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ABSTRACT

Seven papers from the 1987 CAUSE conference's Track III, Organizational Issues, are presented. They include: "Learning Resources and Technologies: A Unified Organizational Reorientation to Administering Educational Support Services" (Morrell D. Boone); "IRM: A Short-Lived Concept?" (James I. Penrod and Michael G. Dolence); "Organizing to Manage Information Resources" (Gene T. Sherron); "Administrative Distributed Computing Can Work" (Stephen Patrick); "User Support for Evolving Technologies in Higher Education" (Robert R. Blackmun, Jeff N. Hunter, and Anne S. Parker); "Establishing an Information-Intensive Health Science Center" (T. Earle Bowen, Jr. and Frank C. Clark); and "Establishing an Information Resource Management Organization at Cal Poly" (Arthur S. Gloster II). (LB)

Leveraging Information Technology

Proceedings of the 1987 CAUSE National Conference

TRACK III: Organizational Issues

December 1-4, 1987
Innisbrook Resort
Tarpon Springs, Florida

CAUSE, the Professional Association for Computing and Information Technology in Higher Education, helps colleges and universities strengthen and improve their computing, communications, and information services, both academic and administrative. The association also helps individual members develop as professionals in the field of higher education computing and information technology.

Formerly known as the College and University Systems Exchange, CAUSE was organized as a volunteer association in 1962 and incorporated in 1971 with twenty-five charter member institutions. In the same year the CAUSE National Office opened in Boulder, Colorado, with a professional staff to serve the membership. Today the association serves almost 2,000 individuals from 730 campuses representing nearly 500 colleges and universities, and 31 sustaining member companies.

CAUSE provides member institutions with many services to increase the effectiveness of their computing environments, including: the Administrative Systems Query (ASQ) Service, which provides to members information about typical computing practices among peer institutions from a data base of member institution profiles; the CAUSE Exchange Library, a clearinghouse for documents and systems descriptions made available by members through CAUSE; association publications, including a bi-monthly newsletter, *CAUSE Information*, the professional magazine, *CAUSE/EFFECT*, and monographs and professional papers; workshops and seminars; and the CAUSE National Conference.

We encourage you to use CAUSE to support your own efforts to strengthen your institution's management and educational capabilities through the effective use of computing and information technology.

INTRODUCTION

As professionals in an always-exciting field, we are constantly facing challenges to blend new information technologies into our institutions. It is important for higher education to develop environments that promote the use of information technology for strategic advantages, that allow faculty, staff, and students to benefit from existing technology, and that stimulate the discovery of new opportunities.

The 1987 CAUSE National Conference, with its theme "Leveraging Information Technology," offered the opportunity for us to share, exchange, and learn of new developments in information technology to improve and enhance our environments. The CAUSE87 program was designed to allow the fullest possible discussion of issues related to these new developments. Seven concurrent tracks with 49 selected presentations covered important issues in general areas of policy and planning, management, organization, and support services, as well as in the specialized areas of communications, hardware/software strategies, and outstanding applications.

To expand opportunities for informal interaction, some changes were made in the program schedule. CAUSE Constituent Groups met the day before the conference, as they did in 1986, but were given opportunities to meet again during the conference. Current Issues Sessions were moved to Thursday afternoon to provide some flexibility with time, encourage interactive participation, and extend opportunities to continue discussions with colleagues. Vendor workshops were offered for the first time this year, the day before the conference. The Wednesday afternoon schedule accommodated continued vendor workshops, vendor suite exhibits, and concurrent vendor sessions.

David P. Roselle, President of the University of Kentucky, set the tone for CAUSE87 with a Wednesday morning opening presentation expressing his commitment to the value of information technology in higher education. John G. Kemeny, past president of Dartmouth College and currently Chairman of the Board of True BASIC, Inc., spoke during Thursday's luncheon of new developments in computing for classroom learning. The concluding general session, Friday's Current Issues Forum, offered an exchange of philosophies about making optimal use of technologies on our campuses.

We were extremely fortunate to be at Innisbrook, a resort with outstanding conference facilities and great natural beauty (and weather)—a real distillation of the best of Florida.

Almost 800 people attended CAUSE87. Many of them described the conference, in their evaluation forms, as stimulating, informative, and memorable. We hope this publication of the substance of CAUSE87 will be a continuing resource, both for conference-goers and for those who will be reading about the conference offerings for the first time.

Wayne Donald
CAUSE87 Chair

Leveraging Information Technology

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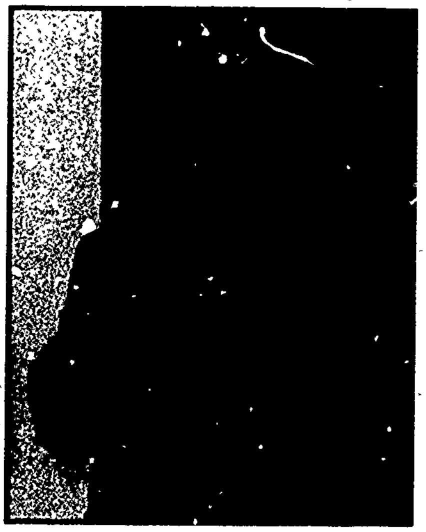

Michael Dolence
California State University/
Los Angeles

LEARNING RESOURCES AND TECHNOLOGIES: A UNIFIED ORGANIZATIONAL REORIENTATION TO ADMINISTERING EDUCATIONAL SUPPORT SERVICES

Morell D. Boone
Dean, Learning Resources and Technologies
Eastern Michigan University
Ypsilanti, MI 48197

ABSTRACT

A trend at many comprehensive universities is to centralize the administration of educational support services for many different reasons. In January, 1986, Eastern Michigan University (EMU) reoriented its administration of learning resources and technologies in support of its educational mission. A Dean's position was created to oversee the development of linkages between information and instructional technologies to the library, media and instructional support services.

This paper will include a description and discussion of EMU's approach to the administration of such services. It will cover the history, goals, mission and impact of reorienting the administration of educational support services at EMU.

Introduction

Historically, directors of academic libraries, media and computer centers have been responsive to student and faculty needs rather than proactive. The relatively new academic jargon "converging technologies" has brought to our attention a serious identity crisis concerning the traditional roles of these educational support services and their leaders. With the new information technologies needing to be merged with more traditional resources and services, who will do what regarding the administration of the evolution of these changing entities becomes a pressing question in higher education today.

This paper deals with this challenge and the initial attempt by EMU to address it. The first step in reorienting the information and learning technology administrative focus within the Academic Affairs Division was to appoint a Dean of Learning Resources and Technologies. This change, its mission, impact and implications will be discussed.

Background

The positions of "directors" of educational support activities as discreet activities are severely challenged by technological convergence much as the traditional teaching department "heads" are challenged by interdisciplinary courses. When a book was in a library and a film was in an A-V center and data were stored in the computer center, life was much more simple and understandable. With the promise of a totally integrated workstation having text, visuals and data ready for direct end-user interface, what happens to the administration of these resources and technologies?

There are data from a few technologically sophisticated institutions, such as Carnegie Mellon, indicating that there is movement toward a change in viewing support services as completely separate units to viewing information services and technologies as utilities. However, if this view of a new academic utility is to be successfully administered, the utility must be implemented effectively and efficiently for the maximum benefit of the end-users. In the beginning of this decade, those institutions which had been on the leading edge of accepting the challenge of this new vision had created a new administrative structure to deal with the increasing number of changes. This position has been given the generic label, Chief Information Officer (CIO). In 1986, Fleit published the first substantive look at the status of CIO positions in American Universities.[1] She has also been working with CAUSE and other organizations to help facilitate rational discussions about the need, strengths and weaknesses of having a simgle administrator over all information technologies. Chambers and Sprecher in their CAUSE '86 paper review current policies and organizational patterns as they relate to the converging technologies of computing, communications and libraries.[2] They note that

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[1] L. Fleit, "Choosing a Chief Information Officer: Myth of the Computer Czar," Cause/Effect. 9, 1986, pp. 26-30.

[2] J.A. Chambers and J.W. Sprecher, "Policy and Organization of Computing, Communications and Libraries in Diverse University Settings," in **Proceedings of the 1986 CAUSE National Conference, December 1986, Hyatt Regency Monterey** (Boulder, Colorado: CAUSE, 1987) pp. 375-385.

there is a strategic planning process for information management in place within the California State University System. However, only at CSU, Chico, is there an organizational structure which encompasses the administration of library, media and computing activities under the direction of a single individual.[3]

Along with many other academic institutions, Eastern Michigan University (EMU) is trying to deal with most of the issues identified in the recent article on this topic by Woodsworth, Gapen and Pollack.[4] Their revealing 1986 Council of Library Resources funded study surveyed 91 institutions regarding the need to have information technologies managed in a more centralized fashion. One of their major conclusions was, "The lines between computing as a utility and information as a distinct service or commodity are blurring."[5] It should not be too surprising to the enlightened observer that a unified description of a CIO structure has not been found, nor does it look likely that there is a mad rush to copy any one particular model at this time. However, it is certain that faculty and students have a pressing need to utilize existing information resources and opportunities for increased utilization through the use of new technologies. The challenge is for administrators, librarians, media and computer specialists to work with these users of information services to develop a more integrated approach to information retrieval and use.

Institutional Setting

Eastern Michigan University (EMU), located in southeastern Michigan, is a comprehensive university with a current enrollment of over 23,000 students (17,000 undergraduates) and a full-time faculty of 680. EMU shares a history much like many state-supported regional institutions that began as teacher training schools. It has grown from a student body of approximately 2,000 in the early sixties, to one with ten times as many students and four colleges, in addition to the College of Education. Today, its mission still includes educating many of the public school teachers in the State of Michigan, but it also has become known for strong programs in applied technology, human services, business and the liberal arts.

Educational Support Services Prior to 1986

The organizational structure for administering the library, media services and computing has been similar to many other non-research oriented universities, the library and media services reporting to the academic side and computing reporting to the administrative side. This traditional structure seemed to have few campus critics as long as the library, media services and computing services remained suppliers of centralized, independent

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[3]Chambers and Sprecher, p. 378.

[4]A. Woodsworth, D.K. Gapen, and K. Pollack, "Chief Information Officers on Campus," **EDUCOM Bulletin**. Summer 1987, pp. 2-4.

[5]Woodsworth, Gapen and Pollack, p. 4.

services. Over the years, non-print services moved from independence within the academic division to a somewhat uneasy merger with print (library) services. On the computing side, all seemed well as long as the central computing facility was mainframe-oriented and supplied adequate "computing power" to both the administrative and academic needs. However, the situation seemed to be changing at a rather alarming pace. The library, media services and computing were all being challenged to meet the demands of acquiring and utilizing new technologies while they maintain a high level of traditional services. That is, the library was to become computerized, offer computerized utilities and CD-ROM-based information systems. Media services was to be equipped to deal with the age of the satellite and interactive video. Computing was being challenged to deal with a more distributive-oriented, world centered around the microcomputer and telecommunication revolutions. Needless to say, the old segregated administrative structure was not able to deal with the age of technological convergence as well as it did with the age of discreet, reactive entities that did what they were supposed to do when they were asked to do so.

Prior to 1980, library and media services were administered by a director with department head status who reported to the Associate Provost for Budget and Personnel. Figure 1, page 9, upper left-hand corner, is a chart depicting the rather straightforward internal organization of the Center of Educational Resources (library and media services). During this time, the Computing Center's director (with department head status and reporting to the Vice President for Administration) was responsible for both administrative and academic computing on DIGITAL equipment.

In the early 1980's, the Instructional Support Center (ISC) was added to the organizational structure of the Center of Educational Resources. At first, there were only three components of the ISC - a language lab, a listening/viewing lab and a tutoring assistance program. In 1983, a 70-station student microcomputer lab was added to the ISC facility and program. The micro lab was funded by the Computing Center, but it was to be administered and operated by the ISC. The Computing Center still kept to a mainframe approach (switched to IBM for administrative computing and dedicated DIGITAL equipment for academic computing). However, the Director was elevated to the rank of Executive Director (with dean's level status) and reported directly to the President, along with new executive directors for personnel, budget and auxiliary services. At about the same time, a new Provost was named and he asked the Director of the CER to report directly to him without a change in status.

Beginning as early as 1983, it became clear that the traditional administrative structures governing the information-based educational support services were not optimally responsive to the changes taking place, both changes internal to the institution and changes in information and learning technologies. It was an institutional given that the Executive Director of Computing would be the President's person regarding the traditional role of providing a predetermined level of computing services to the total campus community. However, it was the Provost's responsibility to formulate the requests for computing on the academic side and to directly administer the other educational support services already within his Division. This being the case, the Provost asked the Director of the CER to develop a plan for reorienting the administration of support services that directly impact on the instructional mission. What follows is a description of this plan (adopted by the Board of Regents in January, 1986), its impact and implications.

Learning Resources and Technologies (LR&T) -- 1986 -

The major problem addressed by the administrative reorientation was that the Division of Academic Affairs had no official representative to coordinate and develop the issues surrounding the appropriate application of instructional technologies. Specifically, the technologies involved are: computers as a tool within instruction and learning (CAI, CAL), and within the administration of instruction (CMI); television within instruction and learning (ETV), and as a product itself (telecourses); and electronic information as a tool (bibliographic data bases) and as a source (full text). Simply put, there was no administrator designated to deal with the critical question -- is the instruction being delivered, the learning taking place, the research being done, utilizing appropriate resources and technologies in the most beneficial and cost effective way?

To address this question, it was recommended that the responsibilities for coordinating, planning and developing a unified approach to the application of computer, video and electronic information within the Division of Academic Affairs be included within the mission of a reconfigured and renamed Center of Educational Resources administrative structure. The four fundamental assumptions behind the establishment of the Learning Resources and Technologies approach are:

- The coordination of the application of learning technologies need to be assigned to a single administrator within the Division who has appropriate expertise and experience.
- The Executive Director of Computing is responsible for the provision of computer and telecommunication services; however, he is not responsible for the specific applications of these technologies within the academic programs.
- New strategies must be developed to formulate a faculty-centered approach regarding the adoption and use of new learning resources and technologies.
- The existing educational support services (library, media, ISC) should be used to integrate these resources and technologies into their services in meeting the needs of their clients.

The revised mission of the reoriented organizational structure is to be more proactive in leading and serving its clients. With the barriers of administrative autonomies being erroded, it will be possible for educational support services to not only embrace new information and learning technologies, but seek to have them integrated into the instructional programs.

Figure 2, page 9, provides an outline of the LR&T organizational structure. There are two very significant changes in organizational structure.

The first is administrative -- elevation of the Director to Dean, establishing an Associate Dean for Library Operations and an Assistant Dean for Media and Instructional Support Services. These changes allow for a direct reporting relationship to the Provost, direct working relationship with the College Deans, liaison relationship with the Executive Director of Computing and assistance in managing the three service components. The second is strategic -- the creation of the Learning Technologies Development Unit. This Unit is the Dean's leadership arena in seeking a faculty-centered approach to the assessment, familiarization and development of appropriate applications of learning technologies. The Unit has three components -- the Center for Instructional Computing (CIC), the Center for Educational Television (CET) and the Center for Information Technology (CIT). Figure 3, page 10, is a description of the specific tasks outlined for each "Center."

At the present time, the Center for Instructional Computing (CIC) is the only Center which is funded and fully operational. The other two Centers are in the early stages of development. The CIC has been in the development stage since 1983. It became operational in January, 1986, when the LR&T was established. The CIC program was described in detail by the author and his colleague, the Director of the CIC, at CAUSE '86.[6] All three Centers are staffed by faculty on release time. Each Center has a direct link to at least one existing operational unit. That is, the CIC's activities are related to the ISC and the Computing Center; the CET's activities are related to Media Services; the CIT's activities are related to the Library and the ISC. Examples of current Center activities will be presented in the following section.

LR&T Impact

The reoriented structure has been in place for less than two years, but there are definite positive successes in both the operational and strategic administrative areas that can be attributed, at least in part, to the change in organizational structure. There are two major indicators of impact that can be identified at this early stage in the life of the LR&T structure. First, there is an objective indicator regarding the operational enhancements in quantifiable terms and terms of strengthened "shoelacing" of projects with the Computing Center. Two examples of these objective indicators of impact are:

- Library Automation Project approved and funded ($842,000) in July, 1987. General project direction is under the LR&T; however, funds for equipment and staff are being allocated to the Computing Center. The administrative structure of the project is a model of shared authority that will be used in other information technology projects in the future. Not only will all the library's clients benefit from this integrated online library system, but the system will also serve as one of the major data bases to be carried on the new EMU component of the MERIT NETWORK (hosted by the University of Michigan).

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[6] . Boone and R.L. Ferrett, "Micros and Faculty: A Developmental ·pproach to Instructional Enhancement," in Proceedings of the ·986 CAUSE National Conference, December 1986, Hyatt Regency ·onterey (Boulder, Colorado: CAUSE, 1987) pp. 491-498.

- Micro Lab Expansion Project approved and funded ($180,000) in November, 1987. The Academic Affairs Division and the Executive Division are co-funding an expansion of the Microcomputing Lab in the Instructional Support Center (ISC). This will be the first general purpose PC LAN available to ISC clients. The LR&T and the Computing Center worked together to make this expansion possible. A side benefit of the project is funding support for the relocation and enhancement of the Media Services television studio and the College of Education's A-V Lab.

Second, there is an observable indicator regarding the strategic developments taking place within the Dean's role as leader of the Learning Technologies Development Unit. Seven examples of this subjective indicator of impact on the organization are:

- Participate in the development of a strategic plan for academic computing resources by the Executive Director of Computing.
- Coordinate EMU's participation in the University of Michigan based NCRIPTAL research project.
- Co-sponsor with Wayne Intermediate School District learning technology showcase seminars for public school and higher education teachers.
- Expand faculty development in the use of microcomputer-based instructional enhancement by creating a "mobile computer-projection cart program" for use in the classroom.
- Conduct pilot projects with University Microfilms, Inc. in the use of new CD-ROM based information retrieval products.
- Conduct pilot project with commercial data base utilities in end-user searching by students.
- Produce videos showing innovative uses of information and learning technologies.

Organizational Implications

The organizational implications for the LR&T specifically and the University as a whole are too numerous and complex to cover in this paper. However, there are two very important related organizational implications that can be viewed as either inhibiting or accelerating factors affecting the unified administration of learning resources and technologies, depending on one's particular point of view.

- Centralized Planning and Budgeting --

  At the present time, the processes of strategic and operational planning and budgeting are not conducive to a unified approach to learning resources and technologies. They have built-in inhibiting factors to accelerating the adoption of new technologies in support of academic programs and priorities.
- Integration of Technologies with Academic Programs --

  In some cases, the long-standing tradition of college and departmental autonomy makes a strong case against a unified approach to learning resources and technologies assessment, planning, budgeting and implementation.

Both of these important organizational implications are behind the Provost's recent decision to form a division-wide educational technology task force similar to one that was formed two years ago to revamp the University's basic studies requirement. This is a very positive step in support of the new LR&T organizational approach.

Conclusion

Eastern Michigan University is attempting to adjust to the need for administering the "converging technologies" revolution. The approach described above is based on EMU's history, mission, political and economic environment. At best, it is a transitional structure, but it is one that has been put forward to reorient the traditional reactive support services model. The reorientation of the administrative structure is a proactive attempt at improving the organizational response to meeting the challenge of providing opportunities for increased utilization of learning resources and technologies by faculty and students.

CER Organization
(Prior to 1980)

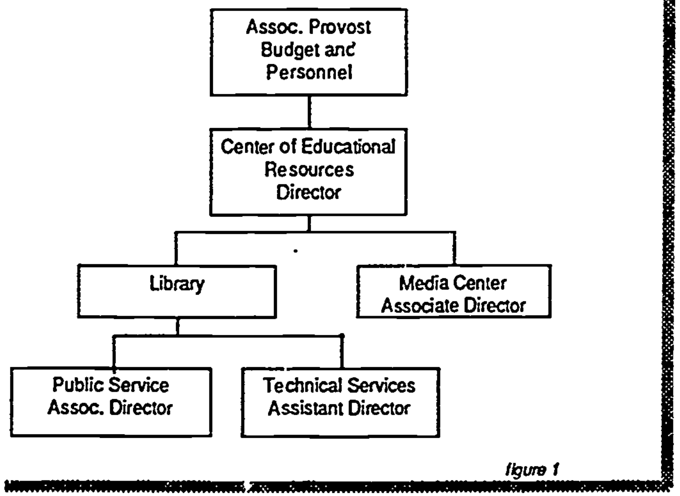
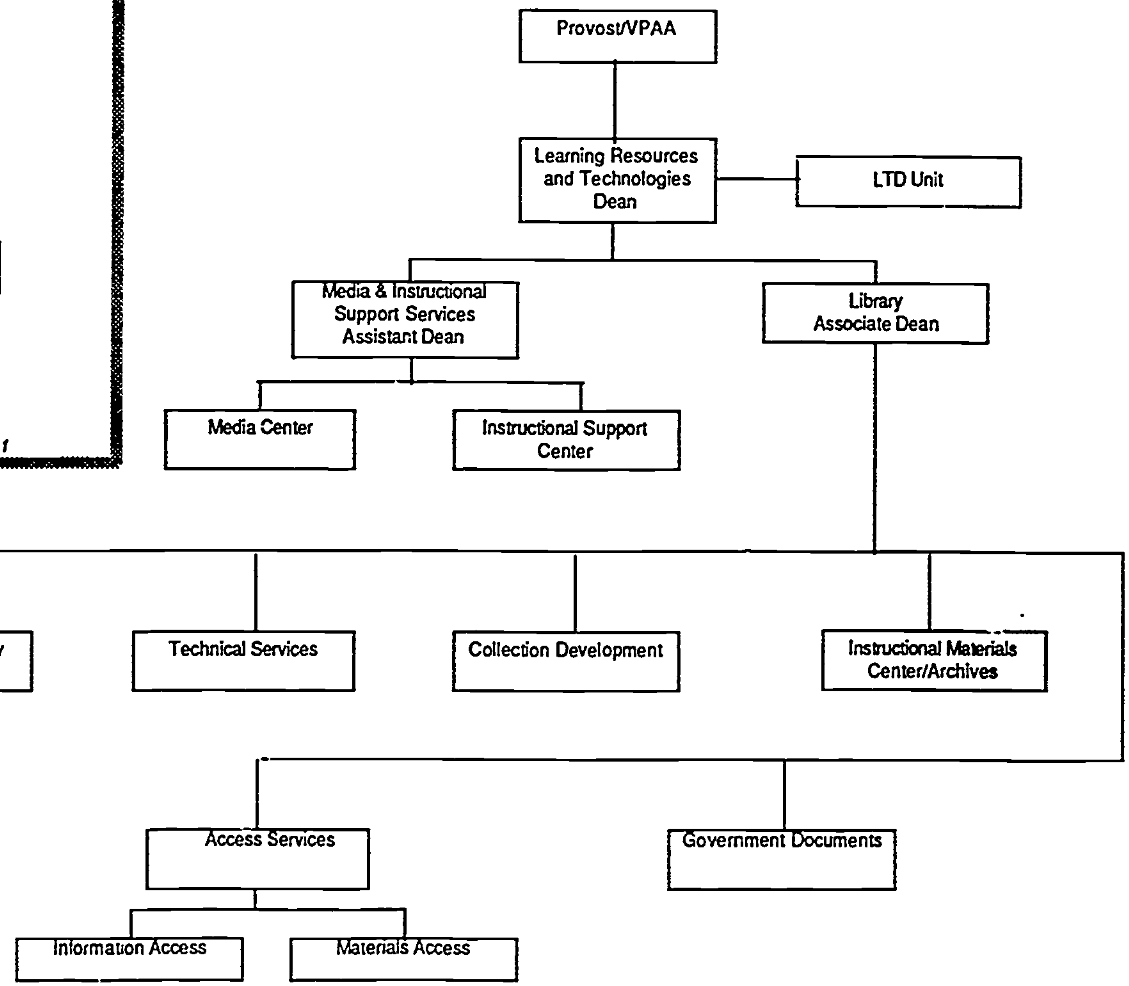


figure 1



LR&T Organization
(1986–)

figure 2

LEARNING TECHNOLOGIES DEVELOPMENT UNIT

Center for Instructional Computing (CIC)

- Develop and administer a program of both academic year and Spring/Summer workshops on instructional computing for EMU faculty members.
- Publish a CIC Newsletter featuring brief descriptions of current instructional computer usage here at EMU, along with abstracts of significant journal publications on classroom computer usage.
- Plan and coordinate a program of "sharing successes" discussion sessions for the in-house exchange of ideas among EMU faculty members on instructional computing topics.
- Coordinate, in liaison with University Computing, the ISC and other appropriate university groups the most efficient instructional usage of available academic computing hardware and software.
- Coordinate and administer a small program of competitive faculty grants for research on instructional computer usage at the university level.
- Stimulate and coordinate the writing of grant proposals and the seeking of private support for major divisional instructional computing projects.
- Develop a CIC network of departmental CIC liaisons, plus provide support for the development of software by faculty.
- Coordinate with other Centers the planning and implementation of programs integrating the use of various technologies.

Center for Educational Television (CET)

- Develop and administer a program of workshops on various facets of educational television usage, including such topics as the in-house production of TV courseware, and the preparation of wraparound materials for courses in which commercially available telecourses are to be used.
- Coordinate, in liaison with Continuing Education, the appropriate college(s) and Media Services, the planning and scheduling of ETV courses.
- Coordinate and administer a small program of competitive faculty grants for the development of ETV courses and/or TV-based instructional modules.
- Coordinate with the other centers programs integrating the planning and implementation of the use of various technologies.
- Publish a CET Newsletter featuring brief descriptions of current educational television usage here at EMU and elsewhere.
- Stimulate and coordinate the writing of grant proposals for major divisional ETV projects.
- Develop a CET network of departmental CET liaisons.

Center for Information Technology (CIT)

- Develop and administer a program of workshops to familiarize faculty with the full range of capabilities of today's electronic information technologies as general components of the teaching and learning process; i.e., teach faculty how to use information in the preparation and design of their classes, and how to teach their students to make appropriate use of these technologies.
- Publish a CIT Newsletter to stimulate greater awareness of research and applications in the field of pedagogical use of information technologies.
- Coordinate and administer a small program of competitive faculty grants for the development of information-based instructional modules.
- Coordinate with the other Centers an integrated program utilizing the various technologies.
- Coordinate in liaison with the Library, appropriate colleges and other appropriate university groups, the most efficient use of electronic information technologies in suppport of the instructional program.
- Develop a CIT network of departmental CIT liaisons that will provide for a sharing of successful applications and uses of electronic information services.

Figure 3

CAUSE 87

IRM a Short Lived Concept?

James I. Penrod, Vice President for Information Resources Management
California State University, Los Angeles
5151 State University Drive
Los Angeles, California 90032

Michael G. Dolence, Strategic Planning Administrator
California State University, Los Angeles
5151 State University Drive
Los Angeles, California 90032

ABSTRACT

The evolution of computing organizations has progressed steadily over the years. During this decade, with the convergence of computing and communications, information resource management organizations with policy level leaders have multiplied significantly. Typically, these new organizational units consist of departments and functions of long standing, pulled together under the umbrella of a chief information officer. In the next few years, as fully integrated networks, decision support systems, expert systems, and distributed database management systems become a reality, a continued organizational evolution is likely. This paper explores some of the causes of change, outlines some of the possible changes, and speculates about the characteristics of the next stage of organizational development.

Introduction

The principal irony of the information age is that while business, industry, education, and government invest rapidly and heavily in equipment, software, and systems to more effectively manage their information resource, investments in and attention to organizational change required to fully utilize and sustain these new capacities is slow and poorly understood. Nonetheless, the age of information will continue to evolve and develop. One scenario describes the next developmental stage as knowledge management.

> A close and direct relationship exists between information management (the ability to manage information and supporting technologies to increase the value and use of this resource) and knowledge management (the ability to search for, have insight into, analyze and synthesize questions, problems and alternatives to resolve or solve significant needs, concerns and interests). [1]

Even though the distinction between information management and knowledge management may appear academic to some, the direction of evolution is clear. A rapidly unfolding movement toward more individual power to acquire, store, organize, manipulate, retrieve, transmit, and display information is significantly expanding the knowledge base. The information economy we are in today will continue to drive this evolutionary movement.

Such an evolutionary path is not smooth but unfolds in convulsive advances evident in a number of major information trends.

10 Information Megatrends Impact Education [2]

Strategic Networking: The exploding area of systems integration is focusing on merging networks of systems into a hypersystem or "Information Utility" of the future. This is a strategic move to close the gap between computing and communications in order to bring about compatibility among incompatible systems. This "anything talks to anything approach" eventually will make available to users (regardless of access port) the power of all the combined resources of the hypersystem. The Information Utility, therefore, becomes the electronic nervous system linking processors, mainframes, minicomputers, microcomputers, servers, local area networks, and a vast array of functional peripheral devices.

The advent of this Information Utility will provide university users directly with sophisticated tools to meet more and more of their information needs. This fluid, continually changing system will foster increased expectations and demands for information technologies. It will further increase the reliance on digitally stored and transmitted data, voice, and image--both on and off campus. It also will decrease the reliance on sheer volume of stored numerical data, as well as reduce data redundancy, and require an integrated systems philosophy.

The linking of local area networks and wide area networks will continue to expand ties to widening geographic areas by providing electronic communication and other services on a global scale. For education, the result is scholarly networking which will remove geographic barriers to intellectual interchange and dissolve discipline-based isolation, fostering global scholarship on a basis of dynamic international networks. The continued evolution of the information society will forge new dynamic linkages between universities and business, industry, and government.

Commercial Globalization: Technology has spawned significant increases in international trade. As a result, the "Global Marketplace" has emerged as a given in all areas of commercial endeavor.

Competition has increased in both quantitative and qualitative terms forcing large and small producers and suppliers of goods to meet unprecedented challenges of scope and complexity. This continued trend will increase the demand for skilled, knowledgeable graduates in areas involving international trade. The universities of tomorrow will also face increased competition for student markets that they have historically had to themselves. These markets can be expected to shrink as the number of competitors for a given student increases. For other institutions, expansion into the international student market and attracting more students by investing in technology will secure their enrollment future. Decreases in traditional enrollments and funding for education will continue to require greater administrative control and productivity.

Corporate Consolidation: We already have begun to see the emergence of a two-tiered vendor environment with a comparatively small number of large corporations accounting for most of the business volume and a large number of entrepreneurial firms accounting for the majority of product innovations. The divestiture of AT&T will continue to result in incremental increases in telecommunications costs. It also will continue to encourage the development of fourth generation digital telecommunications systems with vastly expanded features and growth capabilities for the full integration of voice, data, and eventually video. Since divestiture, AT&T has entered the computer market, and IBM has acquired Rolm and entered the communications market. The dynamics of both computing and communications have entered a new era.

Operational Integration: Traditional bureaucratic barriers between the departments of large organizations and their personnel will weaken. Instead, organically functioning, continuously interactive, electronically linked operational units will pursue overall organizational goals. There will emerge a single data structure for the organization. There will be information at the work group level, department level, and institution level.

In concert with corporate consolidation, there is a continued trend toward the merger of previously separate entities. Postsecondary institutions will need to maintain state-of-the-art information technology that is both appropriate and necessary for highly integrated organizations. However, the resulting infusion of these technological advances will require extensive professional development of faculty and staff.

Management of the educational enterprise will continue to be enhanced. Relational data bases, fourth and fifth generation tools, and integrated systems that meet the depth and breadth of institutional needs will continue to improve the quality of management and help to maximize the deployment of scarce resources through operational integration.

Management Realignment: As the integration of the information system into the corporate mainstream occurs, the roles of professional managers will change from builder/operator/ maintainer to architect. The decision-making capability and power of mid-management specialists will broaden. Top echelon management structure will be simplified, and automation will reduce entry level management jobs.

Automated Expertise: Driven by increased hardware capacity, software developers will continue to make available increasingly powerful software tools. Very soon this will include artificial intelligence (AI) utilized in very practical ways. AI oriented software will become widely available, and expert support systems will become commonplace. The ability to manipulate symbols, deal with uncertainty, and use rules and inferences to solve practical problems and simulate human intelligence will continue to drive increasingly sophisticated AI applications.

User Sophistication: Steady demystification of technology will continue to decrease intimidation. As demystification occurs, user sophistication will increase. Increased sophistication will increase constituent expectations. There will be a significant increase in user technical proficiency and productivity through education and broadened experience. In a relatively short time, esoteric sophistication will be rendered unnecessary by the availability of increasingly "user friendly" products. This will require expanded technical and consultative support.

Consumer Expectations: With the decrease in consumer intimidation, the public's expectations and demands for excellence in both products and services will escalate steadily. There will be an increasing impact of information technology upon curricula and the teaching and learning processes themselves. Introduction of computing tools in the elementary and secondary schools will give rise to a significant increase in the expectations of available technologies among students. The issue of technology availability also will continue to be a factor in attracting and holding top scholars. Discipline and institutional forces will drive the need to provide each faculty member not only with a workstation but a full toolchest. Curricular realignment will be required as the top scholars use technology within and across disciplines and redesign curricula to incorporate its use. Disciplines that have significant alignment with business, industry, or government will need to realign curricula in order to produce graduates who are literate and current in their fields. Ethical and legal issues regarding the uses of information technology have been neglected and will demand increasing attention by the institution as the economic value of information increases.

Reoriented Distribution: The public will demand prompt, if not instantaneous, service and product delivery. Significant growth in vendor-owned, electronically supported distribution systems (along with erosion in third-party distributors) will occur. "Information brokers" will emerge as an integral part of the economy. Libraries will continue to have increasing demands for automated library services, including ties to internal and external networks. In education, technology will continue to de-institutionalize the learning and scholarship process. Computer-aided assessment will provide the greatest opportunity for significantly increasing the amount and quality of individualized student attention.

Technical Redirection: The conceptual parameters of information technology will finally have been established. Technological advances will continue to result in a merger of various technologies including computing, word processing, telephone services, data or text transmission, media, and possibly copy services. Hardware capacity will continue to grow, providing increases in computing power and storage capabilities. These will drive further development and expansion of academic and administrative workstations to encompass word processing, microcomputing, and intelligent terminal capabilities. There continues to be a rapidly expanding introduction of new video devices connected to computers that provide higher-resolution images, animation, audio, and video, as well as low-cost, graphic hardcopy. Users will direct energies toward creative optimization of existing equipment and concepts rather than delay action in anticipation of revolutionary breakthroughs. Increasingly, computer-intensive environments will utilize greater central resources as well as more microcomputers. However, central resources will shift from delivering products to optimizing systems and capabilities, while distributed microcomputers will provide more immediate computing power to individual users and departments.

The rates of change in hardware and software and the advent of converging technologies will require continued institutional attention to training/education for information technology literacy defined in terms of specific disciplines and levels of staff responsibilities.

Information Organizations

The megatrends outlined above will shape the organizations of the future. Significant strides have been made in the effective and efficient management of information. These are attributable primarily to the recognition that information is a basic resource. Within this context, both the content and the technology required to deliver the information is managed. Accordingly, such management more and more frequently is charged to a chief information officer (CIO) who must be knowledgeable about the primary enterprise of the organization and have some background in information systems technology. [3]

Defined, Information Resources Management (IRM) is the management (planning, organization, operations, and control) of the resources (human, financial, and physical) concerned with supporting (developing, enhancing, and maintaining) and servicing (processing, transforming, distributing, storing, and retrieving) information (data, text, and voice).

Appropriately, the first stage in implementing an IRM organization, after establishing a CIO, is to pull together the diverse functions surrounding the management of information. These new heterogeneous organizations must concentrate on consolidating form and function while building a comprehensive information strategy and supportive information infrastructure.

A number of challenges face the development of a new IRM unit. A change methodology must be implemented which facilitates transition from a group of diverse units to an IRM organization. The methodology must involve the development of an understanding among the existing management team of the purpose and theory behind implementation of an IRM program. Next, a planning model must be adopted. Planning must focus on the identification of the functions that IRM needs to perform. Old units then can be reshaped into new IRM components based on identified functions. The results of this process should be summarized in an IRM Strategic Plan and circulated for review. [4]

The success of IRM planning can be enhanced by soliciting broadbased participation in the planning process and providing integration of the IRM plan into the campus Strategic Plan. A recognized need to improve the decision process can be addressed by ensuring that decisions are made in a timely manner, at the most appropriate level, and with a view to the interests of the institution as a whole. Human resources development extends beyond the efficient and effective use of existing resources to the cultivation of an IRM organization "culture." The successful implementation of IRM means not only a major commitment to improve the quantity and quality of services, but also to maintain an alignment between services that are needed and those that are actually provided. This is ensured by establishing of evaluation mechanisms. Smooth development and operation of broadbased IRM support systems such as telecommunications, broadband networks, and central computing systems also must be supported by IRM unit goals and objectives. Through this stage, the new IRM organization usually maintains many of the traditional hierarchical characteristics of its component parts. At this time, most IRM organizations in higher education find themselves at this stage in development.

Hierarchical characteristics include many organizational levels, integrated vertically, controlled by layers of management exercising authority over relatively homogeneous enterprises. This layered organizational architecture emphasizes a chain of command; therefore, any given manager is focused on the layer immediately above or below rather than on the environment. Information flows up and down the corporate ladders being re-interpreted, filtered, massaged, and passed on at each level. Such, organizational culture stresses that the organization is only as strong as its weakest link, causing the development of risk-averse behavior. This rigid structure determines enterprise strategy bounded by narrow spans of direct control designed to maintain the status quo.[5]

Transitional Forces

There are many parallels between the development of information organizations in business and higher education. The development of the global economy with increased competition and its squeeze on corporate profits first drove businesses to rethink the hierarchical structure. Layers were removed to conserve resources. At the same time, rapid developments in technology began to allow the span of communication to replace the span of control. In order to increase effectiveness and efficiency and thereby maintain a competitive position, bureaucratic, hierarchical, information-dependent organizations have had to evolve.

Similar forces (scarce resources, technological developments, changes in mission) are driving the evolutionary process in higher education. The development of IRM organizations in over 200 colleges and universities reflects this trend. The path is shaped continually by the impact of new and developing technology spawning greater functionality. Technology permits wider access to data; more power to shape data into organized information; easier, more rapid communication with colleagues; direct user control over output; and more rapid passes through "what if" loops. Effective users rapidly increase their value to the success of the organization and emerge as the pacesetters. The success of these power users creates an aura of status around possession of technology. Status seeking may well precede need as a determining factor driving technology acquisition and should not be underestimated as a powerful force affecting organizational evolution.

One of the most important evolutionary anomalies is the concurrent development of a single corporate data philosophy and data structure while encouraging the distribution of the data itself. The resulting distributed data base system consists of a collection of sites, linked via a communications network. Each site maintains a data base system of its own and cooperates with other units so that a user at any site can access data located at any other site, as if it were their own.[6] To take full advantage of the distributed data base strategy and realize the potential benefits requires (soon to come) truly distributed relational data base management system software.

The advent of decision support systems (DSS), integrated networks, distributed data base systems (DDBS) and expert systems will continue to cause organizational reorientation. Expansion investments and increases in the numbers of users have led to the development of: 1) a decentralized corporate technology managed centrally, 2) the need for a standard application architecture, 3) the need to accommodate and integrate an expanding array of technologies, 4) the need to support applications at each organizational level--institution/school/department/individual, and 5) the need for a comprehensive organization-wide computing/ communications strategy and infrastructure.

Organizationally, this mandates the role of data administration. The need for this function first became apparent as data base management systems, managed by technically-oriented data base administrators, failed to foster data independence, control data redundancy, provide system integration, and facilitate the level of information sharing that organizational functions required.[7]

The continued development of artificial intelligence will influence the evolution of information organizations. We have moved beyond just the AI concept and are seeing important practical applications in education. Knowledge-based front ends designed to improve and increase service such as bibliographic retrieval systems and a variety of help functions, will smooth the incorporation of technology into the enterprise. [8]

Along with the intended developmental cutcomes cited above, there also are unintended and unexpected outcomes with the increased use of technology on campus. One example is the converging of computing and communications coupled with the continued impact of divestiture, which puts the institution in the business of being its own telephone company and further mandates that it service data (and even video) needs as well as voice communications. Another example is the social impact evolving from the incorporation of technology into the workplace, producing fears, phobias, anxiety, and frustration among new or non-users over learning the use of these new technologies. [9]

Technology also changes communications patterns especially between strong computing and communications users and non-users. Many basic job functions have been affected as individual workstations are substituted for typewriters, filing cabinets, copying machines, calendars, and, in some cases, partial replacement for the telephone and mail. These replacements have deep impacts on traditional support staff fostering a user/non-user hierarchy and fading the lines between clerical and professional ranks. Among the most profound impact is the changes in standards by which work effectiveness, efficiency, quality, and quantity are measured. The use of technology causes a shift--non-user output is compared with and in some cases competes with user output. These changes are evident in the shift in focus from maintaining the elite technocracy to empowering the user with increasingly sophisticated tools and services.

A New Model

One result of these transitional forces may be the emergence of a networked organizational structure. A networked structure is characterized by fewer organizational levels with a wider span of control, horizontally integrated, adopting a flexible operating style designed to respond to a variety of strategic possibilities. The fundamental feature in these new organizational environments is their interconnectedness.

> These interconnections and interdependencies did not develop slowly, one step at a time, ...rather, their emergence is ... of instantaneous networks forming to link historically separate and autonomous agencies, organizations and institutions. [10]

Since the evolving network organization is more strategically focused, it encourages significant involvement with the outside environment. Operating in a matrix, the network approach is more flexible, encouraging a blend of organizational units and crossing organizational barriers, permitting the strategy to determine the operating structures. Success is measured more by the degree of progress toward meeting strategic goals than by interaction with levels above and below each operational level. An orientation toward achieving goals fosters a more self-disciplined culture with broader understanding of organizational purpose and environmental parameters, thereby recognizing rapid change in the environment. These evolving characteristics are in stark contrast to traditional hierarchical structures that support a static environment. The matrix structure permits a contingency approach to management, permitting the more effective targeting of resources, the possibility of eliminating overlap and duplication, and the fostering of a focus on strengthening weak areas. [11]

A responsive network organization recognizes the value of smart risk-taking coupled with planned change. Technologies alone cannot make an organization successful. Both the personal and technological networking must foster a collegial environment. The developed Information Utility will provide an infrastructure to support a mix of services and products, place emphasis on client involvement, provide education and training for a standardized "tool box" of applications, stress the participatory prioritization of services, provide maintenance for the campus network and associated standardized devices, and lead the strategic planning for information resources.

As organizations transition to a networked structure, a new culture will develop. The new culture and philosophy will contrast with the current IRM environment in several ways (Figure A). The new organization will concentrate on optimizing information as a resource rather than legitimizing its emphasis and support. The focus on information technology will become organization-wide rather than on IRM organizations integrating information functions. Organizations will focus on meeting strategic goals by applying technology rather than increasing functionality by melding technologies. IRM staff will begin to shift from doers and helpers to designers and consultants. Acquisition will focus on why the organization is buying technology rather than on what is being bought. Responsibility will shift to all organizational managers sharing responsibility for information technology rather than responsibility being that of IRM alone.

Figure A: Comparison Between Early and Late IRM Culture

EARLY IRM CULTURE	LATE IRM CULTURE
Legitimizing Information as a Resource	Optimizing Information as a Resource
Focus of Integrating Function within IRM	Focus on Integration of Information Technology Organization-wide
Increases in Functionality by Melding Technologies	Focus on Meeting Organization Strategic Goals by Applying Use of Technology
IRM Employees as Doers and Helpers	IRM Employees as Designers and Consultants
Focus on What You are Buying	Focus on Why You are Buying
IRM Organization Responsible for Information Technology	All Organization Managers Share Resonsibility for Information Technology

Transition Strategies

Transition strategies require a clear and concise idea of the target environment. They must be politically sensitive, factually based, and technologically sound. Managing knowledge resources must expand to become a central theme of institutional administrative philosophy. In this model, the role of the Chief Information Officer will parallel that of the Chief Financial Officer (CFO). Like the CFO, the CIO will be a senior level policy officer sharing the responsibility for both setting and accomplishing the strategic goals of the organization. The CIO will lead strategic information planning, oversee information technology investments, manage the information infrastructure, and maintain information accountability. Line managers throughout the organization will be expected to effectively and efficiently use information technology just as they are expected to be fiscally responsible.

For this to come about, management must be re-educated about the strategic and operational role information plays in the continually emerging knowledge economy and in the organizations of the future that will flourish in it. The education program must emphasize the acquisition of new skills to appropriately use information technology and impart a sense of urgency about the opportunities arising and the consequences of not seizing them. As organizations are reshaped by strategic decisions, the role of all managers is reshaped by the demand to deal with, manage, and capitalize on information.

Strategic Decisions

> The key concept to keep in mind when planning for new technology is that the development of an information system is a strategic decision, not a technological one. [12]

The information system crosses all organizational boundaries and penetrates to every organizational entity, and its impact on organizational effectiveness and efficiency is profound. In the new model, there is an increased dependence on and penetration of information technologies into the strategic, operational, and managerial decision-making processes throughout every level of the enterprise.

Information systems add value to decision-making by being easy to use (physically accessible, and easy to find and format), limiting irrelevant information (appropriate, selective, precision), providing quality information (accurate, reliable, valid, comparable), increasing adaptability (flexibility), and saving time and cost. Information systems also allow this value to be put where most decisions affecting an enterprise are made. New information systems can help target decision-making on meeting strategic goals if managers at all levels assume and accept responsibility for their decisions in this context, rather than the context of serving parochial unit interest.

Once this occurs, the organization is reshaped into an adaptable, flexible, networked organization with significantly enhanced strategic response capabilities.

Conclusion

Reflecting on the fundamental purpose of IRM organizations -- to facilitate and provide for the effective and efficient use of information as a basic organizational resource -- it is clear that the principles of IRM will not change much in the forseeable future. Current IRM organizational structures, however, may well change radically.

The four cornerstones for establishing an IRM program which have served its development so far -- 1) defining the IRM concept in the context of the organization, 2) establishing governance, 3) developing a strategy that defines the organization's unique information architecture and articulates the desired information environment, and 4) establishing the appropriate level of technology standards -- will continue to allow the desired environment for information resources to be realized. [13]

Without question, the information resources management environment will continue to evolve. The evolution will take place in a future dominated by the 80/20 rule--80% of what anyone does can be done equally well by anyone else--future success depends on our ability to develop the other 20%. The new competition will be one of ideas, concepts, and visions; it will be oriented toward the future; it will be interactive and on-line; and it will require innovative learning and a creative, effective response to change. Management in this new era will be in the open, and power will be redistributed to those who have access, down to the individual and small group level. Institutional missions will change, management will change, information skills required to meet these new evolutionary challenges will change. There is no longer any such thing as a predictable 25 year career path. [14]

The authors believe the emerging organizations will be networked ones. They will facilitate change, capitalize on information, employ more self-actualized, empowered workers who are closer to decision-making. They will be future-oriented, meeting to discuss what worked rather than what went wrong. For this to happen the change process and the orientation to the future must be internalized. It is clear for this transition to occur management at all levels need to rethink their roles in the organization, reassess how they do their job, adjust their attitudes toward change, and equip themselves with new visions, strategies and methodologies of implementation.

Is IRM a short lived concept? We don't think so.

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"ORGANIZING TO MANAGE INFORMATION RESOURCES"

Gene T. Sherron, D.B.A.

Associate Vice President for Computer & Information Resources
Associate Professor of Information & Management Sciences

Florida State University

Tallahassee
Florida

ABSTRACT

The 1980s will be remembered for its personal computers, supermicros, supercomputers and a deregulated telecommunications industry. And, on the management side, we have been blessed with chief information officers (CIOs), computer czars, and information resource management (IRM).

No doubt these new concepts were necessary and are timely to recognize that functional areas have grown much larger than DP, ADP, and MIS. But, what do we know about it? WHY has this happened? Was it because of the micro invasion or deregulation or the "information wave"? Yet, maybe the more important question is WHAT is IRM and WHO are these CIOs?

The integration of the various information technologies has become today's restructuring rage. And, colleges and universities have been changing their management structure in recognition of the need to deal with these burgeoning technologies. This paper is structured to review the various organizational implications of a broadened technology scene and a recognition that information is a resource that will now be managed from a much higher level.

Highlighting the paper are two "studies" on CIO positions in higher education. Finally, a case example is provided to indicate how Florida State University is organized to manage its information resources. In both instances, comparative data are presented to allow others to deduce how their organizational issues may be resolved.

From DP to IRM

Over a span of more than thirty years, we have called our computer boss by the title that most approximated the name given to the industry, at that time. Let us take a look back to see how we went from DP to MIS to IRM.

In the 1950s, when tabulating equipment was used by the accounting department, we began to call him the DP Chief or the Chief of Data Processing. And, even when PCM or punched card machines became the peripherals on either end of those newfangled computers, it was still DP.

By the 1960s, we evidenced a bit of sophistication and called our business ADP or Automatic Data Processing. Funny thing is that we all new then as now that there is nothing "automatic" about this computer business. We began talking about information systems so the "Director" of Information Systems title began to emerge in the latter part of the decade. As a post script to that decade, the Federal government adopted the name EDP or Electronic Data Processing.

The 1970s, with MIS or Management Information Systems and DDS or Distributed Data-processing Systems, broke the mold of centralized computer center and function. Now, the head guy became the Director of MIS. And another thing happened in the 1970s, we began to see some lady directors join this elite group of computing managers.

In the 1980s there emerged a new but higher level of administrative position endowed with broad responsibilities for information systems, computers, telecommunications, and technology in general. The title given to this position varies from Information Resource Manager to Chief Information Officer to Computer Czar.

But, WHAT does it mean? WHO are IRMs? WHEN did we start using these terms? WHERE do IRMs fit in the organizational structure? And, WHY? WHY do we need yet another acronym to label the same old function?

The Capsule News Lead

IRM. Information Resource Management. Its new. Is it NEWS? Well, let's suppose it is. So, let's give it the journalist's treatment. For an outline concept that will help us understand this topic, the tried and true capsule news lead approach of "who, what, when, where, and why". With this structure, we can logically explore the subject "Organizing to Manage Information Resources".

WHAT is Information Resource Management?

A little "editorial license" is needed at this point. It will make much more sense to start with "what" IRM is as a function rather than "who" an IRM is as a position. But even the "what" is not so easy.

A review of over fifty publications on IRM reveals that there is no accepted or standard definition of the term. Surprised? No, we have come to live with such facts. Recall that MIS never received a simple definition so why should IRM be any different.

This leaves us with no option but to check over the literature and see what people are saying. In building a definition, there is a normal tendency to first describe a philosophy or concept and then identify its components. For our philosophical underpinning, let us go back to Toffler.

Alvin Toffler (1980) reminds us that a new civilization is emerging in our lives.[1] Toffler describes his Third Wave of societal change as the Information Revolution. Suggesting that this "wave" began in the 1950s, it has brought with it the widespread use of computers and even changed the way we work. In this century, we have gone from factory workers to office workers to knowledge workers.

We find that management of this knowledge worker, the new technology and this new information resource is basically management of permanent change. New concepts, issues, and notions remind us that revolution means "change" and new challenges mark our daily lives. The conceptual response has been to recognize information as a resource. Many management textbooks now make information the fourth resource added to the traditional list of "men, money, and material". In 1979, John Diebold stated that "the organizations that will excel in the 1980s will be those that manage information as a major resource.[2]

To get a flavor for this "information as a resource" concept, consider these definitions:

> At one level, IRM manages information as an organizational resource similar to capital and personnel. In this sense, IRM is a philosophy that is directional in nature. At a second level, IRM incorporates information services in the traditional sense--communications, office systems, and such informations components as records management, library functions, and technology planning.[3]

> IRM is the management of the data, people, and processes that produce information that serves a business or functional need. IRM focuses on embracing productivity within a corporation by taking a comprehensive view of systems development. A key feature of IRM is centralized control of information resources.[4]

Notice what is implied in IRM. As a philosophy or concept, we can detect the emphasis on management, the shift in perspective from data to information to all information resources, and that information is being viewed from a higher level in the organization.

> The various components of IRM include human resource management, hardware and software management, telecommunications, office automation, and information systems.[5]

The list of components that can be derived from these definitions suggest that the CIO will most likely be responsible for:

--Computer Technology,
--Information Systems,
--Telecommunications, and
--Knowledge Workers.

Over and above some of the components contained in these definitions, universities have added some that tend to be unique to higher education. Some of these CIO's responsibilities include such broad information services areas as: libraries, printing operations, mail services, instructional (media) resources, bookstores, and the like.

And, to get the flavor of the responsibilities to be performed, the CIOs tend to be involved in:

--Strategic Planning
--Operational Planning
--Policy Formulation,
--Capital Budgets,
--Operating Budgets,
--Negotiations with Vendors, and
--Major hardware/software purchases.[6]

WHO: The Chief Information Officer

Let's use a few word pictures to give the flavor to this Chief Information Officer or CIO character.

Planner and architect of the organization's information resources.
Manager of the organization's vital information resource assets.
Promoter of information technology throughout the organization.
Watchguard of the corporation's investment in technology.
Communicator of technological change.

With that heroic introduction, we move on to the issues of the title, the organization level, and the skills of the position.

Synnott and Gruber (1981) wrote one of the early books on IRM, in fact that was the title--Information Resource Management. In it is found one of the most comprehensive descriptions of the role and responsibilities of the CIO:

> Chief Information Officer (CIO)--a senior executive responsible for establishing corporate information policies, standards, and procedures for information resource management, and for identification, collation, and management of information as a resource.[7]

It was recommended that the CIO in an organization operate at a highly senior level, but at the same time share power with other managers responsible for the control of information in subdivisions such as computer centers, communications units, and information systems.

In the early 1980s when this position was being discussed and described, it is hard to establish whether people first focused on the function of Information Resource Management or the position of Chief Information Officer. However, it is clear that the decision-makers had decided that there was a large technology function that needed to be managed. And, they probably did not start by saying that they needed an Information Resource Manager. More likely, CEOs (Chief Executive Officers), working with their CFOs (Chief Financial Officer), determined that they needed a CIO (Chief Information Officer). At this point, they were describing the function, not the actual title. So, just as the CEO is the President, the CFO is the Vice President for Finance, the CIO is the Vice President for Information Resources, or some comparable title. Placed at this level in the organization, the CIO can function as the bridge between top management and the technicians, while applying technology to promote the effectiveness of the organization.

As to the skills of this position, the shift is from the technical to the managerial. Consider this "ad" as a way to convey the flavor of this new "who":

Wanted: Chief Information Officer.
Prerequisite: General management experience and ability to implement the latest technologies.
Technicians need not apply.[8]

WHEN Did This Get Started?

As with most new concepts or types of positions, there is seldom a date marking its advent. But, it is fairly safe to say that IRM and the CIO are less than a decade old.

Through the use of several bibliographic databases, over one hundred references were developed. A review of each reference revealed that this phenomenon really took off in 1979.

In that year, John Diebold wrote about organizations and resources. And, note the title of the article--"IRM: New Directions in Management."[9] Another good indication of the timing and rapid development of this concept was a survey made by the Diebold Group. In that survey of 130 major corporations, it was found that only 5 percent of them had what we now call CIOs in 1979. By 1984, those same companies reported that 33 percent of them had Os.[10]

However, one forward thinking researcher discovered the emergence of a high-level senior information manager as early as 1974. Howard (1974) presented a "communications" model which reflected the information services function in eight universities which had grouped their information functions under such a CIO.[11] Fewer than twenty such CIOs existed in colleges and universities as of 1984 according to Turner (1984).[12] But, by 1986, Fleit (1986) found that fewer than 100 institutions actually had a "czar".[13] But, the fever rises and many CIOs are added each week to reflect a growth that is climbing at an increasing rate.

WHERE Does IRM Fit in the Organization?

There is no generally accepted models for structuring this technological diversity. The technology is too recent in design and too unpredictable in innovation to permit valid forecasts. The present need is to find a balance between centralized management of the entire field through an IRM and creating the proper environment for end-user computing which is neither forcing nor constraining.

Without this ideal model for the location of the IRM function in the organizational structure, most organizations have developed a place at the vice-presidential level or stress that the position of "corporate-wide" in scope and operation. So, expect to see this IRM function in the organizational charts right along the same functional or operational level as marketing, production, finance, administration, and research.

In colleges and universities, clearly the IRM has been moved above the departmental level. Yet, it is not typically at the VP level. To send the right message, the reporting line goes to the Executive VP or Provost level to demonstrate that the function is truly campus-wide.

WHY Do We Need IRMs and CIOs?

There was no watershed event, article, or announcement that indicated why we must now have a new, higher-level function in organizations that is called Information Resource Management. You know, even that phrase seems awkward. But what ever you call it, the idea was developing that there had to be some name for what is more than DP and bigger in scope than MIS. This new perspective had to embrace hardware from micros to supercomputers, the enhancement of end-user computing, and above all telecommunications. Would it be reasonable to search for that one cause agent to explain the origin of this new function? Well, probably not. Yet, it might be helpful to consider some of the events that certainly contributed to why this phenomenon has occurred.

In terms of timing, it could have been the pervasive spread of the micro computer in our society. From a control standpoint, many were concerned that these new personal computer needed to be managed or gosh knows what will happen.

The other major occurrence was the deregulation of the telephone industry. Almost overnight, organizations went from ordering up phones from the downtown office to creating their own in-house telephone companies. And, during this timeframe, data networks and voice-data integration increased in importance.

In higher education, the study by Howard (1974) documented that the reason most frequently mentioned for integrating information services was to lighten the load at the vice-presidential level.[14] When you think about this you realize that the several vice presidents, all with different functions, did not feel comfortable managing an information function also. Other reasons that can be cited for consolidating the IRM function under the CIO include:

--The need for closer coordination of information services.
--The linking or merging because of commonality of functions.
--A means of decreasing "competition" of operations.

CIOs in Research Universities

In 1987, a study was made of the CIOs at the American research universities.[15] About a third of these 91 universities had CIOs. This is a landmark study of CIOs in higher education. There was a slight emphasis on libraries because of the background of the researcher. Yet, a vast majority of the insights developed in the project were right on target for CIOs in higher education.

Some interesting observations came from this work.

--Of the 32 positions identified, 26 different titles were used and none used the CIO title.

--The level of reporting was fairly evenly distributed between President, Executive Vice President, and Chief Academic Officer.

--Over half of the titles were VPs, Associate VP, or Associate Vice Chancellor.

--The most common descriptors used with the titles included: computer/computing, information systems/technology/services/resources, and technology.

--Over 85 percent of the respondents had been in the position three years or less.

--About 40 percent came to the position from other institutions.
--Only 35 percent had majors in computer/physics/engineering areas.
--Over 80 percent attained doctoral degrees.

CIOs in Higher Education

Because of the exhausting variety and size of business and governmental organizations, it was thought that by looking at institutions of higher education a reasonable survey of IRM/CIO could be made. The campuses of America are often referred to as microcosms of society. So, you might be interested to note how this one segment of society is responding to this concept. In some cases, colleges and universities are on the leading edge and sometimes on the trailing. Yet, in the case of IRM and CIO, there is solid evidence that the concept is catching on. This survey only scratches the surface in that CIO positions were the focus. But, these new titles often suggest new organizations and functions.

The hard evidence of what universities are doing with this "computer czar concept" is revealed in a survey of the 3,300 colleges and universities included in the 1987 Higher Education Directory,[16] only 35 have listed such positions. Through other research, 50 more were identified. Positions at the "director" level and lower were excluded. This makes a grand total of only 85 Chief Information Officers or Information Resource Managers in U.S. colleges and universities today. A rather exclusive club!

The Directory uses a new code and description of administrative officers to describe the CIO. The generic title is "Director, Computing and Information Management". The description is "Coordinates computing systems and the flow of information to and from computing operations". In this directory, there is the old title of Director, Computer Center who "directs the institution's major data processing facilities and services".

What's in a Name?

Few if any colleges and universities have followed the lead of corporations by titling the position as Chief Information Officer (CIO). In fact, by looking at the titles of these new officials, it is difficult to know exactly what functions are associated with the office. So, one method of assessing the magnitude of responsibility is to review the "rank" associated with the titles.

The rank of these university positions vary widely. Vice President, Vice Provost, or Associate Vice President represent typical "ranks".

Once the rank or level has been appreciated, the rest of the title descriptor can be analyzed. And, here again, there is no standard. Usually, the position is broad in scope. Computer responsibility is usually considered as a given. But, is it to be both academic computing and administrative computing? Yes, that is normally the case. Including the area of telecommunications is common but not universal.

At What Rank?

Following its conservative and methodical approach, universities have not tended to create these new positions at the vice president level. Rather, in trying to be at the cutting edge and hedge their bets at the same time, the majority of these new positions are "ranked" at the "associate" or "assistant" level.

The frequency of the different ranks can be readily seen in Table 1.

TABLE 1

CIO Positions Grouped by RANK

30%	Associate Vice President/Chancellor
26%	Vice President
20%	Assistant Vice President/Chancellor
15%	Vice Provost
9%	Associate/Assistant Provost

If the vice president or vice provost rank is used, the individual is clearly a university-wide official. Which implies no special allegiance to academic units or administrative units but rather the concern is for all functional areas of the university. Linking the person to one of the functional areas through an "associate/assistant" title of the principal vice president tends to narrow the scope of the position.

Areas of Responsibility

The scope of responsibility for the "Czar" is also highly dependent on the personality of the institution. And, although the titles following the rank of the position might vary from place to place, there is beginning to emerge a certain uniformity. Note the following summary of title data as taken from Table 2. Understandably, some of the "titles" were close enough to the major titles that they were grouped with them whenever it appeared reasonable to do so.

TABLE 2

Grouping of Positions by TITLE

35%	Computing & Information Systems
24%	Information Systems
20%	Computing
9%	Computing Services

The translation of some of these words in terms of what they mean in the technology industry may be appropriate here. "Computing (or computer) and Information Systems (or services or technology)" gives the broadest connotation: academic computing, administrative computing, and telecommunications. Normally, when the title "computing" is used, telecommunications is being excluded from the scope of responsibilities.

The personality of each campus dictates if it makes sense to add other responsibilities beyond those just mentioned. For example, the technology of a modern learning resources center suggests that this new Chief of Technology could easily assume such responsibility. Several major universities have moved the libraries under the new Vice President. With similar reasoning, a university press and the various copy centers can fit neatly into this new organizational structure. The responsibilities just described are neither exhaustive nor suggestive. Turf wars can erupt easily over lesser issues.

The purpose of mentioning these different areas of responsibility is to give some notion of the range of activities that might come under this new university vice president.

And, it is interesting that with all of the emphasis in supercomputing, that none of the titles reflect this costly resource. So, that humbles us to recognize that, after all, "a supercomputer is just the fastest computer of the day". Or, the supercomputer of today is tomorrow's mainframe. Thus, one must conclude that there is no need to give the "czar" such a narrow title.

Organizing at Florida State

Now, let us move from the general to the specific or from theory to the way we "practice" the management of technology at Florida State University (FSU). In the late 1970s, after several attempts to fill the vacant computing center director's from in-house or local sources, a national search was conducted. As those of you have been a part of such searches, finding these talented computing managers is no easy task. In fact, after several unsuccessful searches, the University Executive Council went back to the drawing board. Enough time had passed that both the technology and the structure to manage it was beginning to change. And, the fact that the University would have to manage its own telecommunications (because of deregulation), made the Council take a whole new look at the position.

In the Spring of 1984, it was decided that the position of Associate Vice President Computer and Information Resources should be established and filled as soon as possible. This new office would be responsible for academic computing, administrative information systems, and telecommunications.

Further, it was decided that the position would be a university-wide official reporting to the Chairman of the Executive Council, who is also the Provost. Please take note that three key management and organization decisions were made consciously at this point.

1. The major technology areas--academic computing, administrative computing, and telecommunications--that affect campus end users were included in the scope of responsibility;
2. The new associate VP was to operate as a university-wide official; and
3. The position was placed at the vice-presidential tier of the organization by "drawing" the reporting line to the Provost.

Closing Thoughts

Do you ever get the feeling that, somewhere along the way, the computer industry has been tripping over itself in the race toward the automation of America by falling short of its own ambitious goals? The computer revolution was supposed to liberate workers from mindless drudgery, yielding soaring increases in productivity, automate the office and home alike, and uplift the lot of virtually every soul. And, it has done some of this. But even the industry's most enthusiastic visionaries now admit it will take decades, perhaps well into the next century to truly fulfill such vaunted promise.[17]

Much has be explained and observed concerning IRM and CIOs. But, new concepts and new positions, a better world do not make. But really, managing information resources in the 1990s should be a lot easier than today. By then, management will have recognized the importance of information as a resource and will have become involved in its management.[18]

But, in the meantime, I wish you well back at your campus. Be of good cheer. Be good managers, take care of your people, and be flexible in the application of these new technologies. And, before you know it, we'll all be enjoying the 21st Century.

FOOTNOTES

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Administrative Distributed Computing can work

Stephen Patrick

Abstract

Much discussion has taken place in the trade journals about the concepts of distributed computing, while in practice distributed computing is a rare phenomenon. The University of Wisconsin-Stevens Point (UWSP) moved from a centralized (mainframe) DP shop to a distributed environment (mainframeless) with applications processed on one of seven UNIX computers and a host of micro computers.

Key differences between the UWSP approach and other distributed computing approaches are that UWSP operates in a multi-vendor environment, does not maintain a central mainframe, and computer users manage the resources without a central data processing organization. Determinate factors for the success of distributed computing are social, political and economic, not technical.

Administrative Distributed Computing can work

Stephen Patrick

Introduction

For the past, five years the University of Wisconsin-Stevens Point (UWSP) has been moving to distributed computing. The UWSP approach is quite different from traditional distributed computing. We have eliminated the central computing organization distributing nearly all computing resources to operational departments. The users of computer applications are in control of all aspects of their systems. We call this version of distributed computing "User Driven Computing". The shift to user driven computing was difficult, and at times painful, but it resulted in better applications with line managers taking responsibility for their computing needs.

The UWSP mainframe environment.

In 1983, UWSP performed most of its computing on a Burroughs B6930 mainframe computer. Administrative computing was mainly batch oriented. UWSP was beginning to get into on-line programming, but the resources needed for on-line systems were not present. The B6930 had 110 Burroughs compatible terminals on its network with 36 dedicated to Academic computing and the remainder to Administrative computing. Unfortunately, when more than 45 terminal users were active at any time the response time degraded to an unacceptable level. Academic computing requirements vary considerably with no load at some periods and a full load at other times. When academic Computing was loaded, there were only 9 terminal sessions available for Administrative computing.

The computing organization in 1983 was a typical "Centralized" data processing organization. The Executive Director of Computing reported to the Assistant to the Chancellor. Three units reported to the Executive Director - Academic Computing, Computer Operations, and Systems Development.

<u>The move to distributed computing.</u>

The reason why.

Listed below were the <u>perceived</u> problems with the UWSP mainframe environment.

The unit was not responsive to users needs.

Computing was very expensive.

A move to on-line computing would require a massive capital investment.

Academic computing needs were not well served on a Burroughs mainframe.

The unit was very bureaucratic.

Certain users were treated better than others.

The Executive Director promised on-line inquiry of the data base, but did not deliver.

The department continually went over budget.

Programmers and Scheduling personnel were surly.

The Burroughs mainframe was not "state of the art" hardware.

Cobol was not "state of the art" for program development.

In 1982, the Controller wanted to implement a computer system to support Purchasing, Accounts Payable, and Stores Inventory. The Burroughs mainframe did not have sufficient capacity to do this and a project was initiated to do this in a distributed environment. A programmer from Computing was assigned to the Controllers office for one year to implement this project. The project was very successful. Computer resources were under direct control of the Controller. Response time was better than it was for mainframe applications. The distributed system cost less on a per user basis than mainframe applications.

Organizational changes made.

The fateful day for computing at UWSP was November 14, 1983 which was known locally as the "Holiday Inn massacre". A radical approach was taken. Rather than firing the Director and replacing him, computing was split. Academic Computing was placed in Academic Affairs and Administrative Computing was placed in Business Affairs. Within Business Affairs, Administrative Computing was further divided. Computer Operations was placed in Financial Operations and Systems Development was renamed Administrative Systems and placed in General Services. Business Affairs management felt that the problem with computing could best be solved by making the unit managers responsible for their computing applications. A strong push toward distributed computing was initiated early in 1984 and continues to this day.

From 1984, resources from Computing Operations and Administrative Systems were reallocated to Academic Computing and user areas. In 1986, $150,000 base budget was returned to the campus general budget. Computer Operations will meet its final demise on July 1, 1988. Administrative Systems remains, but its mission has changed. Administrative Systems is responsible for providing the campus wide network, the Computer Information Center, and a very limited application development role (1 full time programmer/analyst after July 1, 1988).

The UWSP distributed environment.

Technical environment.

Early in the movement to distributed computing, Business Affairs management attempted to develop concepts needed for successful distributed computing. The concepts we developed are listed below:

Software First

The purpose of computing is to run applications. Software makes up applications, not hardware. The primary factor in selecting computers at UWSP is the software requirements of the application. We will select software, then purchase the appropriate hardware to run the software.

Vendor Independent Environment

For years, we have been at the mercy of a single vendor (Burroughs). We felt that we wanted to be in the driver's seat in vendor negotiation. For that reason, we sought a vendor independent environment.

Fourth Generation Programming

The development and maintenance of Cobol based computer software is a greater effort than an institution our size can afford. Cobol based applications are slow to develop and difficult to maintain.

Campus Wide Computer Network

Distributed computing implies that a large number of computers will have to share data. If they are to share data they must be able to communicate with each other. Additionally, end users will need access to applications on a variety of computers. This objective was attained in 1985 when we installed an AT&T PBX and campus wide network.

In 1984, Business Affairs issued an RFP for sufficient computing to handle all Business Affairs applications. This process was our attempt to establish distributed computing standards consistent with the concepts stated above. As a result of this process, we purchased four Sperry computers establishing the following standards:

UNIX Operating System

Numerous computer vendors are marketing computers with a UNIX operating system. Properly implemented applications should be transportable from one vendor's hardware to another. This makes price a marketing factor which computer vendors dislike, but provides very cost effective computing. An alternative to UNIX is MS-DOS for personal computer applications.

Oracle Data Base

Oracle is a data base management system that contains the tools necessary to do all the programming for simple applications and 80-90% of the programming for complex applications. Oracle also helps to support vendor independence because it is supported in an IBM, DEC Vax, and UNIX environment.

The proof of UNIX as a vendor independent environment came to us last year when we issued an RFP for a large mini computer for student records. Three major computing vendors with UNIX computers were locked in a price war. We obtained a HP 9000/850 at a cost significantly less than the cost of a comparable computer with a proprietary operating system.

At this time, we have a many UNIX computers performing different applications in a distributed environment.

Sperry 5000/90 - Accounting

Sperry 5000/80 - A/R, Cash receipts

Sperry 5000/40 - Physical Plant

Sperry 5000/40 - Capital Inventory, Backup

HP 9000/850 - Student Records (Summer 88)

AT&T 3B2 - Alumni

AT&T 3B2 - Electronic Mail

Economic factors.

When we began the move to distributed computing we were faced with a mainframe computer at its performance limit. To upgrade to a computer that would be able to handle 100 users would have cost in excess of $1,000,000 or more than $10,000 per user. Our distributed pilot project (1982) resulted in a 12 user system for $65,000 or $5,500 per user. Costs have changed considerably since that time, but the proportions have not changed. Economy of scale does not apply to computing. It costs more on a per user basis to buy a mainframe than a mini or micro computer.

Resources on a smaller computer can be obtained in smaller increments. It is much easier to obtain funding to upgrade a $65,000 mini computer than a $1,000,000 mainframe computer. This was a factor at UWSP. We had the funding to purchase small computers, but did not have the resources to upgrade to the next mainframe model in the Burroughs line. Field upgrades to increase the memory, disk, or data communications capabilities are six digit investments on a mainframe.

By connecting the cost of computing to the applications, we are in a position to do accurate cost/benefit analysis of computer applications. With a single multi-purpose mainframe it is nearly impossible to find out accurate costs of a proposed application. It is much simpler to predict and measure costs when all hardware and software needed by the application are dedicated to the application.

Social environment.

When the Business Affairs unit discovered the benefits of distributed computing, the rest of the campus was converted to distributed computing the same way Cortez converted the Aztecs to Christianity. The (implied) threat was that at a certain date the Burroughs mainframe would be sold and if you didn't have your own computer it was too bad. This is not a way to win friends, but with strong political support and the guts to maintain the pressure, it is a way to implement user driven computing. I do not feel that there is another way to accomplish this. Eventually, operational departments came to realize that they would have to accept distributed computing.

What was once a central organization was disbursed to the user areas. Each major unit hired individuals to function as systems analysts, programmers, and computer operators. Users were in complete control of their resources. They had the staff to make the systems do what they wanted. This was very successful at meeting the needs of the offices. Programmers worked in user areas, developed a rapport with their clients, saw problems first hand, and had to live with the results of their efforts. The level of distribution of resources is not consistent across campus. Some areas concentrate their computing resources at a higher level than others. Admissions, Financial Aids and Registration have decided to share a computer. This decision is a management decision of each individual unit.

We did experience some negative results to the move of computer individuals to operating units. Each programmer became a generalist with no "experts" in technical fields (data base management, systems analysis, etc). Standards were difficult to develop and monitor. It is difficult to concentrate resources for major projects. Resource allocation is based on a department having the budget to accomplish its goals, not necessarily the needs of the unit. No backup of technical individuals (things go wrong when the one person that can correct a problem is on vacation). Small departments who cannot justify a full time programmer have a difficult time with computing. Operating departments must be concerned with all the problems of computer operations like backup and recovery, scheduling, resource allocation, and system administration. Certain equipment is cost effective when centralized, but not cost effective when distributed. Each department cannot purchase decollators, bursters, high speed printers, or 9 track tape drives. This often makes pre and post processing more difficult than it was in a centralized environment.

We did not concern ourselves with the problems of distributed computing until they occurred. UWSP management felt that we could solve any problems as they occurred. We continue to resolve these problems.

What it takes to make distributed computing work.

It is not my intent to say that our method of distributed computing will work in all environments, or even in a majority of environments. Certain characteristics have to be present for user driven computing to work, and actions must be taken to insure that user driven computing continues to work.

Distributed management style.

Our university has a highly distributed management style. The centralized computing utility was the exception rather than the rule. If middle managers are not allowed to make decisions, there is no point to user driven computing.

Talented "risk taking" managers.

Managers are required to take the initiative and go into unfamiliar areas. The unit manager must become somewhat of a computer expert. Some managers welcome this challenge and become very effective computer managers. Other managers have not adapted well to this change. These managers need someone else to solve their computer problems and units with a significant number of these types of managers should consider centralized computing.

Communication between managers.

In a central DP environment, much of the application integration is hidden from operational managers. In a distributed environment, all integration needs to be explicitly identified and communication weaknesses are brought to the fore front. It needs to be clearly defined what functions take place in what applications.

Hardware and software standards.

Ideally, individuals would execute applications and would not need to know what computer is the host for the application. Consistency should be maintained between applications. The same user interface should be used on all systems. Screens should be designed in a consistent manner. These factors should be present in any organization, but they are more difficult in a distributed environment because each programmer has a tendency to do what he sees without consideration for the "big picture".

Hardware and environmental software compatibility standards need to be implemented. It would be difficult for the end user to use a different terminal emulator for each application.

With distributed computing programmers and operations personnel are stretched fairly thin. The closer hardware, software and procedures conform to a standard, the easier it is to go outside a unit for help or coverage when critical individuals are not present.

Computer communication network.

A campus wide network is very important in a distributed environment. Our network allows any computer user on campus with a telephone to communicate with any computer on campus. In addition, massive amounts of data must be passed from system to system. With the current state of the art, the most feasible way to do this is through batch file transfers. In the near future, applications will be able to use and update data in data bases on different systems. A high speed network is essential for this to take place. Because we have a campus wide network, we will only be dealing with software modifications to implement distributed data bases.

Communication - the key factor

Most of the problems with distributed computing result from a lack of communications between the individuals involved. Several groups of individuals need to meet regularly to keep computing on an even keel.

Line managers of computing resources need to establish application responsibilities and need to be concerned with the presentation of the systems to end users. A suitable vehicle for this would be a coordinating committee. At UWSP, this committee consists of four faculty members and five administrators. The group contains both line managers and technically oriented individuals. This committee is an advisory committee and has functioned informally for a number of years. Now that many of our distributed systems are on-line and we have experience in this environment, the campus has formalized the committee.

Technical individuals need to communicate to exchange ideas and standards. There needs to be a forum for programmers to learn and express their views. Professional development of technical personnel needs to be a concern. Operational managers are often not aware of the need for computer professionals to continue to grow. One approach to this situation would be to have a regular technical seminar where all the computer professionals gather and show what they are doing.

User driven computing has succeeded at UWSP, although not without a certain amount of suffering. Certain activities continue to be centralized. The campus network is a university wide resource. The Computer Information Center is a "one stop" resource for campus end users to deal with the complexities of the situation. Data integrity and consistency is a function of the Computer Coordinating Committee. Some of our areas have had tremendous successes in computing, while others have limped along. The success of a unit is directly attributable to the manager of that unit.

User Support for Evolving Technologies in Higher Education

Robert R. Blackmun
The University of North Carolina at Charlotte
Charlotte, North Carolina

Jeff N. Hunter
North Carolina State University
Raleigh, North Carolina

Anne S. Parker
The University of North Carolina at Chapel Hill
Chapel Hill, North Carolina

Abstract

Effective support for end users of computers has been an important issue in higher education from the first applications of general purpose mainframe computers through minicomputers, microcomputers and supercomputers. With the continued growth of end user computing in an environment of changing technologies, administrative and academic computing organizations must organize to meet the specific needs of their institutions. This paper reviews the development of end user support and examines a number of organizational models which can be useful in supporting end user computing.

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I. Evolution of End User Computing Support

User support may be defined as providing the information and assistance which enables people to use computers as an effective tool to accomplish work. These end users are the faculty, administrators, and students involved in the research, instruction, and administrative activities of our colleges and universities. To understand how evolving technologies will impact end user needs and our support organizations, it is useful to look at the history of end user computing and support.

The automobile analogy

The development of end-user computing is, in many ways, analogous to the development of the automobile in the first half of the 20th century. The initial owners of automobiles were forced, both by the early technology and a very limited "support organization", to know a great deal about the technology and its application. The mass production of automobiles both resulted from and encouraged the development of support organizations: "full service" gasoline stations, restaurants, motels, and organizations such as the American Automobile Association.

The automobile has had a significant impact on society. The movement of homes and businesses away from central cities and the development of the interstate highway system are significant examples of the universal adoption of technology and the importance of an adequate support structure to that evolution. Although computing is a much newer technology than the automobile, it is already clear that a combination of technology-driven advances and effective end-user support structures will be required if computing is to realize its full impact. It is difficult to imagine that the automobile would have achieved universal acceptance if all drivers were required to be able to repair their cars or even crank them by hand!

Evolution of End User Computing in Colleges and Universities

Like the earliest automobiles, the first university mainframe computers were limited in capabilities, accessibility, and usability by other than highly trained people (see Figure 1). Toward the late 1960's, end users were scientists and their "end user computing tools" were FORTRAN compilers and collections of subroutines. To use these tools, researchers had to go to the computer, submit programs, and wait for results. Administrative data processing was performed by professional programmers. The end user had little or no direct involvement with the computer.

Figure 1. Mainframe End User Computing in Higher Education

	1960		1970		1980	
What	Engineering Scientific research	Accounting, Admin, Computer science	On-line data entry, Statistics	DB Query, Ad hoc reports	Report Generation, "What If", Dept data mgt	E-mail, Ad hoc query, Biblio mgt File transfer
End Users	Engineers, Scientists, Grad students	Scientists, Prof admin programmers	Social scientists, Students	"DP Coord", Admin staff	Functional admin users	Info managers, Non-numer research
Support	Prof programmers Part-time consultants	Grad students, full time consultants	Colleagues	Prof support staff	Info Centers	Dept support staff
Hardware Software	Primitive ass'y language	FORTRAN and other compiled languages	Interactive processing, parameter driven stat pkgs	Full-screen interactive Info retrieval, DBMS	Admin tools (ADRS) rel DBMS languages	Fourth generation
Access	on site, limited access, run your own program	on site job submission	Remote terminals, convenient access	Inexpensive ASCII terminals	Higher speed comm links	National networks

1

To assist these early scientific end user computing efforts, the professional staff at first provided rather limited programming assistance. The demand for computing services increased as wider segments of the academic community recognized the advantages of the new technology. Academic computing centers began to employ "user consultants", often graduate students, to provide advice, assistance, training workshops, and documentation.

With speed, storage, and software improvements, interactive time sharing became a reality in the 1970's. Computing was accessible from one's own office, providing a (relatively) quick response. In the administrative area, these developments supported "on-line" query and data entry; for researchers, remote job entry meant fewer trips to the computer. Ease of use was still a problem — a great deal of training and assistance was still required. Support organizations had to adapt their delivery systems to provide timely assistance to a dispersed population.

To reduce the need to learn programming, groups of social scientists and statisticians at several universities developed parameter-driven statistical software. Using these packages, an end user could perform complex statistical analyses without knowing a programming language. Large numbers of social scientists began to use computing in their research and instruction. For administrative data processing applications, end user computing began in earnest with non-procedural reporting packages. To allow end users to make use of these software tools, support staff were called upon to provide training and assistance in the software, the structure of data files and the computer system's control language.

In the early 1980's, the ability to perform sophisticated data analyses without extensive programming skills stimulated computer use by large numbers of inexperienced faculty, students and administrators. For the first time, the user support staff found it necessary to provide assistance and documentation to a growing number of individuals who were not interested in or willing to learn the details of computer operations (job control, data storage, etc). In some cases this new class of users was assisted by the academic user support staff. In other cases, administrative centers developed their own end user support using IBM's Information Center model.

IBM-Canada first used the term "Information Centre" in 1976 to identify the organization which provided support for non-programmers. These end users employed tools such as "A Department Reporting System" (ADRS) and the forerunners of today's 4th generation languages to create reports and even develop small applications.

The development of minicomputers in the late 1960's and early 1970's followed a similar end user evolution pattern. Early minicomputers met specific research needs for real-time data acquisition with readily available hardware. Simplicity kept down the cost of hardware, software, and support.

As research applications grew, the systems' users often developed related management applications such as data analysis and equipment inventories. These applications were often supported by a scientist who had assumed the role of "system administrator" — handling everything from installation and maintenance of software and hardware to assisting others in developing application programs.

Figure 2. Minicomputer End User Computing

	1970		1980	
What	Process ctrl, real time data acquisition	Research project admin.	Vertical market admin systems, "What if," ad hoc repts	Ad Hoc Query electronic mail, file transfer
EndUsers	Quantitative researchers, students	Admin. support staff	Financial and office admin users	Information managers, non-numer researchers
Support	Colleagues	"System Administrators"	MIS, Dept support staff, third party	Information Centers
Hardware Software	Real time data acquis peripherals	Full-screen interactive	Admin appl, info retrieval DBMS	Fourth generation languages, relational DBMS
Access	on site, dedicated, run your own pgms	Access from department offices, high speed	Higher speed communic links	National networks

The growth of management applications created a demand at the department level for business-oriented software tools, such as data base management software. Vendors initially attempted to market minicomputers to departments as general purpose computers, but were unsuccessful because they found support staff both necessary and non-existent. Consequently, a number of third-party organizations developed and supported industry-specific applications systems for minicomputers. Office automation systems are a common example.

Nevertheless, the scope and complexity of administrative minicomputer systems continued to increase, and along with it, the need for support staff. In academic laboratories, it was often sufficient for the technical staff to be provided with manuals and advice from more experienced users. In administrative departments however, functional managers quickly found themselves overwhelmed by the effort required to use the new technology. As noted above, third-party organizations were often used to meet this need; in other cases, an "MIS department" was created or assigned to undertake this responsibility. Continuing development of software "packages" led to less dependence upon traditional MIS software development support. With the shift in emphasis to consulting, Information Centers often assumed the responsibility for minicomputer support.

Following the same end user development path (Figure 3) as mainframe and minicomputers, the first generation of microcomputers were the play things of hobbyists and useful tools for a knowledgeable few. The machines lacked a user interface, but they did have convenient access, computing power, local storage, and quick response time—and they didn't cost much.

With the Apple II and the development of Visicalc, the first general purpose end user software, the personal computer moved quickly to became a tool for financial and administrative users. Although beset with "user hostile" problems like complex operating systems, low cost and menu driven applications made computing very accessible. IBM's entry into the microcomputer market created new respectability and credibility — and a flurry of new software applications and users resulted.

End user support needs proliferated as well. Support organizations were called upon to supply the same training, troubleshooting, and data access support for microcomputers that end users had come to expect — however, this technology introduced larger numbers of inexperienced users. The existence of support organizations has led to an even faster rate of adoption than had occu[illegible] for mainframe or minicomputers.

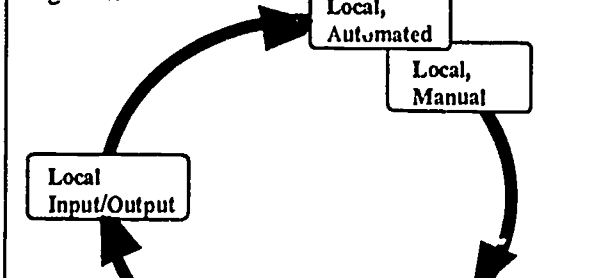
Figure 3. Microcomputer End User Computing

	1975	1980	1985
What	Research, Mech control	Vertical market admin systems: OA, query, ad hoc repts	Ad Hoc Query, Electronic mail, biblio data bases
Who are new end users?	Engineers, computer scientists, hobbyists	Financial and office admin users	Information managers, Non-numerical researchers
Support added	Colleagues	Colleagues, 3rd party, and limited prof. staff	Info Centers and Departmental support staff
Hardware & Software Development	Full-screen interactive, ass'y language	Admin appl., Spreadsheets DBMS, Acctng	4GL, Networks
Access to services	on site, dedicated access, run your own pgms, cost OK for indiv	Mainframe terminal emulation	Software and info. via dept. LANs and low cost

End User Computing Today

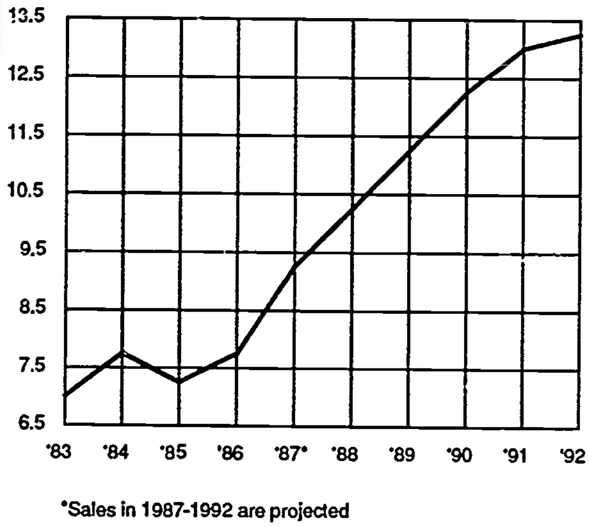
As indicated in Figure 4, this evolutionary process has brought us full circle. Information processing is once again the responsibility of local operating departments. On an institutional scale, we now find ourselves with a wide range of popular hardware and software tools for

Figure 4.



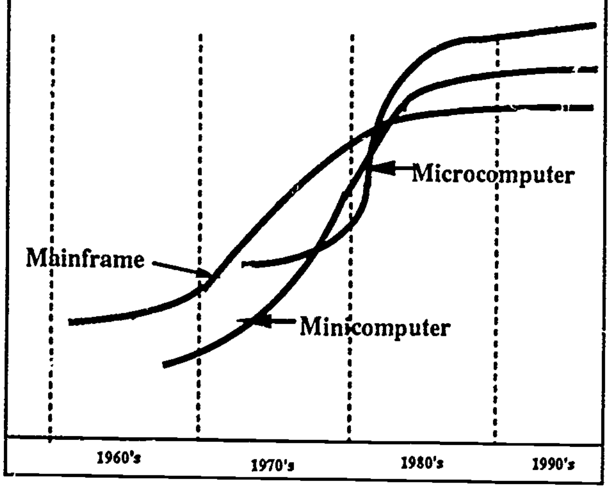
end user computing, connected by national networks, and a sometimes wider variety of end users. It has been predicted that at the current rate of growth, especially for personal computers, (Figure 5), end user computing will likely be 90% of all computing by 1990 (Wall Street Journal, 1987).

Figure 5. Annual Sales of Personal Computers in the U.S. in millions.



Concurrently, the time needed for mainstream adoption of each new technology has been decreasing; from 25 years for the mainframe to roughly 10 years for micro-computing, (Figure 6). The change in the rate of acceptance is due largely to two factors: access and support. Access, as we have seen is a function of cost and convenience. Support has been provided by, or evolved from, organizations which provided support for preceding technologies.

Figure 6. Adoption of New Computer Technologies



Issues Facing End User Computing Support

Today, we face three major challenges in supporting end user computing:

1. How best to support maturing technologies
2. How to manage the impact of decreasing hardware costs
3. How to apply and adapt support strategies to new technologies

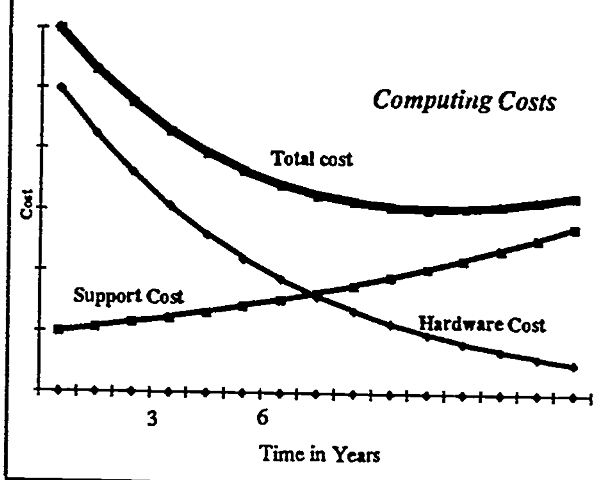
As end user computing continues to evolve, questions arise about how to best support this maturing technology. Two trends are likely to continue:

1. The evolution from technically sophisticated users towards application—oriented users who view the computer system as a "tool"
2. The rapidly increasing capabilities of the computer software, hardware, and communications networks

If our goal is to make end user computing effective (which is not necessarily the same as efficient use of hardware) then the combined effect of these two trends will be to increase the need for, but perhaps to change the focus and delivery, of user support. For example, fourth generation languages allow information to be organized according to a "relational" model. Because a user needs to know less about database structure than with previous tools, less support will be needed there, but more support will be needed for training, for evaluation of new tools and techniques, and for communicating the information across campus. In addition, there will continue to be a need for support services such as file conversion, networking, access to data, development of macros and templates, coordination of purchases and repairs, and strategies for coordinated planning.

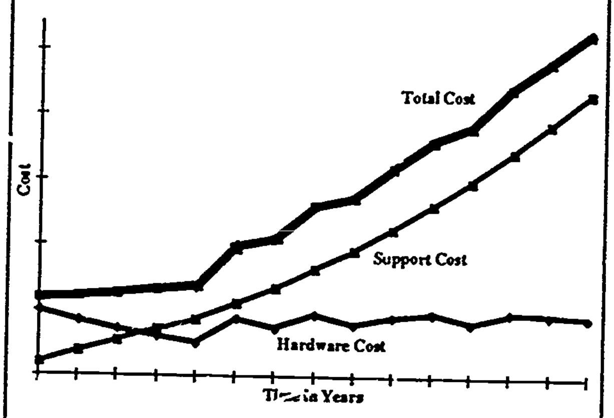
The second challenge we face is the impact of the rapidly declining unit cost of computing equipment coupled with the increasing cost of people and software development. This fact has been widely recognized by James Emery (Emery, 1978) and others. Figure 7 shows these annual cost curve expectations. In the late 1970's and early 1980's, it was expected that the decline in equipment cost would offset the increase in the cost of people and software so that substantial increases in the amount of computing could be accomplished within a relatively constant budget (in real dollars). Many academic institutions, emerging from a decade of intense cost pressures resulting from inflation, expected to be able to meet the needs of faculty, administrators, and students for the benefits of computing technology without significant increases in funding.

Figure 7. Predicted Computing Costs



This has not, however, been the case. As shown in Figure 8, declining hardware unit costs have lead to increased purchases and therefore a relatively flat curve for total hardware cost rather than the predicted declining one. The increase in number of units purchased has lead to an increased demand for support and therefore an increased total cost. This effect is easily seen in the impact of the relatively low price of Apple and IBM personal computers which resulted in a rapid increase in

Figure 8. Actual Costs



the rate of purchase (Figure 5), more than offsetting the decreased unit cost. In addition, this created an increase in the demand for software, user support staff, and maintenance services. Many organizations continue to struggle with unexpected growth in the overall cost of computing resources along with difficulties in managing the acquisition and support of a large volume of distributed equipment and software and training or recruiting support staff.

Our third challenge is how to support new technologies. As the "old" technology matures, new technologies are evolving. Supercomputing with its associated national networks is certainly one of these. With supercomputing we are seeing a repeat of the same adoption cycle that we have seen for mainframes, minis, and micros. The National Science Foundation program for supercomputing has recently recognized the importance of user support to speed the evolution from specialized resource to widespread adoption — to further compress the adoption curves shown in Figure 6.

Another new technology beginning to impact instruction is the evolution of visual learning environments such as MIT's Project Athena. Graphics rich computers provide developers with new software possibilities — and new areas to support. Manipulation of graphic information requires intensive computational capabilities, large memories, high speed network access to data bases, and shared specialized resources.

The challenge facing end user support organizations is to apply and adapt the knowledge and skills learned in supporting the "microcomputer revolution" to these new and evolving technologies.

II. Support Strategies

Is a Formal Support Structure Necessary?

In designing a strategy to meet these challenges, one of the first questions that must be asked is whether a formal support structure is necessary at all. A major argument for providing formal support for end user computing is to insure that end users can focus on their jobs, not on using the computer. As we have seen in the evolution of each of these technologies, initial support is provided by the familiar department computing "guru"— the professor (or accountant, or ...) who started colleagues computing and who now finds herself or himself occupied for large amounts of time answering questions, troubleshooting, and sometimes changing printer ribbons. The fact that this phenomenon exists and has existed for each technology is proof that support is both necessary and inevitable, whether in a form that is in the best interests of the institution or not.

A second reason for formal structure is that without, it is virtually impossible to evaluate the efficiency or effectiveness of support.

A third reason is to facilitate access to distributed information. Effective use and understanding of data by end users. who are not the data "owners," requires coordination such that data is defined, access is controlled, if necessary, and quality and timeliness are assured. Given that most end users use data from a variety of sources, a formal structure for providing access is necessary.

Goals of End User Support

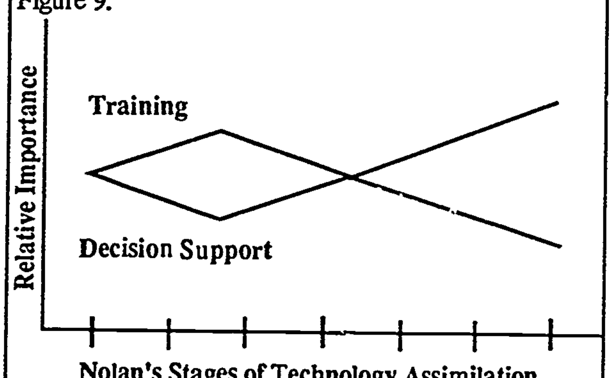
Before defining a formal structure, it is important to review the goals for end user support. These goals reflect the dynamic state of technological change in institutions. They include:

- To achieve the institutional mission
- To recognize that technologies for a given institution evolve at different points in time; for example, an organization may have mature technologies as well as those that are just being initiated.
- To empower the end user (whether an individual or a department) with the ability to pursue his/her own information technology requirements.

With these goals in place, an institution can pursue an organizational structure for end user computing support which best meets its needs.

The evolution of technologies (as depicted in goal #2) seems to move through different phases. One example of the phases necessary to support a technology is shown in the following chart (Figure 9) by Burkin (Burkin, 1985). As technologies evolve in an institution, so must the support of these activities change.

Figure 9.



In the next section, we take the concept of evolutionary phases a step further by examining Nolan's model of the stages theory of computer growth.

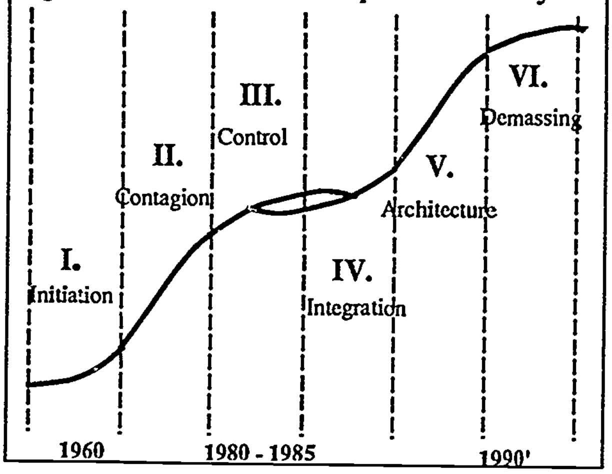
Nolan Model — A Theoretical Framework for Support

Richard Nolan first developed the stages theory of computer growth in 1973. As shown in Figure 10, Nolan's stages theory is based on identification of an S-shaped learning curve of technological assimilation. "The learning curve, manifested by a company's annual expenditures on computer technology, proposes to reflect the company's organizational learning of how to incorporate computer technology to carry out business functions more effectively and efficiently." (Nolan, 1984)

In 1979, Nolan expanded the original four stages to six. The two additional stages reflect computing in the maturing organization. As noted in Figure 10, the six stages are initiation, contagion, control, integration, architecture, and demassing. Stage one is the introduction of new technology and raising awareness and interest to stage two where everyone wants to get involved. In the third stage, the institution tries to bring some order to the chaos through control. Technologies are integrated in stage four. The last two stages reflect the maturing organization. These stages appear simultaneously for different areas of the institution because of the many and varied user-oriented technologies. "During the early 1980's it became clear that computer expenditures were accelerating and growth was being driven not by DP technology but by user-oriented computer technologies." (Nolan, 1984)

Figure 10. Nolan's Stages of Computer Growth

Organizational Models: Descriptions and Analyses



Having considered the need for a formal structure, the goals of end user support, and the Nolan model for the adoption of technologies, we will now examine several organizational models which may be useful in establishing a support structure. Since the mission, tradition and needs of end user computing support will vary from institution to institution and over time, we will describe and compare four distinct models:

- End user support — centralized within MIS
- End user support — centralized and separate from MIS
- Information Resource Center
- Function/discipline-oriented end user support

Any one of the four models presented may work effectively in institution "A" and be completely ineffective for institution "B." The overall organizational structure of the institution, the manner in which computing evolved on the campus, and the "mentor" of end user computing play critical roles in how end user computing is supported. (Atre, 1986). In addition, the success of any model supporting end user computing is dependent on the development of a "strategic direction" for the implementation of new technology by the institution. (Gerrity and Rockart, 1986, p. 30).

In Figure 11, a summary comparing the four models across several key factors is presented. Additional detail for each model is found in later sections.

Advantages:

- easy access to systems support personnel
- global perspective on the direction of computing

Disadvantages:

- limited user influence on design, procedures, and services - end user support is the creation of the central IS department
- limited staff with multiple products and services to support
- interrupt-driven support severely impacts development and maintenance activities

Figure 11. Organizational Models

Key Factors	END USER COMPUTING IN MIS	END USER COMPUTING NOT IN MIS	INFORMATION RESOURCE CENTER	FUNCTION/ DISCIPLINE ORIENTED
Scope	Institution	Institution	Institution	Department
Staff Priority	1. Tools/Tech 2. People	1. People 2. Tools/Tech	All Information Tech Skills	Application Oriented
Activities	Write Programs	Acquire and Use Programs	Coordination and Planning	Acquire and Use Programs
Objectives	Efficient Use of Computing Resource	Effective Use of Computing Resource	Global Optimization	Local Optimization
Advantage(s)	Access to Systems Support	Flexibility in Meeting User Needs	Effective long-Range Planning	Understands Functional Area Needs
	Global Systems Perspective	Relief from DP Stereotype	Reduced Service Duplication	User Sets Priorities
Disadvantage(s)	Limited User Input in Type of Service Interrupt-Driven Versus Development	Limited Access to Systems Support Reduced Global Systems Perspective	Long Queues for Service Delivery Overlap of Operational Activities	High Risk Personnel Investment, Lack of Quality Control

End User Support — Centralized within MIS

Centralized end user support evolved from the traditional data processing organizational structure. When the end user needed changes to a report or enhancements to a system, a request was made to the centralized data processing function. IBM created a new twist in this trend with the formation of the "Information Center" concept. The Information Center was designed as a centralized end user support organization that would provide training, help resolve problems, and provide access to new "tools" with which end users could quench their thirst for data and information by themselves. End user support organizations (like the "information center" concept) developed quickly within the MIS umbrella to assist with the proliferation of personal computers in the early to mid 1980's. End user support organizations under MIS may report to the Director of MIS, the application development manager, or even the data base administrator.

End User Support — Centralized and Separate from MIS

In some institutions of higher education, end user computing support reports directly to the Office of Institutional Research or the Provost. The development of end user computing support originated in a functional area instead of data processing. Many of the same functions are performed in this structure like those found in a centralized, MIS managed group. However, the mission may not be the same and may create solutions and problems different from the first model presented.

Advantages:

- greater flexibility in meeting user needs — less structure
- relief from traditional DP stereotype
- possibly greater knowledge of functional areas

Disadvantages:

- lack of access to systems support personnel

- possibly limited involvement in setting strategic direction and understanding of global concerns

Information Resource Center

The Information Resource Center is an integration of organizations often coming from different "cultures" in the institution, to provide institution-wide guidance, direction, and cooperation in the use of technology. The Information Resource is "the set of procedures, users, software, hardware, data, and human resources that work together to provide necessary information to a firm." (Licker, 1987) This center may report to the Chief Information Officer (CIO) and may comprise MIS, the computing center(s), audio visual services, the library, institutional research, telecommunications, among others. Coordinated planning for information technology has been the force driving consolidation of some or all of these information-based service agencies.

Advantages:
- more effective long range planning and coordination of technology and its application
- reduction in duplication of services

Disadvantages:
- overlap and confusion with operational activities
- differing missions, employee pay scales, and classifications
- introduction of long queues for service delivery

Function/Discipline—Oriented End User Support

This fourth model applies the technology trend of distributive processing to organizational support structures. Specialized computing needs in functional areas, combined with an increased need to strengthen the business orientation of information systems, creates a need for functional end user support. In general, this support is located within a functional area to improve responsiveness and to provide assistance with new technology at the local level. In some cases this functional support has come in the form of a centralized, discipline-oriented unit, providing, for example, statistical computing support.

Advantages:
- better understanding of functional areas' needs
- immediate response
- functional area sets priorities

Disadvantages:
- career path problems
- lack of influence on institution's needs
- limited access to new technology and global perspective for computing within the institution
- quality control — who evaluates work of individual
- high risk investment if/when person leaves

Summary

These four organizational models represent ways in which the institution can address the challenge of supporting end user computing. The application of a model to an organization is dependent on many factors, such as those key factors discussed previously. The manner in which computing evolved at the institution and the overall organizational structure help to determine whether one model will work better than another. The purpose of describing these models is to raise the level of awareness that different organizational structures for supporting end user computing do exist. In the next section, a description of converging cultures and converging technologies is presented, along with a new proposed model for supporting end user computing across the entire institution.

Converging Cultures or Converging Technologies

The number and diversity of end users are accelerating at the same time the variety of new technologies to be assimilated according to Nolan's 'Stage Theory' is also increasing. Administrators, students, and faculty recognize a need to merge information from a variety of sources and to use new digital technologies for the communication of knowledge. Similar technologies are often used to accomplish dissimilar tasks. The tools one uses to combine the results of a literature search with the analysis of experimental data or mathematical model are similar to the tools used to select and sort information from a student data base, using the results to generate custom letters. The lines between the technologies, as well as the skills required to use and support them, are growing faint, as are the differences between the 'traditional' support units — the academic and administrative computing centers, the library, institutional research, voice and data communications, audio-visual, printing and video services. The convergence of these technologies and supporting 'cultures' has stimulated considerable interest. While technologies converge, they do so at varying rates:

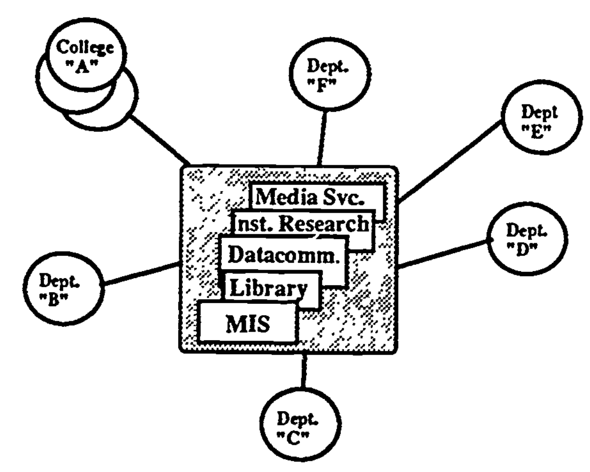
"At any point in time our communities are spread across these stages of growth in very uneven ways. Methodologies that treat all of our people and departments as if they are at the same stage - say integration - simply don't work if a department has just entered the contagion stage. And, as new technologies become real, a mature department or individual may in fact begin a retracing of the growth stages." (Ernst and Shaw, 1984, p. 12).

Since "Organizations change much more slowly than technology and must grow to productively assimilate new information services. " (McFarlan, 1983, p. 37) an organizational model which can handle both the diversity of end users and support cultures while dealing with dynamic technologies is needed.

The Federal model

An organizational model for information services which combines decentralized "entrepreneurial information-related behaviors by business units" with centralized planning, control and support of technologies has been proposed by Robert Zmud (Zmud, 1986) and others. The local units provide functional/discipline related support, while central units "insure that these behaviors are not detrimental to the enterprise's information technology posture in either the short or long run." This federal model, shown in Figure 12, can be adapted to higher education institutions' efforts to accommodate multiple "Nolan curves" by providing end user computing support from several sources.

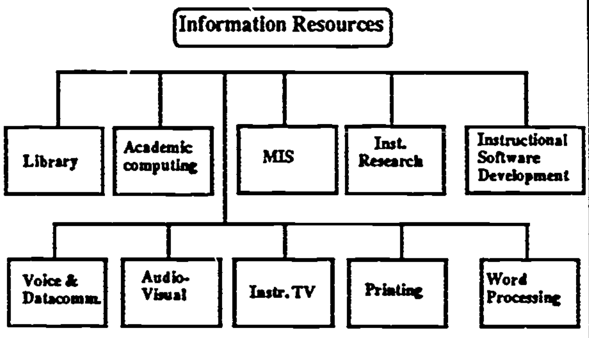
Figure 12. Logical Organization



Centralized units, such as those within an academic or administrative computing centers, may provide high-level technical support and guidance and help to establish institution-wide guidelines which implement the institution's strategic information technology plans. Such centralized units are quite similar to the organizational models which provided centralized end user support, either within the MIS department or as a separate unit, and have similar strengths and limitations to those organizations.

The local end user support "businesses" provide a better understanding of functional areas' needs and can respond quickly to those needs. With the support of central units, many of the disadvantages of the Function/Discipline model are overcome, especially the access to new technology and a lack of global perspective.

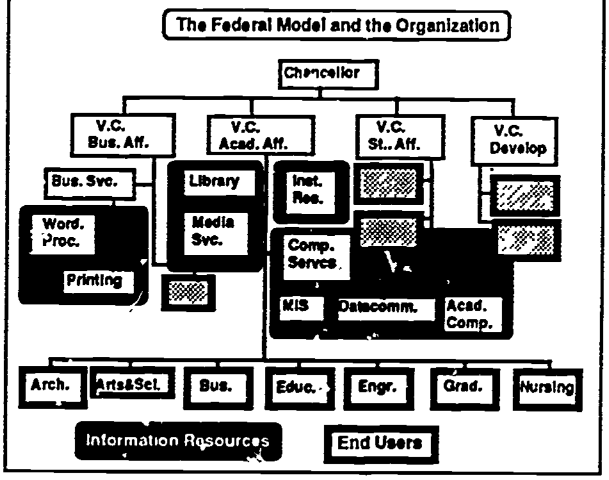
Figure 13. Formal Central Organization



The federal model proposes that the Information Resources Center or its equivalent be the central facilitator in developing and maintaining a healthy information economy in the institution. A formal central organization (Figure 13) which manages all of the technology-based support organizations in the institution would provide a high degree of coordination in some institutions.

In other institutions, combining libraries, computing centers, et. al. would be difficult because of the diversity of cultures — education, salary scales, career opportunities, professional organizations, and priorities. These institutions find that an informal combination (Figure 14) of centralized information resources combined with discipline-oriented support resources provides an appropriate balance between flexibility and effectiveness.

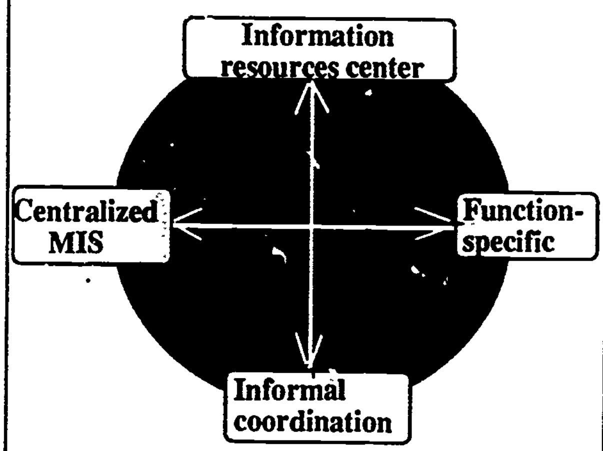
Figure 14. Informal Organization



The two essential ingredients in both implementations are the provision of first line, distributed support staff who are familiar with the particular needs and capabilities of a group of faculty or staff members, and a second line, centralized support staff who are familiar with a variety of technologies which can be used to meet the needs of various end users.

The two dimensions — centralization vs. distributed user support and formal Information Resources Center vs. informal coordination, may be considered together (Figure 15).

Figure 15.



An institution which has previously focused on a formal, centralized information resource can move in the direction of increasing distributed user support by shifting resources — staff, equipment, space, etc. — towards department or discipline-oriented support. Similarly, an organization which has depended on many decentralized support groups but lacks central coordination can apply existing or new resources to implement the federal model described above. The center of both of these dimensions provides institutions with an opportunity to combine the advantages of several of the end user support organization models in a way that allows them to meet the challenge of the ongoing evolution of end user computing support in higher education.

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Establishing an Information - Intensive Health Science Center

T. Earle Bowen, Jr., Ph.D.
Vice Chancellor for Academic Affairs
Chandler Medical Center
University of Kentucky

Frank C. Clark, Ph.D.
Chairman, Computer Sciences &
Assistant to the Chancellor for
Information Technology
University of Tennessee, Memphis

In the late 1970's the leadership of the University of Tennessee, Memphis adopted the goals of becoming a major biomedical research institution, recognized for excellent academic programs, a model of innovative health delivery and a national information resource. Essential to the accomplishment of these goals were modern laboratories and research equipment, adequate support services and resources to attract and retain the other key factor, top-notch research teams. This presentation deals with one of the support services, an information intensive environment.

It was felt by the leadership of the campus that the ability to manage information transfer would place UT, Memphis in a strategic position to pursue the goals mentioned before. Indeed, it was felt that lack of that ability - to manage information transfer - would significantly inhibit UT, Memphis's ability to compete for research funds and investigators. The four hundred-odd miles separating the health science center campus and the UT, Knoxville campus in addition to the unique needs of the biomedical academic community mandated the development of major computational and telecommunications systems.

As opportunities arose, resources were employed so as to move in the direction of creating the information intensive environment. In 1979 discussions began which resulted in the purchase of a telephone system for the UT, Memphis campus. As the campus was being wired, it was decided that two coaxial cables should be installed, connecting all existing buildings on campus. These later became the basis for a broadband network for the campus. A networking strategy evolved which involves voice, data, and image communications via a variety of technologies (broadband, ethernet, microwave, fiber optics, etc.). A decision was made to merge the small existing but separate academic and administrative computing operations. This lead to the development of a division of computer sciences. As a result of retirement and other factors the Graduate School of Medical Sciences was reorganized and expanded to include academic departments of Biomedical Engineering, Biostatistics and Epidemiology, Comparative Medicine, Computer Sciences and Information Sciences (Library). These new departments were charged with academic and service responsibilities. After a needs assessment of the UT, Memphis Campus, vendors were invited to present a program of mutual synergistic benefit over a long period of time. The result is a multivendor environment of networked (Ungermann-Bass Net One) workstations (Apple, DEC and IBM) using a central minicomputer (VAX8600 cluster) with telecommunications (South Central Bell) to other data bases or main frames.

The Chancellor of UT, Memphis made the commitment to capitalize the critical mass of hardware, software, personnel and space necessary to begin to meet the needs of the health science center. Recently additional commitments have been made to expand the capacity and capability of the information intensive environment. This paper details the key factors and developments in this six year process.

In 1982, the leadership of UT Memphis, most notably, Chancellor James C. Hunt, M.D., set as a goal for the institution that of becoming an information intensive campus. In realizing this goal of an information intensive campus, UT Memphis will provide an environment in which good people may have whatever information technology proves advantageous in accomplishing its mission of excellence in biomedical research, delivery of health care services, and health professions education. Also, the university will provide electronic access to all forms of information by faculty, staff, and students in a timely and effective manner. The chancellor felt the long term success of the university depended heavily on whether or not this goal was reached.

STRATEGY FOR ACCOMPLISHING GOAL

The university will accomplish the goal by maximizing the use of the following information technologies: state-of-the-art computing technologies; cutting edge telecommunications systems including fiber optics, microwave, broadband, and satellite transmission; advanced image transfer capability for ultra sound, CT, PET, MR, and x-ray; relational database systems and fourth generation development software.

STEPS TAKEN TO PROVIDE THIS ENVIRONMENT

CREATION OF SERVICE DEPARTMENTS

Starting in 1982, the Chancellor created the first of several service departments. The first was the department of education which provides support services for health science instruction and biomedical research. The second was the department of computer science which provides computing and telecommunications services. The third was the department of biostatistics and epidemiology which provides statistical design and analysis. Each of the three departments have faculty who engage in teaching and research, but the primary role is support service.

MODERN COMPUTING CAPABILITY

The university leadership recognized that a rich computing capability is the keystone to an information intensive campus. In 1983, after twelve months of evaluation, UT Memphis chose the DEC VAX architecture for its computing system. The easy to use VMS operating system and the ability to cluster CPU's were key factors in the decision. The Health Science Computing Center (HSCC) consists of a VAX cluster of an 8650, an 8700, and an 8800, along with several PDP 11's.

In addition to the hardware, the university has invested heavily in software to support instruction, researcher, patient care, and administrative activities. Such software products as ORACLE, ALL-IN-ONE, Video Text, RS1, LIMS, SAS, SPSS, BMDP, etc. have been installed.

STATE-OF-THE-ART COMMUNICATIONS NETWORK

Because the university is in the business of creating, storing, retrieving, and transferring information, it needs a extensive, fast, and reliable communications network. A campus-wide broadband backbone connects all 23 major campus buildings along with other non-UT buildings in the medical community. Both broadband and baseband is used for intra building wiring. Ethernet is used where megabit speed is needed for processor to processor and image transfer. Presently, there are over 1500 users on the network. The broadband is also used to transmit video signals about the campus.

ACCOMPLISHMENTS

VAX 8xxx cluster
State-of-the-art software
Campus-wide local area network(LAN)
Microcomputer laboratory
Extensive computer literacy/training program
Satellite teleport(uplink and three downlink dishes)
Modern NT SL-1 voice switch
Video distribution
Library information system

Student information system
Office automation/ electronic mail

DETAILS OF ACCOMPLISHMENTS

VAX 8XXX CLUSTER

The university has three VAX 8xxx processors in the cluster with approximately 25 MIPS capability and 15 gigabyte of disk storage.

STATE-OF-THE-ART SOFTWARE

A relational database and fourth generation development language is being used to develop many of the corporate systems. DEC's All-In-One office automation system is meeting the electronic mail, office management, scheduling, etc. needs. Laboratory information management and researcher's electronic notebook packages are assisting the researchers.

CAMPUS-WIDE LOCAL AREA NETWORK(LAN)

A mid-split broadband cable plant serves as the backbone of the campus local area network. Both ethernet and terminal traffic are being transmitted over the system. Also, security and television distribution is part of the network. Via the network, over 1500 users can access all of the CPU's at the central facility or any CPU connected to the LAN.

MICROCOMPUTER LABORATORY

A microcomputer laboratory containing almost 100 devices serves as an open access facility for faculty, staff and students and also as a site for most of the training and computer literacy activities. A variety of makes such as Apple II's, Macintoshes, IBM PC's, DEC Rainbows, and DecMates make up the lab. Most of these devices are connected to the LAN so they can be used in a stand-alone capacity or as an intelligent terminal to the central site CPU's.

EXTENSIVE COMPUTER LITERACY/TRAINING PROGRAM

The university is in its fourth year of an intensive computer literacy program in which some 500 faculty/staff have participated in the literacy training. Eight week Micro based training for the Macintosh and the IBM PC has attracted many faculty to participate. Some time is given to the use of the network and how to access and use the VAX cluster and the PDP 11's.

SATELLITE TELEPORT(UPLINK AND THREE DOWNLINK DISHES)

The very recent installation of a seven meter KU-band uplink disk to go along with three downlink dishes(two KU and one C band) gives the university a first rate teleport capability. The first transmission, a dental continuing education program, will occur December 5, 1987. In addition to teleteaching, the teleport uses will include teleconferencing, telemedicine, and data transfer.

MODERN NORTHERN TELECOM SL-1 VOICE SWITCH

The switch is meeting the voice needs of the campus. Also, Integrated Services Digital Networking (ISDN) is being looked at very closely at this time.

LIBRARY INFORMATION SYSTEM

The Georgetown Library Information System(LIS) has been purchased, is being implemented . will be be accessible via the LAN from office, dorm, or home. The seven teaching hospitals in the Memphis medical community will be able to access the library's medical holdings.

OFFICE AUTOMATION/ELECTRONIC MAIL

Electronic mail has really caught on and is being used instead of the telephone by many on campus.

BIOMEDICAL INFORMATION TRANSFER (BIT) CENTER

Realizing that information was rapidly becoming as important a commodity as money, people, and space, the university has chosen to pull together those functions that impact directly on information by establishing the Biomedical Information Transfer(BIT) center whose mission is:

To facilitate the creation, storage, retrieval, and transfer of biomedical information by coordinating functions including academic and administrative computing; all forms of voice, data, video, image and text communications; automated library system; institutional modeling and research; office automation; user services and technology training.

The BIT Center will consist of the following sections:

- Computing Systems
- Technology Services
- Information Systems
- Telecommunications Services

The goal of the BIT Center is to assist the university to realize its mission of excellence in biomedical research, health science education, and patient care.

ESTABLISHING AN INFORMATION RESOURCE MANAGEMENT ORGANIZATION AT CAL POLY

by

Dr. Arthur S. Gloster II
Vice President for Information Systems

California Polytechnic State University
San Luis Obispo
California

Abstract

The IRM program gave CSU campuses more authority over local computing and communications resources. Recognizing the vital role information systems would play in Cal Poly's future, the president appointed a task force to analyze the IRM organization. The task force recommended organizational changes, including hiring a Vice President for Information Systems, and a commitment to user-driven planning. Implementing the IRM organization provided further challenges. Hiring the new Vice President, new fiscal constraints, inadequate staffing, and resistance to change hampered implementation. Long-term benefits included increased systemwide and industry visibility; proactive, creative leadership; completion of pending projects; user-driven planning mechanisms; and a cohesive organizational structure.

California State University (CSU) Executive Order No. 447, Information Resource Management Program, November 30, 1984, established a framework for effective systemwide and campuswide planning and management of information and information technology in support of the overall mission, goals and objectives of the CSU system. The basic campus planning process is depicted in Figure 1. Under the executive order, each CSU campus President was delegated authority to approve computing and communications procurements totalling less than $100,000 per year. The idea was to grant more autonomy to the campus to determine and expedite its information needs. Projects exceeding $100,000 per year would continue to be forwarded to the Office of Computing and Communications Resources (CCR) at the Chancellor's Office. Approval from the California State Department of General Services would also be required.

The new framework required each CSU campus to review its current practices and establish a formal mechanism for planning, evaluating and managing computing and communications resources. This framework had to address planning, approval, budgeting, procurement, contracts management, accounting, reporting, and evaluating of all campus computing and communications projects through a single campus entity, the IRM designee. This individual would ensure that projects were congruent with an overall strategic plan for computing and communications designed to meet the unique programmatic needs of academic and administrative users at each campus. The programmatic needs, target environment, budget request, project plans and inventory of campus resources would be detailed in the annual Campus Information Resources Plan.

During this same period, Cal Poly was undergoing an extensive process of total self-evaluation, with the goal of developing a plan to address its future over the next decade in a constantly changing environment. The campus evaluated its strengths, its unique educational philosophy and its place in the hierarchy of California higher education. A mission statement and goals emerged into a formal document that was given as a presidential address at the Fall 1985 Conference of Faculty and Staff.

Cal Poly's new mission statement emphasizes disciplines and teaching methods that enable graduates to succeed in the professional "world of work." High priority is given to the development of the individual student in an environment that encourages "learn by doing." Emphasis is on the applied and practical without diminishing the importance of principle and theory. As a polytechnic university, arts, humanities and science must play a fundamental role. The development of the total student is a primary objective and must provide a foundation for continual learning and productive citizenship.

The goals of the University to support this mission are:

1. A commitment to the individual;

2. A commitment to quality undergraduate education;

3. A commitment to an emphasis on the polytechnic

4. A commitment to a strong liberal component of education for all students; and

5. The development of graduate programs that build on our strength, have a positive influence on the graduate programs, and foster interdisciplinary activity among the faculty.

With this strong directive from President Warren Baker as a backdrop, the campus evaluated its potential to accomplish these goals. It was immediately recognized that information resources and their management would play a key role in determining the ultimate success of Cal Poly and accomplishment of its goals. However, the campus did not have a strong, overall strategy or plan for addressing its needs in the area of computing and communications resources.

Over the years, the computing organization had undergone several changes in management structure and reporting authority. It began as a fairly traditional campus computing center initially concerned with meeting administrative data processing needs and supporting the technical disciplines such as computer science and engineering. The changing technology and the concurrent decrease in cost made it possible for computers to be integrated into a wider range of disciplines and administrative processes. Decentralized computing accompanied a decreased dependency on the central computing organization for mainframe support but an increased need for user support.

As campus needs changed, so did the computing organization. The computing and communications organization was now viewed as a campuswide resource with diverse responsibilities. Decisions could have major impact on the university's future. A new advisory position, Associate Provost for Information Systems, was created to reflect the higher level of responsibility, control and planning accorded computing and communications.

The new organization was charged with supporting three levels of computing: mainframe, minicomputers and microcomputer. Major functions included the computer center, user services, voice and data communications, and a systemwide CAD/CAM project for academic computing.

This transition took several years and was traumatic. The Information Systems organization experienced several years of interim management. Strategies, direction, philosophy, and organization structure changed with each succeeding change in leadership. There was a growing disenchantment with the overall quality of service and responsiveness to user needs. Because of the reluctance of interim management to make long range plans, the computer center was perceived as a "reactive" rather than "proactive" force for change. There was a growing concern over the apparent lack of vision and leadership within

Information Systems to develop and drive a central computing organization consistent with the new mission, goals and objectives of the university.

This posed a major problem for the President. Several major computing and communications projects impacting the future goals and directions of the university were pending. These included replacement of the current administrative and academic mainframe, implementation of a campuswide data communications, replacement of an antiquated telephone system, and satisfying the diverse needs of an academic community ranging from general education to advanced technology disciplines. Decisions had to be made soon. The President realized that a door was closing; if the university didn't act soon, an opportunity would be lost.

For Cal Poly, establishment of an IRM framework presented an opportunity to examine the role of information systems in relation to its entire academic and administrative community and to seek solutions to these pending projects. Coupled with the need for a formal campuswide IRM planning framework, the President decided to act.

In September 1985, the President appointed a 10 member task force to review the IRM organization. Representing a broad spectrum of interests, the task force included five representatives appointed by the Academic Senate, three appointed administrators, and the chairs of the two campuswide advisory committees on computing. Members were selected based on their past experience with and knowledge of computing and communications at Cal Poly.

The committee was charged with two primary tasks. They were to:

1. Recommend alternative organizational models, identifying functional areas for inclusion and defining relationship with existing advisory committees

2. Recommend appropriate level of experience, expertise, skills and qualifications to administer the recommended IS organizational model, i.e., develop a position description, course of action (recruitment, appointment, etc.)

Related to the above, the committee was asked to look at mechanisms for increased user input and feedback regarding IS activities and IRM planning. The task force reviewed several organizational units with connections to Information Systems. These included the Computer-Aided Productivity Center (CAPC); Computer Services charged with managing the central mini and mainframe computer hardware and software and related user consulting services; and Microcomputer and Telecommunications Services. The latter group included telephone services, user consulting and technical support for microcomputers, and central hardware and communications equipment installation, maintenance and repair. Peripheral units reviewed included Audio-Visual Services which supported academic and administrative offices with graphics, photography, and the delivery of media support (filmstrips, videotapes, etc.) to the classroom. A-V had been instrumental in developing a coaxial video cabling plant on the campus which supported data as well as video communications. Finally, because of the increasing emphasis on electronic information, the library was included in this review.

In December 1985, the task force issued its recommendations. These can be summarized as follows:

1. Elevating the leadership role for Information Systems to that of Vice President reporting directly to the President. A position description was developed and submitted to the President with the task force recommendations. The level of Vice President was recommended because Information Systems transcended all university operations, and the designation was consistent with trends at other institutions.

2. Establishing a long range planning unit with a reporting relationship to the Vice President and appropriate planning and data base management elements within Information Systems. A commitment to the principle of user driven planning was seen as critical to address campuswide concerns that decisions were being made in a vacuum and not derived from user needs.

3. An organizational structure designed to eliminate duplication in service offerings. This structure should separate administrative and academic computing, retain the CAPC function, establish a data base management and planning units, and provide software consulting services irrespective of hardware.

Two alternative organizational structures were presented to the President for consideration (See Figures 2 and 3). For the time being, the task force recommended excluding the library and portions of Audio-Visual Services from the Information Systems organization because of the number of computing, networking and telecommunications projects that needed to be addressed coupled with concerns of library staff. At the same time, the task force acknowledged need to direct additional personnel, operating expenses and equipment resources to IS to meet current and emerging needs.

The task force identified long-term benefits of the proposed IRM organization as increased systemwide and industry visibility through proactive and creative information systems leadership; implementation of major computing and communications projects; establishment of a user-driven strategic planning mechanism; and a strengthened organizational support structure which reduced redundancies and clarified responsibilities.

The full support of the President was a key to implementing the new IRM organization. The position of Chief Information Officer was created at the Vice President level and a nationwide search was conducted. However, recruitment took longer than anticipated and created the initial challenge to the new organization's success.

When the new Vice President was appointed in December 1986, the campus faced several challenges. The "pending" projects had reached critical milestones. The administrative mainframe project had been abandoned; equipment for the campuswide network had arrived but IS lacked the manpower to install it; the telephone project was proceeding slowly; the budget situation was worse than anticipated; resistance to change at the systemwide and campus level; reluctance to allocate resources to IS projects; and disagreement over the rate at which change should take place. Recognizing the urgent need for additional manpower to accomplish these projects, the President facilitated permanent transfer of Audio-Visual Services in its entirety and temporary transfer of other resources to Information Systems.

With these transfers, the new Information Systems organization emerged as five separate and distinct entities: Academic Computing Services, Administrative Systems (including an End User Support group and Data Base Administrator), Communications Services (including Audio-Visual Services), Computer Operations, and Specialty Center (including CAPC). The new organizational structure and emphasis are depicted in Figures 4 and 5.

In keeping with the task force recommendations, a new ad hoc Information Systems Policy and Planning Committee was formulated. Chaired by the new Vice President, committee membership consisted of three administrative and three faculty representatives. Their first charge would be to formalize a plan for academic computing.

The new IRM organization was able to take a proactive role with industry. Recognizing that new computing equipment is costly and that funding constraints placed on the CSU campuses made it difficult to keep pace with changing requirements, creative solutions had to be found. With its Vice Presidents for Information Systems and University Relations, Cal Poly now had a team that could actively seek relief in the private sector.

The new organization has been in place for nearly a year now and its success is evident. Campus attitudes and perceptions of Information Systems have undergone a complete turnaround. There is a perception of Information Systems as responsive to user needs. While service levels and contacts are still being defined, avenues of communication between Information System and campus users are much stronger and clearer than ever before.
This strengthened relationship can be attributed to three major factors:

First, the "pending" projects of a year ago have been completed far earlier than anticipated. Through a joint study project with IBM and Information Associates, the campus has a new administrative mainframe and is in the process of developing a DB2-based student information management system. The campuswide data network is up and running, connecting numerous users to the central computing resources. Touchtone telephones and Centrex service have replaced a thirty year old Western Electric 701 relay switch.

Secondly, the new user-driven planning committee is an enthusiastic proponent and vital element of the new IRM organization. They are actively involved in determining the future direction of computing and communication at Cal Poly. They are charged with developing the strategic plan for computing and communications to be implemented by Information Systems. They are key to communicating and representing the users. This process started in Fall 1987 with an academic computing planning session.

Thirdly, the involvement of industry is key. Negotiations are underway with several vendors to increase the computing capacity in the academic curriculum at minimum expense to the university. Building on its OASIS and CAPC projects, Cal Poly is current being considered for designation as an IBM Specialty Center for the entire CSU system. This specialty center would offer an IBM environment to all 19 CSU campuses to support Schools of Business and other applications. IBM, Hewlett-Packard, Apple Computers, Digital Equipment Corporation, Pacific Bell, MSA, Arthur-Anderson, Northern Telecom, and others are actively negotiating with Cal Poly regarding outright donations of hardware and software, special discounts, research and development efforts, and more.

Finally, the major benefit of the new IRM organization is the intangible yet real sense of direction and proactive leadership within Information Systems. In a recent issue of U.S. News and World Report, Cal Poly was cited for national recognition among colleges and universities in the West. This recognition challenges the university to maintain or exceed current levels of academic excellence, especially in the area of advanced technology. Computing and communications resources are an essential element in this challenge. To provide the necessary resources, Cal Poly's IRM organization must continue to be creative and proactive. It is only through innovation, positive thinking and take charge actions that Cal Poly can achieve the kind of computing and communications environment to match its reputation for excellence.

FIGURE 1

IRM PROGRAM

Planning Framework

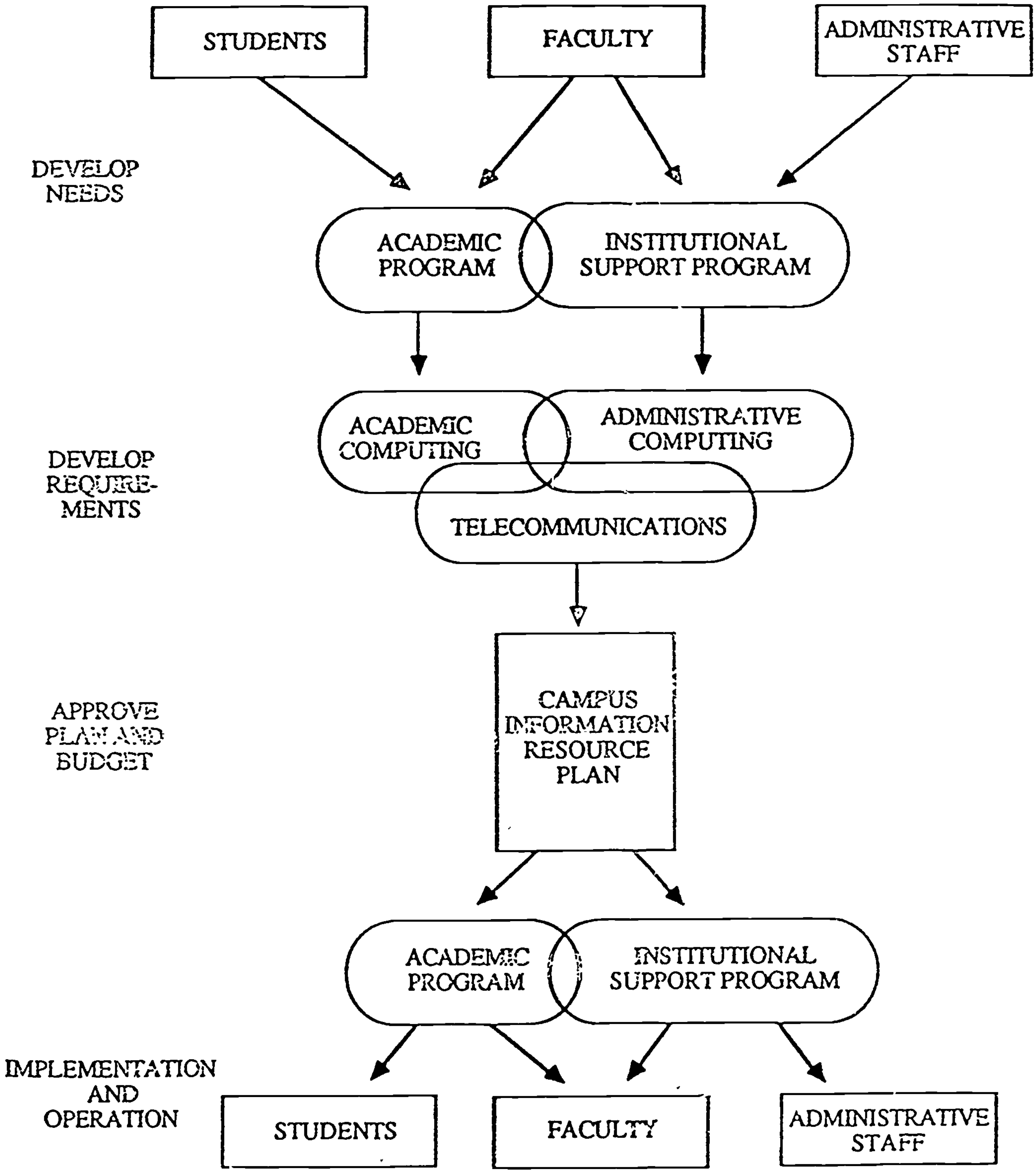
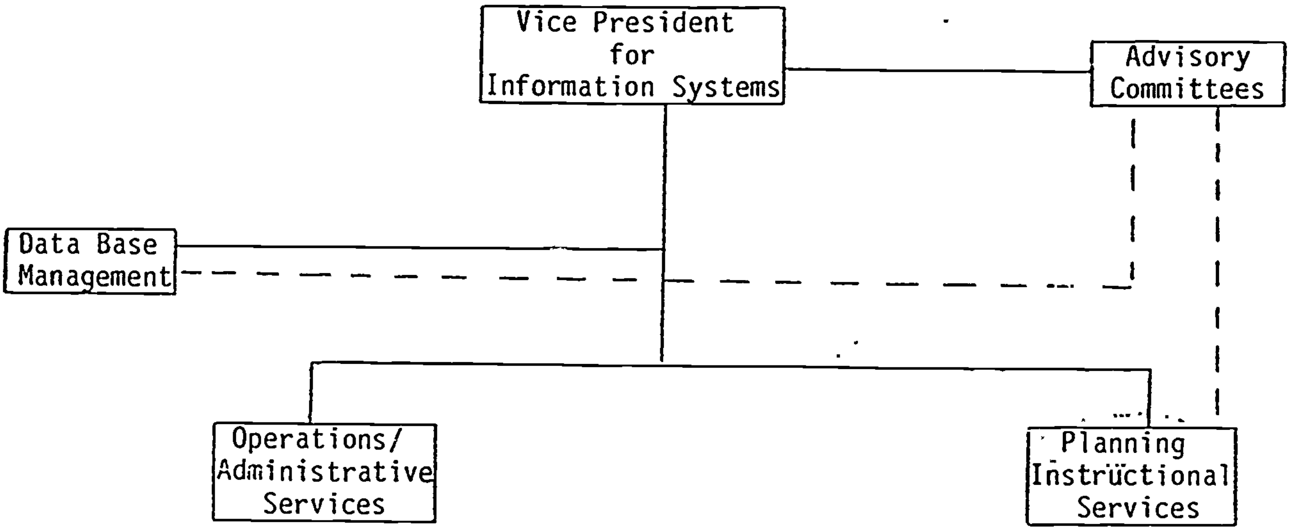


FIGURE 2

INFORMATION SYSTEMS ORGANIZATION STRUCTURE
ALTERNATIVE 1



-Adm. H/W Oper./Sys.*

-Adm. Application S/W Support
- -Maintenance
- -Development
- -Consulting
- -Training
- -Installation

-AIMS

-Office Automation

-Communications/Networks
- -Telephone/Voice
- -Data
- -Alarm
- -Video
- -WANS
- -LANS
- -Environmental Controls

-H/W and Network installation & repair

-Inst. H/W Oper./Sys.*

-Inst. Application S/W Support
- -Maintenance
- -Development
- -Consulting
- -Training
- -Installation

-CAPC

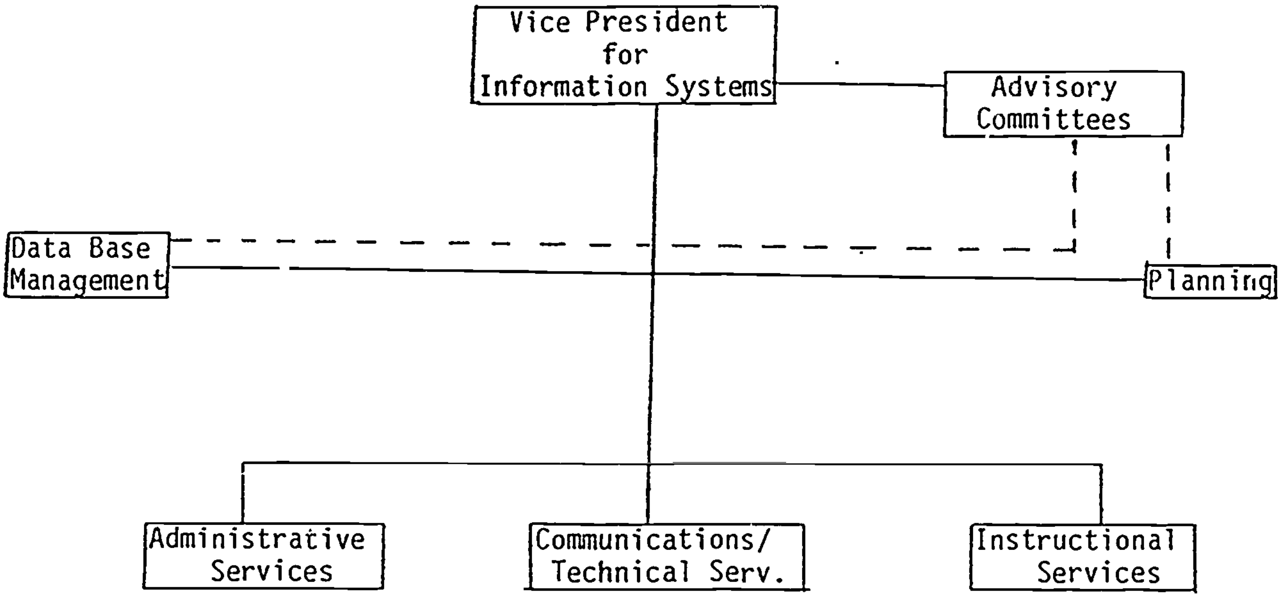
-Inst. Computer Labs

-Planning

* Assumes adequate staffing to effect separation of instructional and administrative operations and systems support - otherwise combine activities under Operations/Administrative Services.

FIGURE 3

INFORMATION SYSTEMS ORGANIZATION STRUCTURE
ALTERNATIVE 2



Administrative Services

*-Admin. H/W Operations/ Systems Support
-Admin. Applications S/W Support
  - -Installation
  - -Training
  - -Maintenance
  - -Development
  - -Consulting

-AIMS

-Office Automation

Communications/Technical Serv.

-Communications/Net.
-Telephone/Voice
-Data
-Alarm
-Video
-Environ. Controls
-WANS
-LANS
-H/W & Network install./repair

Instructional Services

*-Instr. H/W Operations/ Systems Support
-Inst. Applications S/W Support
  - -Installation
  - -Training
  - -Maintenance
  - -Development
  - -Consulting

-CAPC Workstation Lab

-Inst. Workstation Labs

* Assumes adequate staffing to effect separation of instructional and administrative operations and systems support - otherwise combine activities under Administrative Services.

FIGURE 4

Information Systems Organization Chart

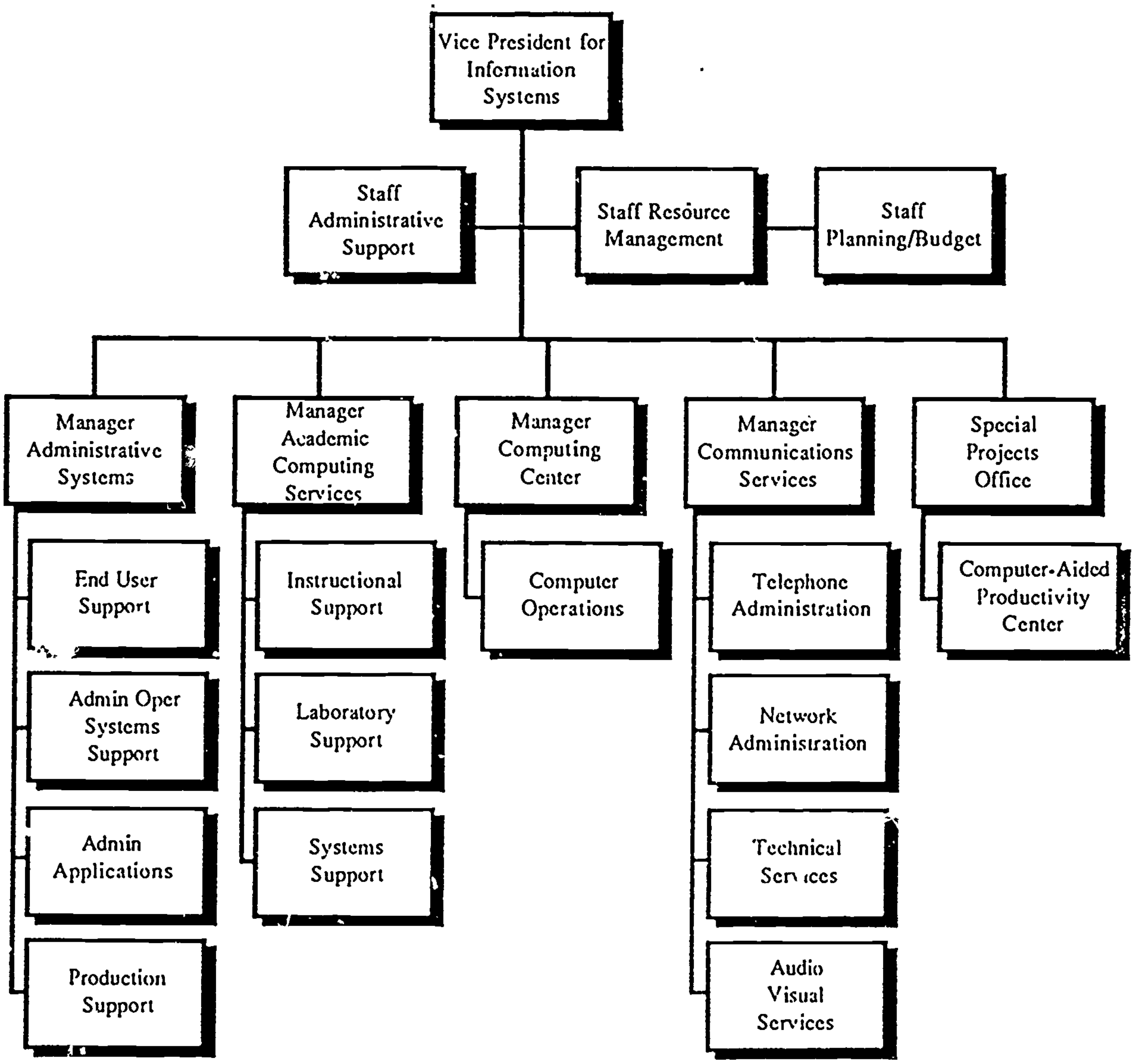


FIGURE 5

Information Systems . . .Who We Are

Academic Computing Services

Academic Computing Services (ACS) is charged with planning for and meeting the academic computing needs of the university by enabling Cal Poly faculty and students to gain access to vital computing resources to conduct their academic endeavors and providing professional support services in an environment conducive to learning.

ACS provides the following services:

- o **Operating Systems Support** programs and manages centrally supported academic minicomputers and mainframe systems.
- o **Instructional Support** services, consults and trains faculty and student users on centrally supported microcomputer, minicomputer, and mainframe resources.
- o **Laboratory Support** plans for and manages centrally supported campus microcomputer and terminal lab facilities
- o **Computer Accounts** issues and maintains individual and class accounts, and implements access policies for campus minicomputer and mainframe systems.

Communications Services

Communications Services plans, coordinates, facilitates, implements, maintains and manages all campuswide communications resources including but not limited to telephones, broadband and baseband data, television, satellite, radio, paging, voice amplification, visual presentation, and alarm/life safety support systems.

- o **Telephone Administration** provides and administers necessary telephone services to all campus users.
- o **Data Network Administration** provides data communications management and support for campuswide data communications resources.
- o **Technical Services** provides campuswide installation, maintenance and support services for all Information Systems operations.
- o **Audio Visual Services** maintains adequate classroom and laboratory facilities and the necessary equipment to provide comprehensive audiovisual aids to learning.
- o **Engineering Services** plans, designs, documents, maintains files and libraries, and engineers communications systems to meet the needs of all areas of Communications Services.

Administrative Systems

Administrative Systems (AS) plans, implements and facilitates the use of computing technology, including administrative data, to support the day-to-day operation and management of the university and its various academic programs, activities, and functions.

AS incorporates the following subgroups:

- o **End User Support** provides a central contact point for training and consulting on computing resources and data available to administrative users.
- o **Operating Systems Support** implements, maintains and monitors system software utilization on centrally supported administrative mainframe to ensure optimum access by users.
- o **Applications Development** analyzes, designs and implements computing oriented solutions to specific university problems.
- o **Production Support** handles the day-to-day processing of administrative applications (grades, CAR forms, etc.) and program maintenance and library management functions for all operational central administrative systems.

Computer-Aided Productivity Center (CAPC)

CAPC is a CSU speciality center devoted to the support of academic programs in the areas of computer-aided drawing, design, and engineering analysis. The primary software products utilized stem from an IBM university grant which included an IBM mainframe, high resolution graphics terminals, and a number of speciality software products. The Center's resources are open to all academic programs, with past usage primarily from engineering and architecture.

Computing Center

The Computing Center plans, manages and implements policies and procedures controlling the day-to-day activities within the actual machine room where the centrally supported hardware resides.

- o **Operations** is responsible for supervising the delivery, installation, operation, maintenance, and disposal of centrally supported hardware. In conjunction with this, they handle routine and emergency system shutdowns; plan, manage and control access to the machine room facilities; monitor machine performance and environmental conditions; deliver user printouts; and order routine supplies and services.