fall far behind in meeting their administrative systems needs. As an alternative, they can turn to software vendors for proprietary systems to meet their needs. There are a number of companies with software products sufficiently broad in scope to serve most colleges and universities of similar size. However, it is probable that the costs of acquiring and maintaining such software will rise.

Although colleges and universities are sometimes fiercely competitive, and sometimes very different in the nature of their academic programs, they have the same basic administrative systems needs. A consortium approach to meeting administrative computing requirements through joint development and systems maintenance efforts seems to be an alternative worth serious investigation by the higher education community. The State University of New York has taken such an approach by requiring its campuses to get the approval of a broadly representative, multicampus committee before any major new administrative systems work can be undertaken. The same approach has been used in the acquisition of computer hardware. Similar efforts are possible in other public university systems and among independent institutions on a regional basis.

However, the findings of this study indicate that small universities and colleges do not see such an approach as a major answer to their needs. They were asked to indicate if they planned any major administrative applications changes within the near future via the three methods mentioned above. Sixty-one percent indicated that they planned to purchase additional proprietary software. Such a strategy was prevalent throughout. Similarly, 74 percent planned in-house development of major applications with such a strategy predominant in all groups. With respect to the shared development of applications with another college and university, 38 percent indicated such plans. The fact that 38 percent planned shared

development while only 9 percent of all existing applications represent shared efforts indicates a substantial, albeit minority, movement toward the shared development approach.

The survey participants were also asked their institutions' plans with respect to moving administrative applications to larger on-campus processors, to smaller on-campus processors, and to off-campus processors. Seventy-seven percent of the respondents, and the majority in each group, indicated they had no plans to move applications to larger processors. An even larger group, 85 percent, indicated no plans to move applications to smaller on-campus processors, and 93 percent had no plans to move applications off campus. Evidently, the growth in interest and use of the microcomputer for administrative applications is supplemental to existing applications running on other, more powerful computers and does not reflect any decline in the use of larger processors by small universities and colleges. Service bureaus and facilities management firms would appear to be well advised to focus their business development efforts at industries other than higher education.

Computer Security

This study asked its participants to indicate their experience with regard to computer security issues which have been given considerable attention by the popular press. Responses indicated that 78 percent of the total population had not experienced electronic crime or vandalism. Fifty percent of the respondents in the $600,001-$800,000 group had such experience, however. Those with the smallest computing budgets had the least crime or vandalism, probably a result of having less equipment which could be used improperly.

Seventy-six percent of the responses, and a majority in each group, indicated that computer equipment rooms were given extra security protection. Similar findings were apparent with regard to security precautions for microcomputer laboratories. Eighty-three percent of all responses indicated that access to such facilities is monitored or controlled. When asked if they planned to improve current security measures, 60 percent stated they had such plans.

Some colleges and universities have instituted codes of ethics for computer users in an effort to control "hackers" and to prevent illegal copyright-infringement copying and use of software, and other unethical practices. The survey participants were asked if they had instituted or planned to institute a code of ethics for computer users. Fifty-seven percent indicated they had done so or had such plans. The prevailing attitude varied with the $600,001-$800,000 group responding in the negative while other groups either had or planned to have codes of ethics.

DELINEATION OF THE STANDARD MODEL

In sum, the following conditions were found to be prevalent and apparently successful elements of computing strategies in small colleges and universities:

- One officer is responsible for both administrative and academic computing. That officer is either the chief business officer or the chief academic officer. If supervision of academic and administrative computing is split among two persons, both report to one senior officer.

- Mixed committees of cabinet officers, faculty, and staff are responsible for making major policy (strategy) recommendations to the chief executive officer.

- The chief computing officer is responsible for making hardware acquisition and software development/acquisition decisions.

- Decision making on the acquisition of resources for decentralized use is centralized, and the chief computing officer has the major responsibility for such decisions.

The major findings on personnel-staff within these small universities and colleges indicate:

- They employ a mean of fewer than 7.00 positions to serve both administrative and academic computing needs. The major portion supports administrative computing.

- The positions in greatest demand are programmer/analyst and operations personnel. The positions most difficult to fill are programmer/analyst and management. The best source for recruiting is professional contacts.

- Part-time employees generally are not used, nor are there plans to increase such employment.

- No adjustments to the professional salary structure to improve recruitment/retention chances have been made or are planned.

The findings of this study with regard to faculty personnel practices in computing areas indicate that small universities and colleges may have plans which run counter to the available labor supply, and place the quality of their academic computing programs at risk.

- There is a decided preference for full-time faculty over part-time instructors. The credentials of current faculties are low in computer-related advanced degrees.

- There is little interest in retraining, even though surplus non-technical faculty exist who could teach computer-related courses.

- There is disinterest in changing salary compensation policies and practices to improve recruitment/retention of technical faculty.

These personnel strategies appear to put small universities and colleges at a competitive disadvantage to other employers, while making their plans to hire more computer-related faculty seem unrealistic.

The findings of this study indicate that academic computing is an important factor in the overall strategic plan (mission) of small universities and colleges.

- A majority plan to increase computer-related enrollments. These enrollment increases are seen as offsetting the declines resulting from demographic or other factors.

- Computer literacy programs will be added or expanded in the future.

- New computer-related majors are not planned.

This study found that small universities and colleges provide relatively limited computer-supported library services to their students and faculty. Improvement of such services would enhance the institution's appeal for both the student and the professional scholar.

The prevalent guidelines or strategies of these colleges and universities with respect to word/text processing are:

- Word/text processing is decentralized on microcomputers and single-purpose word processing machines.

- The microcomputer will be the most important type of equipment for such work in the future.

- Additional microcomputers will be acquired for student use.

- Students will not be required to purchase their own computers.

The major strategies of these small universities and colleges with regard to financing are:

- The computer budget is given a high institution-wide priority, and it is better supported than the institution as a whole.
- There is no charge-back for computer resources consumed by administrative and academic users either on a real dollar or internal cost accounting basis.
- Surplus computer resources are not sold to off-campus purchasers as a revenue or cost-reduction source.

Major observations on computer hardware strategies include the following:

- Small universities and colleges rely predominantly on on-campus minicomputers for academic computing, but plan to rely increasingly on microcomputers for academic use.
- They rely primarily on on-campus mainframe computers for administrative computing, but also plan to rely increasingly on microcomputers.
- They prefer to own their own computer hardware rather than to lease equipment from vendors. No decision to standardize on a computer architecture or vendor has been made.

With respect to communications strategies, the institutions in this study plan to make major changes in their intra-campus telecommunications systems to improve data transmissions. However, they do not have electronic mail services and do not plan to install such systems.

Institution strategy with regard to administrative computing among the study population indicates:

- The preponderance of administrative computing has been developed in-house.
- Future development plans call for increased software development in-house, and acquisition from proprietary sources. Cooperative development with other universities and colleges is not planned.
- The microcomputer is a supplement to larger computers in administrative computing, not a replacement.

The colleges and universities in this study generally had not experienced computer-related crime or vandalism. However, they did adopt strategies to provide extra protection to computer facilities and microcomputer laboratories, including implementation of a code of ethics to govern use of computer facilities and software.

It is noteworthy that this study found no indication that either the strategic policy-making structure or the management structure of computing in small universities and colleges created any bias which affects the character of operations or the choice of hardware or software resources throughout the study population. It is probable that the policies and practices with regard to computing evolved out of pragmatic considerations rather than from any formal plan for development, i.e., long-range strategic plan for computing.

Although the existence of strategies is indicated, it does not appear that comprehensive strategic plans which weigh such factors as demand, the employment market, technological changes, and other variables have been collated into unified plans. This is indicated by the study findings with regard to the balanced emphasis on academic and administrative computing when the national concern is on the academic; the plans to increase computer-related course offerings despite the national shortage of qualified faculty and without plans to improve chances at attracting or developing such teachers through altered personnel policies; a general absence of systems to account for the use of computer resources, particularly by administrative users; the majority's lack of any overt decision to standardize on a specific hardware vendor or architecture; and the absence of any plans to cut software acquisition/development costs through the shared development of applications with other universities or colleges with the same basic needs and operating problems. Prospective users of the data set forth in this study will want to temper the existing standards with thoughtful consideration of these factors.

RECOMMENDATIONS FOR FURTHER STUDY

This study can provide a basis for further studies of the strategic issues involving computing in higher education. Prior to this study the major investigations of computing in higher education were those by EDUCOM and CAUSE, neither of which covered as broad a spectrum of strategic elements as this study. A study similar to this which focuses on larger institutions would have great potential value.

This study also did not attempt to analyze the technical factors which will influence computing, such as local area networking. As technological advances occur, such information will be important to the executive and computer professional alike.

The effects of computer enrollments on the economic and academic health of colleges and universities could be studied to see if computer-related courses are the panacea which some institutions appear to believe them to be.

In-depth studies of personnel policies and practices in computer-related areas appear not to have been pursued in higher education. With the increased interest in ergonomic concerns, such a study might be of significant scholarly and practical value, as would a study of personnel classification, compensation, and development practices.

A comprehensive study of computer financing in higher education might aiso be of practical and scholarly value.

The strategies of colleges and universities might also be studied as they compare to those of other industries. With the exception of the roles of academic computing, the same decisions and practices occurring in higher education occur in other segments of the economy.

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In researching the literature and previous research on computing strategies in colleges and universities, the author placed primary reliance on computerized searches of bibliographic data bases.

Two searches of the national dissertation data base BRS/DISS, which contains descriptive terms on all dissertations written in the United States from 1861 to October 1983, were conducted. The first search used as descriptors the terms: computer, facilities, college, and planning. The second search used as descriptors the terms: compute (any ending), planning, higher education or university, and college. The only dissertation on record is that written by James Coland Witherbee in 1976, for Texas Tech University, entitled A General Purpose Strategic Planning Methodology for the Computing Effort in Higher Education: Development Implementation and Evaluation.

Witherbee's work dealt with the establishment of a methodology for strategic planning based on the concepts of Zero-Based Budgeting and Planning-Programming-Budgeting Systems. His methodology was successfully tested at two other universities over a two-year period. His work did not focus on small universities and colleges, nor did it attempt to develop strategic models, identify trends affecting existing strategies, or identify probable new strategies. In addition, Witherbee's work took place before the effects of major technological changes on college and university computing became apparent.

Searches were also made of the BRS-ERIC (educational) data base for the period from 1966 through September 1983 to identify journal articles. The first search used as descriptors the terms: computer, facilities, computer-oriented programs, colleges, educational planning, needs assessment, and long-range planning. The second ERIC search used as descriptors: computer-oriented programs, information, information processing, computer facilities,

college planning, educational planning, and strategic planning. A search was made of the BRS-MGMT (management) data base as well. Descriptors used were: computer facilities, colleges and universities, planning, and computer.

These sources provided a number of articles on computing in higher education. However, the number of references to strategic planning and/or models was limited. All such sources were researched and are referenced in Chapter One.

Books were searched by using Books in Print, searches of two universities' catalog files, references found in journal articles, and Library of Congress catalogs.

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APPENDIX:
Survey Respondents and Questionnaire

The survey questionnaire, a copy of which follows the list below, was sent to 271 institutions (see page 41 for an explanation of the survey population selection). The institutions listed below are those for which completed questionnaires were received. Respondents were given the option of not indicating the name of their college or university. Ten of the 104 respondents chose this option, and thus their institutions could not be identified for inclusion in the list which follows.

Alabama A&M University, Normal, AL
Albany State College, Albany, GA
Alcorn State University, Lorman, MS
Alvin Community College, Alvin, TX
Arkansas College, Batesville, AR
Armstrong State College, Savannah, GA
Augusta College, Augusta, GA
Austin College, Sherman, TX
Beaver College, Glenside, PA
Bryn Mawr College, Bryn Mawr, PA
Bucknell University, Lewisburg, PA
Catawba College, Salisbury, NC
Cleveland State Community College, Cleveland, TN
Colgate University, Hamilton, NY
College Misericordia, Dallas, PA
College of Wooster, Wooster, OH
Davidson College, Davidson, NC
Dickinson College, Carlisle, PA
Dillard University, New Orleans, LA
District One Technical Institute Eau Claire, WI
Franklin & Marshall College, Lancaster, PA

GMI Engineering & Management Institute, Flint, MI
Genesee Community College, Batavia, NY
Georgia Southwestern College, Americus, GA
Hamilton College, Clinton, NY
Hood College, Frederick, MD
Husson College, Bangor, ME
Indiana Vocational Technical College, Ft Wayne, IN
John Brown University, Siloam Springs, AR
Kentucky Wesleyan College, Owensboro, KY
King's College, Wilkes-Barre, PA
Lakeshore Technical Institute, Cleveland, WI
Laredo Junior College, Laredo, TX
Louisiana State University at Eunice, LA
Loyola University, New Orleans, LA
Macalester College, Saint Paul, MN
MacMurray College, Jacksonville, IL
Macon Junior College, Macon, GA
Manhattan College, Riverdale, NY
Mansfield State College, Mansfield, PA
Marist College, Poughkeepsie, NY
Mars Hill College, Mars Hill, NC
Marymount College, Tarrytown, NY
Marymount Manhattan College, New York, NY
Mesa College, Grand Junction, CO
Mid-State Technical Institute, Wisconsin Rapids, WI
Mills College, Oakland, CA
Northeast Technical Community College, Norfolk, NE
Norwich University, Northfield, VT
Ohio College of Podiatric Medicine, Cleveland, OH
Oklahoma State University Technical Institute, Oklahoma City, OK
Oral Roberts University, Tulsa, OK
Orangeburg Calhoun Technical College, Orangeburg, SC
Pacific Lutheran University, Tacoma, WA
Paul Smith's College, Paul Smiths, NY
Polytechnic Institute of New York, Brooklyn, NY
Presbyterian College, Clinton, SC
Quinnipiac College, Hamden, CT
Rhode Island School of Design, Providence, RI
Rogue Community College, Grants Pass, OR
Salem College, Winston-Salem, NC
Shorter College, Rome, GA
South Dakota School of Mines, Rapid City, SD
Southeastern College, Lakeland, FL
Spoon River College, Canton, IL

SUNY Agricultural and Technical College at Canton, NY
SUNY Agricultural and Technical College at Cobleskill, NY
SUNY Agricultural and Technical College at Delhi, NY
SUNY College at Old Westbury, NY
SUNY College at Potsdam, NY
SUNY College at Purchase, NY
SUNY College of Environmental Science and Forestry, Syracuse, NY
SUNY College of Technology at Utica-Rome, Utica, NY
Stevens Institute of Technology, Hoboken, NJ
Susquehanna University, Selinsgrove, PA
Tougaloo College, Tougaloo, MS
University of Massachusetts Medical Center, Worcester, MA
University of North Carolina, Asheville, NC
University of Scranton, PA
University of the South, Sewanee, TN
Utah Technical College at Provo, UT
Vassar College, Poughkeepsie, NY
Virginia Military Institute, Lexington, VA
Volunteer State Community College, Gallatin, TN
Wartburg College, Waverly, IA
Washington & Lee University, Lexington, VA
Waycross Junior College, Waycross, GA
Wayne State College, Wayne, NE
Western Maryland College, Westminster, MD
Wheaton College, Wheaton, IL
Whitman College, Walla Walla, WA
Williamsport Area Community College, Williamsport, PA
Winston-Salem State University, Winston-Salem, NC
Wittenberg University, Springfield, OH

STRATEGIC MODELS FOR COMPUTING
SURVEY QUESTIONNAIRE

Institutional Profile:

1. Institution Name (Optional): _____

2. Status: Public _____ Independent_____

3. Highest degree granted: Assoc _____ Bach _____
MA/MS _____ Ph.D._____

4. Student Enrollment (Headcount)_ _____

5. Total institutional annual operating budget $_____

6. Total computer center operating budget (personnel, hardware, software, service, etc.) for administrative $_____ and academic.

7. Percent of total institution operating budget (5 ÷ 6) $_____

Management/Governance Structure:

8. Is one officer responsible for directing both academic and administrative computing services?
8. Yes_____ No_____

9. Are you aware of any plans to separate or unify the two functions.
9. Yes_____ No_____

10. Who does the chief computing officer(s) report directly to?
10. a. Chief academic officer_____ c. President_____
b. Chief business officer_____ d. Other (please specify title) _____

11. If any change in reporting is planned, who will the chief computing officer(s) report to?
11. a. Chief academic officer_____ d. Other (title):_____
b. Chief business officer_____ _____
c. President_____

12. What group or individual is responsible for setting overall institution computing policy, i.e., making final recommendations to President?
12. a. Faculty committee_____ e. Chief academic officer_____
b. Staff committee_____ f. Chief business officer_____
c. Mixed committee_____ g. Other (please describe):
d. Computer center dir._____ _____

13. Who is responsible for making major computer resources decisions, such as major hardware acquisition or software development/acquisition?
13. a. Faculty committee_____ e. Chief academic officer_____
b. Staff committee _____ f. Chief business officer_____
c. Mixed committee _____ g. Other:_____
d. Computer center dir._____

14. Is there centralized control over acquisition of computer resources for decentralized use, such as microcomputers?
14. Yes_____ No_____

15. If Yes, who exercises such control?
15. a. Faculty committee_____ e. Chief academic officer_____
b. Staff committee _____ f. Chief business officer_____
c. Mixed committee _____ g. Other:_____
d. Computer center dir._____

16. Does your institution plan to decentralize microcomputer acquisition decision-making to users?
16. Yes_____ No_____

17. Is the computer center consulted on decentalized computer services?
17. Yes_____ No_____

18. To date, in which area have computer priorities been more emphasized?
18. Academic_____ Administrative_____ Evenly distributed_____

19. Does your institution plan to change the emphasis? Which area will receive more emphasis (+), less (-) no change (X)?
19. Academic_____ Administrative_____No Change in emphasis_____

Personnel Staff

20. Please indicate the number of FTE computer center staff by classification:

a. Management _____
b. Analyst/programmer _____
c. Systems programmer _____
d. Operations _____
e. Secretarial/clerical _____
f. Total _____

21. If your institution plans to increase/decrease staff in the next year, please indicate FTE change:

a. Management _____
b. Analyst/programmer _____
c. Systems programmer _____
d. Operations _____
e. Secretarial/clerical _____
f. Total _____

22. What percent of total computer center positions are predominately academic support, and administrative?
22. Academic _____ Administrative _____

23. Have you had difficulty in recruiting computer center staff within the last year? — 23. Yes_____ No_____

24. If yes, please indicate by the order of difficulty, most difficult=1, least difficult=5. — 24. a. Management _____ d. Operations _____
b. Analyst/programmer _____ e. Secretarial/clerical _____
c. Systems Programmer _____

25. Please indicate your best source for recruiting professional staff (best=1). — 25. a. National searches _____ c. Alumni _____
b. Regional searches _____ d. Professional contacts _____

26. Do you employ part-time professional staff? — 26. Yes_____ No_____

27. Do you plan to begin to use or increase use of part-time professionals. — 27. Yes_____ No_____

28. Has the institution's professional salary structure been altered to recruit/retain computer staff. — 28. Yes_____ No_____

29. If No, is such a change planned in the near future? — 29. Yes_____ No_____

Personnel-Faculty

30. What percentages of computer-related courses are taught by full-time, part-time faculty. — 30. Full-time_____ Part-time_____

31. Do all faculty have advanced degrees in computer science, information science, engineering, mathematics or related disciplines. — 31. Yes_____ No_____ Don't Know_____

32. Do computer center professional staff also serve as teaching faculty. — 32. Yes_____ No_____

33. Have any non-technical faculty been retrained to teach computer-related courses. — 33. Yes_____ No_____

34. Does your institution plan to retrain any/more faculty for such teaching. — 34. Yes_____ No_____

35. Has the institution's faculty salary structure been altered to recruit/retain technical faculty. — 35. Yes_____ No_____

36. If No, is such a change planned in the near future. — 36. Yes_____ No_____

37. Does your institution plan to hire additional computer-related faculty? — 37. Yes_____ No_____

Academic Computing

38. Is computer-related instruction mentioned as a high priority in your college/university mission statement? — 38. Yes_____ No_____ Don't Know_____

39. Does your institution plan to increase the number of computer-related course offerings? — 39. Yes_____ No_____

40. If Yes, by what percent will such offerings increase? — 40. Percent Increase:_____ Don't Know_____

41. Approximately how many enrollments are there in computer-related courses each semester. — 41. Computer-related enrollments _____

42. Does your institution believe that increased computer-related enrollment will offset other enrollment declines, such as those caused by the decreased number of traditional college-aged students? — 42. Yes_____ No_____

43. Do you have formal computer literacy programs for (a) faculty, (b) staff, (c) students. — 43. a. Yes_____ No_____
b. Yes_____ No_____
c. Yes_____ No_____

44. Do you plan to institute or enhance any such programs? — 44. Yes_____ No_____

45. Do you have degree programs in any of the following areas (check): — 45. Computer Science _____ Mgmt. info. systems _____
Computer engineering _____ Data Processing _____
Information science _____

46. Does your institution plan to offer any new computer-related majors? — 46. Yes_____ No_____

Library

47. Please check any of the following library services which are now computerized:

47a. Cataloging _____
b. Circulation _____
c. Bibliographic search _____
d. Serials control _____
e. Interlibrary loans _____

48. Please check any of the services which you plan to computerize or enhance in the next year:

48a. Cataloging _____
b. Circulation _____
c. Bibliographic search _____
d. Serials control _____
e. Interlibrary loans _____

Networking

49. Do you have access to national or regional computer networks for:

49. a. Library: Yes_____ No_____
b. Other uses: Yes_____ No_____

50. Do you plan to obtain initial or additional network access within the next year.

50. Yes_____ No_____

Word/Text Processing

51. Please check the types of equipment your institution uses for administrative and academic word/text processing:

51a. Mainframe _____
b. Minicomputer _____
c. Microcomputers _____
d. Single-purpose word processors _____
e. None of the above _____

52. Please indicate types of equipment you expect to increase (+) or decrease (-) in importance for administrative and academic word/text processing.

52a. Mainframe _____
b. Minicomputer _____
c. Microcomputer _____
d. Single-purpose word processors _____

53. Do you permit student use of mainframe/minicomputer resources for word procession of papers, reports, etc.

53. Yes_____ No_____

54. Are you planning to install initial or additional microcomputers for student word processing.

54. Yes_____ No_____

55. Will students be required to purchase central computer time or microcomputers for their personal use.

55. Yes_____ No_____

Financing

56. Has the total central computing budget growth in recent years matched, exceeded or lagged behind the inflation rate?

56. Matched _____
Exceeded _____
Lagged behind _____
Don't Know _____

57. Has it done better, worse, or the same as the college/university as a whole?

57. Better _____
Worse _____
Same _____
Don't Know _____

58. Has increasing the computing budget been given a high priority by the institution's administration?

58. Yes _____ No_____ Don't Know _____

59. Are computer service expenditures charged back to users partially, fully, not at all, or on an internal cost accounting ("funny money") basis?

59. Partially _____
Fully _____
Not at all _____
Funny money _____

60. If any change is planned in charging back please indicate the practice to be adopted.

60. Partially _____
Fully _____
Not at all _____
Funny money _____
No change _____

61. Do you have any mechanism whereby students can purchase additional computing time after they use up their original allocation?

61. Yes_____ No_____

62. If No, do you plan to institute such a policy?

62. Yes_____ No_____

63. Are computing resources sold to off-campus users?

63. Yes_____ No_____

64. If Yes, approximately what percentage of total computing costs are recovered?

64. Percent recovered_____

65. Do you plan to begin or to increase such sales in the near future.

65. Yes_____ No_____

Hardware

66. Approximately what percent of academic computing is done on the resources listed below?

    a. On-campus mainframe _____
    b. On-campus minicomputer(s) _____
    c. Microcomputers _____
    d. Service bureau _____
    e. Other college or university _____

67. Please indicate if you plan to increase (+), decrease (-), or maintain (o) percent reliance on the resources listed for academic computing:

    a. On-campus mainframe _____
    b. On-campus minicomputer(s) _____
    c. Microcomputers _____
    d. Service bureau _____
    e. Other college or university _____

68. Approximately what percent of administrative computing is done on the resources listed below?

    a. On-campus mainframe _____
    b. On-campus minicomputer(s) _____
    c. Microcomputers _____
    d. Service bureau _____
    e. Other college or university _____

69. Please indicate if you plan to increase (+), decrease (-), or maintain (o) percent reliance on the resources listed for administrative computing:

    a. On-campus mainframe _____
    b. On-campus minicomputer(s) _____
    c. Microcomputers _____
    d. Service bureau _____
    e. Other college or university _____

70. If you have on-campus mainframe or minicomputers, is current practice to own or lease equipment?

70. Own _____ Lease _____ Lease/Purchase _____ Not Applicable _____

71. Is any change in mainframe or mini-computer acquisition policy planned? Please use (+) for increase or (-) for decrease.

71. Own _____ Lease _____ Lease/Purchase _____ Not Applicable _____

72. Do you now use or plan to use a facilities management firm to run your computer services.

72. Yes _____ No _____

73. Has any overt institutional decision been made to standardize on a specific vendor or architecture?

73. Yes _____ No _____

Communications

74. Do you plan any major changes in your intra-campus telecommunications system to improve data transmission?

74. Yes _____ No _____

75. Do you have an intra-campus electronic mail system?

75. Yes _____ No _____

76. Do you plan to install electronic mail in the near future?

76. Yes _____ No _____

Administrative Computing

77. On the matrix below please check on the Source of Computer Resources and the Source of Software grids those major administrative applications in use at your college/university.

Administrative Computing Applications	Source of Computer Resources						Source of Software		
	On-Campus Mainframe	On-Campus Mini-Computer	Service Bureau	Other College/ Univer. or State Agency	Micro-Computers		In-house Developed	Proprietary	Shared Devel with other College
General fund accounting									
Payroll									
Personnel Records									
Financial Aid									
Alumni/Development									
Facilities/Space Inventory									
Equipment Inventory									
Admissions									
Registration									
Student Records/Reports									
Student Accounts									
Student Housing									
Purchasing									
Stores Inventory									
Budget Control									
Faculty activity/cost									
Energy Management									
Financial Modeling									
Mailing Lists									
Institutional Research									
Other:									

Administrative Computing (continued)

78. Do you plan any major changes in administrative applications within the near future via the methods listed below:

a.	Purchase of additional proprietary software	a. Yes_____ No_____
b.	In-house development of major applications	b. Yes_____ No_____
c.	Shared development of applications with another college or university.	c. Yes_____ No_____
d.	Movement of applications to larger on-campus processors	d. Yes_____ No_____
e.	Movement of applications to smaller on-campus processors	e. Yes_____ No_____
f.	Movement of applications to off-campus processor	f. Yes_____ No_____

Computer Security

79. Have you experienced electronic crime or vandalism?	79. Yes_____ No_____
80. Are computer equipment rooms given extra security protection?	80. Yes_____ No_____
81. Is access to microcomputer laboratories controlled/monitored?	81. Yes_____ No_____
82. Do you plan to improve current security measures?	82. Yes_____ No_____
83. Have you instituted (or do you plan) a Code of Ethics for computer users?	83. Yes_____ No_____

Additional Comments/Remarks:

If you would like a copy of the survey results please indicate:

Name:

Institution:

Street:

City/State/Zip:

Please mail completed survey to:

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