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ABSTRACT

Seven papers from the 1988 CAUSE conference's Track I, Policy and Planning, are presented. They include: "Developing a Strategic Plan for Academic Computing" (Arthur S. Gloster II); "New Technologies Are Presenting a Crisis for Middle Management" (M. Lewis Temares and Ruben Lopez); "An Information Utility: The Light, Gas, and Water for Information Services" (Frank C. Clark); "The Shortest Distance...: Information Technology Navigation" (Frank A. Medeiros); "Accessing Information for Decision Making: A Tool Kit Approach" (Judith W. Leslie, Jason A. Pociask, and Andrew Alexander); "Developing Data Access Policies in a Decentralized Administrative information Systems Environment" (Bruce D. Batchelder and William M. Gleason); and "Survival Skills for the Computer Center in the University of the Future" (Robert E. Zimmerman). (SM)

Information Technology: Making It All Fit

Proceedings of the 1988 CAUSE National Conference

TRACK I: Policy and Planning

November 29 - December 2, 1988
The Opryland Hotel
Nashville, Tennessee

Track I
Policy and Planning

Coordinator:
Betty Laster
Winthrop College

Information technologies have dictated the need for strategic planning as well as the development of policy. The integration of new information technologies into existing systems will have a significant impact on the policy and planning for information resources within the college or university. Papers in this track discuss how technologies integration is affecting planning and policy issues, share institutional experiences in planning and policy setting, and relate experiences in coordinating information technology planning with overall institutional strategic planning.

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DEVELOPING A STRATEGIC PLAN FOR ACADEMIC COMPUTING

By

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ABSTRACT: In 1987, Cal Poly's central computing environment consisted of multiple vendor CPUs acquired over several years through systemwide procurements. Diverse systems overextended central computing resources while denying instructional access to current, relevant technology. When systemwide contracts expired, individual campuses could plan academic mainframe replacements to better meet their specific needs. At Cal Poly, intensive evaluation of these needs began in Fall 1988 with a planning session of both faculty and administrators moderated by off-campus consultants. Campuswide discussions with many individuals and groups followed, concluding with a campuswide survey reviewed by discipline-specific and campuswide computing committees. A strategic plan emerged through this iterative process, identifying key goals and objectives. Later, these were refined into specific project plans and budget requests for FY 1989-90 for inclusion in the Campus Information Resources Plan. From this experience, a planning process has evolved, providing a vehicle for the university to explore IRM-related issues through meaningful, positive dialogue.

BACKGROUND

With the advent of a formal information resource management (IRM) organization at Cal Poly[1], it was recognized that strategic planning would be an a required element of the IRM process. Committed to the principle of user driven planning for Information Systems, the campus viewed establishment of a long-range planning unit with a reporting relationship to the Vice President for Information Systems/IRM Designee as essential.

In 1987-88, a campuswide Information Systems Policy and Planning Committee (ISPPC) was established. This new committee was comprised of three administrative representatives, three faculty representatives, and the Vice President. ISPPC would address campuswide computing and communications policy and planning issues in conjunction with existing computing advisory committees, providing a vehicle for user participation in the planning process. The chairs of the Administrative Advisory Committee on Computing (AACC) and Instructional Advisory Committee on Computing (IACC) were added to ISPPC to reinforce this relationship.

The IACC includes representatives from each of seven academic schools at Cal Poly, as well as the library and student body. Faculty representatives also serve on their school's computing advisory committee, providing direct links to department faculty and students. The IACC is currently chaired by the campus instructional computing consultant (CICC), a half-time faculty release position providing additional liaison between Information Systems and the academic community. This assignment is only offered to highly-respected faculty with long-standing interest in computing issues and the ability to place campuswide concerns above their own specific discipline needs.

The IRM process requires each campus to produce an annual Campus Information Resource Plan (CIRP), a campuswide planning tool based on the specific program needs and information resource requirements of academic and administrative programs (see Figure 1). The CIRP is comprised of five basic elements: a campuswide strategic plan, specific multi-year project and implementation plans, annual budget requests for central computing and communications, and a campuswide equipment inventory. Each element is updated annually to reflect the evolving information technology needs of the campus.

By September 1987, Cal Poly had formulated a plan to meet its administrative computing needs, using an IBM 4381 mainframe, a DB2-based version of Information Associates' integrated applications software, and other elements. With this project[2] well underway, the campus could now turn its attention to developing a campuswide academic computing plan consistent with the systemwide planning effort to replace the existing Cyber mainframes by July 1989.

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[1]Establishing an Information Resource Management Organization at Cal Poly, Dr. Arthur S. Gloster II, CAUSE 1987.

[2]A Cooperative Research and Development Effort Between Universities and Industry, Dr. Arthur S. Gloster II, WACUBO, May 1988

THE PLANNING PROCESS

To initiate the process, a campuswide planning session was held in November 1987. Moderated by an outside consultant, the session included program managers, ISPPC members, academic deans, Information Systems managers, representative faculty, and members of the Chancellor's Office staff. Over the two-day session, participants analyzed the current state of academic computing, and identified general trends, campus strengths, potential opportunities for expansion, constraints and limitations.

From the two-day session emerged five major goals and objectives, identifying the systems affected, constraints, action items, and responsible parties. Armed with these goal statements, IACC and ISPPC faculty representatives met with each school computing committee, individual faculty, and others to discuss the proposed plans and gather additional information regarding specific academic needs. These discussions resulted in minor changes to the initial goal statements.

Later, a supplementary questionnaire was developed by the CICC and distributed to every department and school through the computing committees. In it, faculty were asked to review sections of the previous year's CIRP and describe curriculum changes impacting their need for access to information services; critical information system needs which could not be met through existing resources; and accomplished or planned changes in hardware, software, personnel and facilities at the department and school level.

Combined with the annual survey of campus computing and communications equipment conducted by Information Systems, this information enabled planners to readily assess each school's resource needs and capabilities. These needs were compared and contrasted to determine which, if any, should be addressed at a campuswide level. When this information was thoroughly analyzed, eight specific campuswide IRM goals emerged. These goals evolved into specific objectives, resource requirements, project plans and budget requests submitted with the CIRP in June 1988.

THE ACADEMIC COMPUTING PLAN

<u>Trends.</u> Two basic schools of thoughts were found to exist regarding computing support for academic programs:

1. Disciplines without a strong tradition of computer usage felt individual workstations at the school and department level were adequate to meet their needs.

2. Applied and technical disciplines with a strong history of computer usage, such as computer science and engineering, regarded access to powerful workstations networked to large central computer systems as critical.

Like many other institutions, Cal Poly had undergone the transition from a centrally managed, equipment-centered information environment to a user-centered, distributed computing environment. It was increasingly evident that the multiple mainframe environment, acquired over several years without a cohesive plan, could no longer meet campus needs. By 1986, these resources were underutilized, expensive to operate and maintain, and unnecessarily complex (see Figure 2). By contrast, the inventory of campus workstations was skyrocketing (see Figure 3) and there was increasing demand for networking and user support by Information Systems.

Strengths. Campus strengths included the excellent reputation of the university's instructional program; a well-defined mission statement and philosophy; outstanding, long-term connections to high technology industries; the president's advisory cabinet, a group of 40 CEOs and other high-ranking officers representing leading national and regional corporations with special interest in Cal Poly; the newly revamped IRM organization and committee structure; the Computer-Aided Productivity Center (CAPC), a unique specialty center supporting CSU/IBM mainframe research and instruction in computer-aided design and manufacturing, expert systems, artificial intelligence, and other applications. Above all, there was a core of dedicated faculty committed to developing and improving computing access at the campus.

Opportunities. While it would be advantageous for Cal Poly to continue to build on its strengths, new opportunities for expansion would also be sought. These included developing partnerships with other industry leaders, such as IBM, Hewlett-Packard, and Apple; implementing a multi-disciplinary computer integrated manufacturing center; expanding CAPC's mission to include IBM mainframe support for other schools and disciplines; and replacing the existing mainframes with more relevant systems.

Constraints. The key constraint for Cal Poly's academic planning effort remains the lack of available funding for central computing. With an annual budget of less than $3 million, it is difficult to acquire and support even the most basic computing resources, such as mainframe hardware and software, communications networking, and instructional workstations. Using systemwide formulas for student and faculty access, Cal Poly's annual support budget for academic computing should be at least $7 million.

While the State has provided some funding to acquire and support student workstations, the mainframe computing budget is limited to $500,000 for academic and administrative support. There is no formal State funding for advanced workstations, faculty workstations, software, and communications networking. The separately funded CAPC Project was seen as a potential area for increased State support for academic computing.

To move ahead, Cal Poly's plan would have to maximize existing resources (equipment, personnel and budgets), seek increased State support, and take advantage of alternative funding sources such as lottery funds, external research grants and contracts, and industry donations.

Campuswide IRM Goals and Objectives

1. Increasing student and faculty access to computing
2. Implementing the systemwide CSU/IBM Academic Mainframe Specialty Center
3. Providing leadership in information technology
4. Stabilizing the academic mainframe environment
5. Implementing integrated administrative systems
6. Developing and extending the electronic campus
7. Improving central service and support levels
8. Achieving adequate funding levels

Resource Requirements. Based on campus surveys, the following campuswide resource requirements emerged as critical to support the current academic program at Cal Poly.

1. Mainframe Access and Support. The School of Engineering required access to UNIX. The only available campuswide UNIX resource, a Pyramid 99X, was rapidly becoming saturated. By 1987-88, CAPC's mission had been expanded to encompass not only CAD/CAM research and instruction but also access to software running under VM to support Schools of Business at other CSU campuses. Beyond these specific needs, the mainframe environment had to be stable; support a wide variety of readily available software; facilitate exchange of information across the campus; and reduce the number of centrally supported operating systems. To meet these needs, an upgraded IBM mainframe, communication lines, and software had to be in place as soon as possible.

2. Faculty Workstations. While information technology had become an integral part of every profession, yet computing had not significantly impacted classroom instruction. Analysis revealed that the only school with the policy requiring every faculty member to have access to a workstation (Engineering) was making the greatest use of computers. Most academic schools and the campus as a whole lack the necessary funds to acquire the large numbers of workstations required to fulfill such a policy. Therefore, a high priority was placed on increasing the number of faculty workstations, particularly in the non-technical schools such as liberal arts.

3. General Student Workstations. While student access remained inconsistent with instructional demands, the number of workstations available to students increased dramatically. A number of labs had been acquired through various means, including industry donations. By 1987-88, Cal Poly had nearly achieved its target ratio of one workstation per every 10 FTE and space for new labs was extremely limited. Therefore, increasing the number of student-owned microcomputers and implementing adequate communications to support access from student residences was deemed essential.

   Advanced Student Workstations. Access to advanced UNIX-based workstations is increasingly viewed as necessary component of the instructional program. Disciplines such as architecture, computer science, and engineering now require access to these systems to receive accreditation. The small inventory of workstations resulted primarily from industry donations. Increasing this resource was another important goal.

4. Ongoing Support. The chronic, widespread problem of support (maintenance, software, space, staffing, upgrades and networking) for the large inventory of computing equipment at the school and department level was universally perceived as having a substantial negative impact upon computing in the instructional program. While the campus could equip student labs using various funding sources (equipment replacement, lottery funds, industry donations, etc.), there was no State funding to maintain or upgrade these systems. Meeting this need will be the major, long term academic computing goal.

5. Networking. All academic disciplines require access to student records, library systems, campuswide computing resources, instructional databases and electronic mail. At Cal Poly, the

desired goal was an integrated computing and communications environment with fully integrated, digital switching capability based on standard network architectures. A campuswide broadband/baseband data network had been partially developed and implemented. Several local area networks were in place. Completing the campuswide network and expanding external communication links would be required to support the other academic goals.

ACADEMIC COMPUTING PLAN - ONE YEAR LATER

One year later, each resource requirement was being actively addressed (see Figure 4).

By August 1988, the campus had acquired use of an IBM 3081-KX mainframe to support campuswide instruction and systemwide obligations. As one of IBM's grantee schools, Cal Poly was able to acquire business, engineering and other software through IBM's Higher Education Software Consortium at substantial discount. Schools of Business at three remote campuses were conducting classes on Cal Poly's IBM mainframe.

The campus had acquired several advanced workstations. Sixteen SUN workstations were purchased for student use. Student terminal labs were upgraded with new units donated by HP to support access to the IBM 3081-KX. Other instructional computing facilities were upgraded through donations by Apple, IBM, Tandem, Xerox, etc., and departmental procurements.

The academic community adopted voluntary support standards for commonly used microcomputer software packages while UNIX was declared an essential instructional operating system requires support. The campus adopted a policy of encouraging students, faculty and staff to purchase microcomputers. Two highly successful special discount sales were offered by Apple and IBM through the campus bookstore.

A faculty software library maintained by Information Systems was evolving into a faculty technology center providing faculty access state-of-the-art hardware and software for demonstration/evaluation.

The broadband network was in place and several buildings and instructional resources were now linked. BITNET, INTERNET and other information services outside of the university were available, too.

The president's advisory cabinet assigned high priority to student and faculty computing and actively aided in efforts to secure increased funding through State and industry sources.

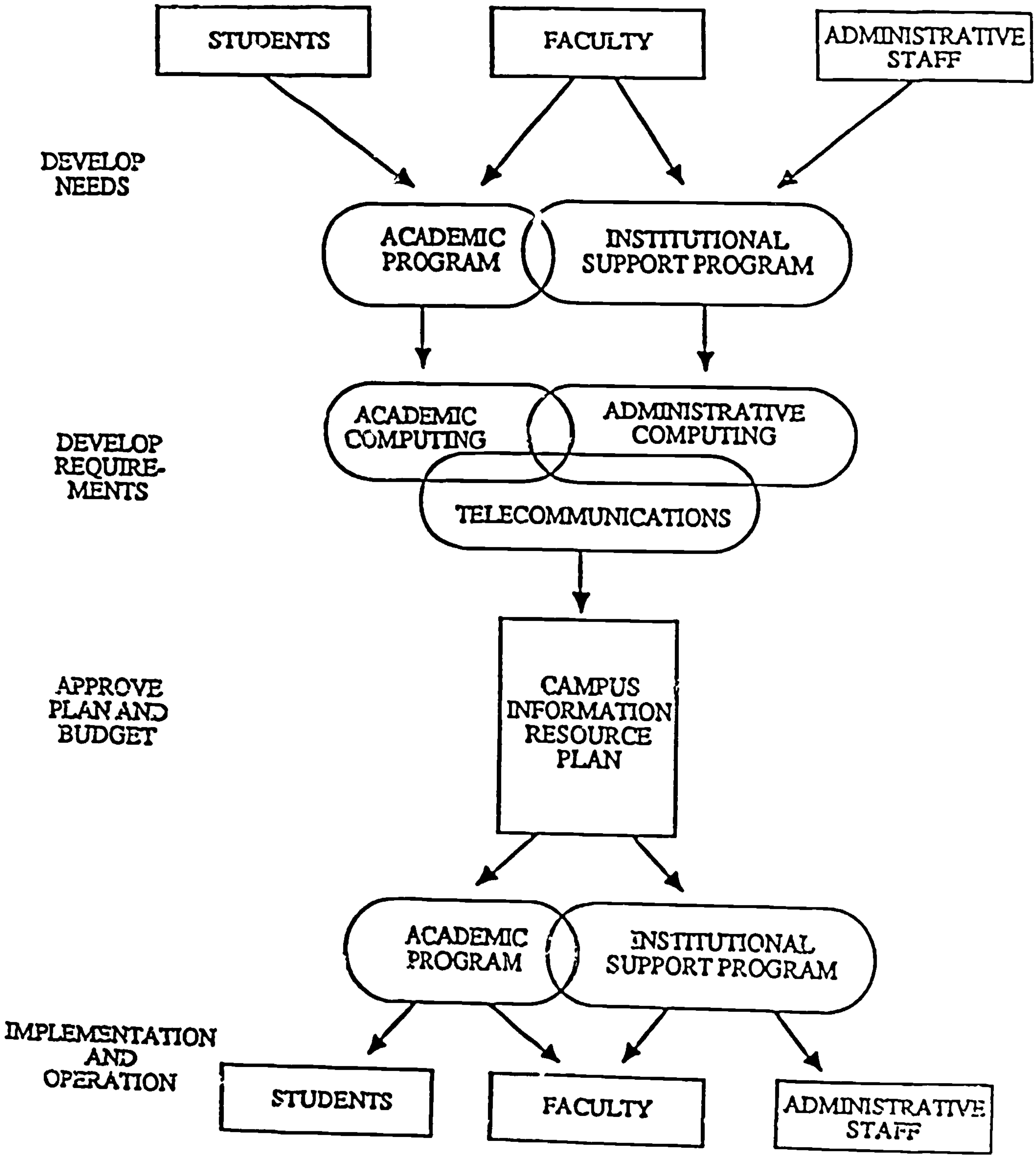
While progress has been made, the issues of faculty workstations, equipment maintenance, completion of the network, and supporting separate administrative and instructional mainframes remain.

CONCLUSION

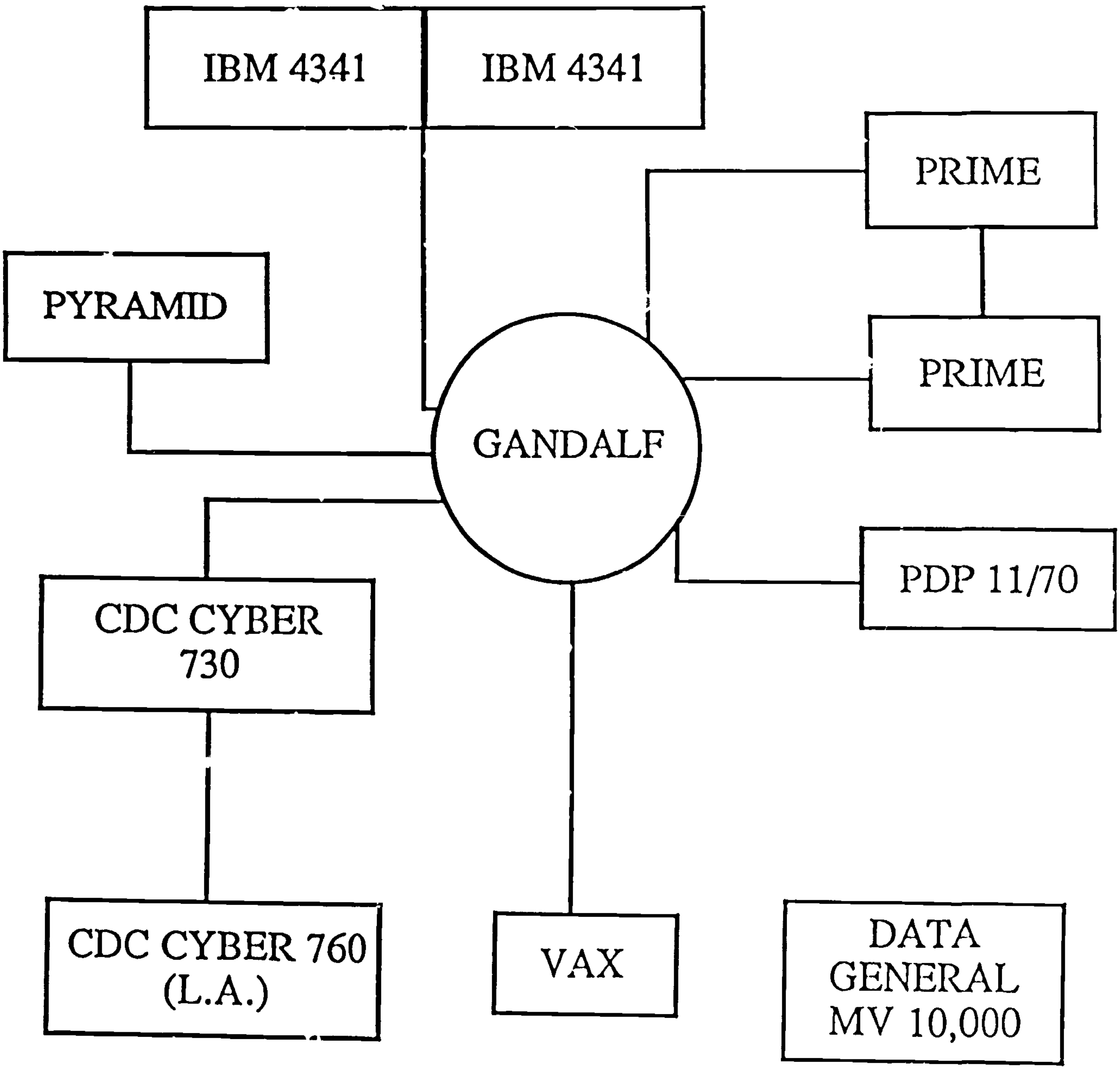
Cal Poly now has a workable planning process and framework by which to assess its academic needs, determine resource requirements, and develop strategies to acquire those resources. In 1988-89, Cal Poly will test the framework, make changes, and develop new plans and objectives. Regardless of the outcome, it is critical that the process continue so that California students and faculty will be prepared to meet the challenges of the new information age.

IRM PROGRAM

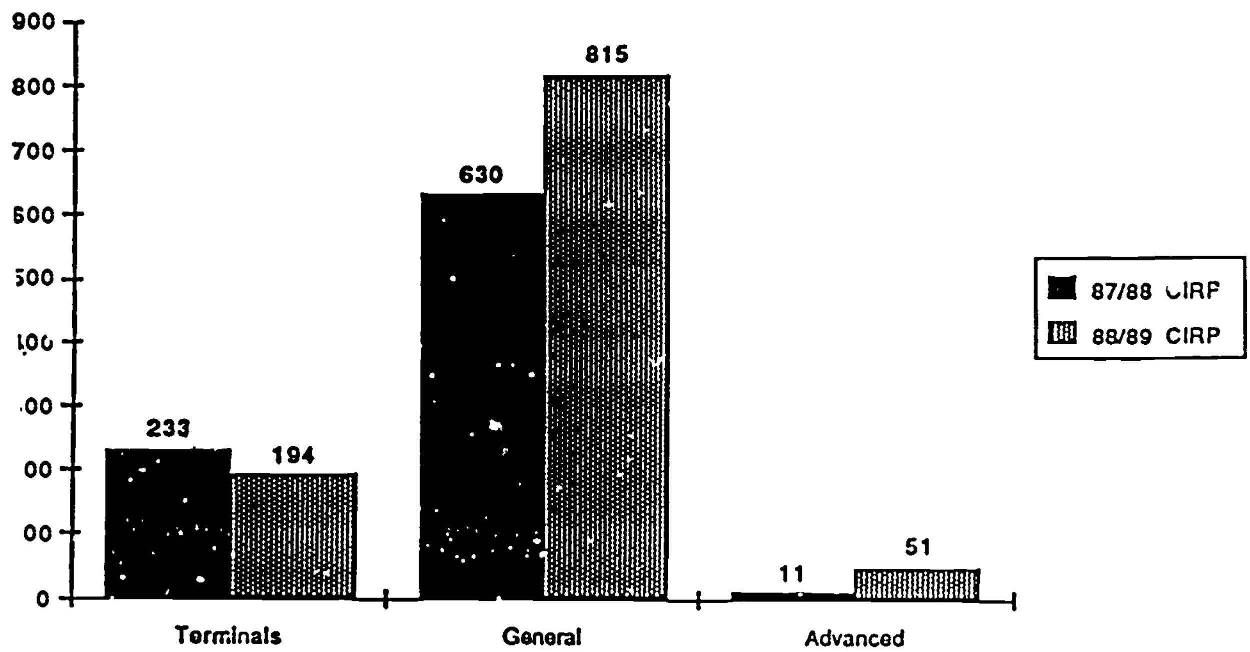
Planning Framework



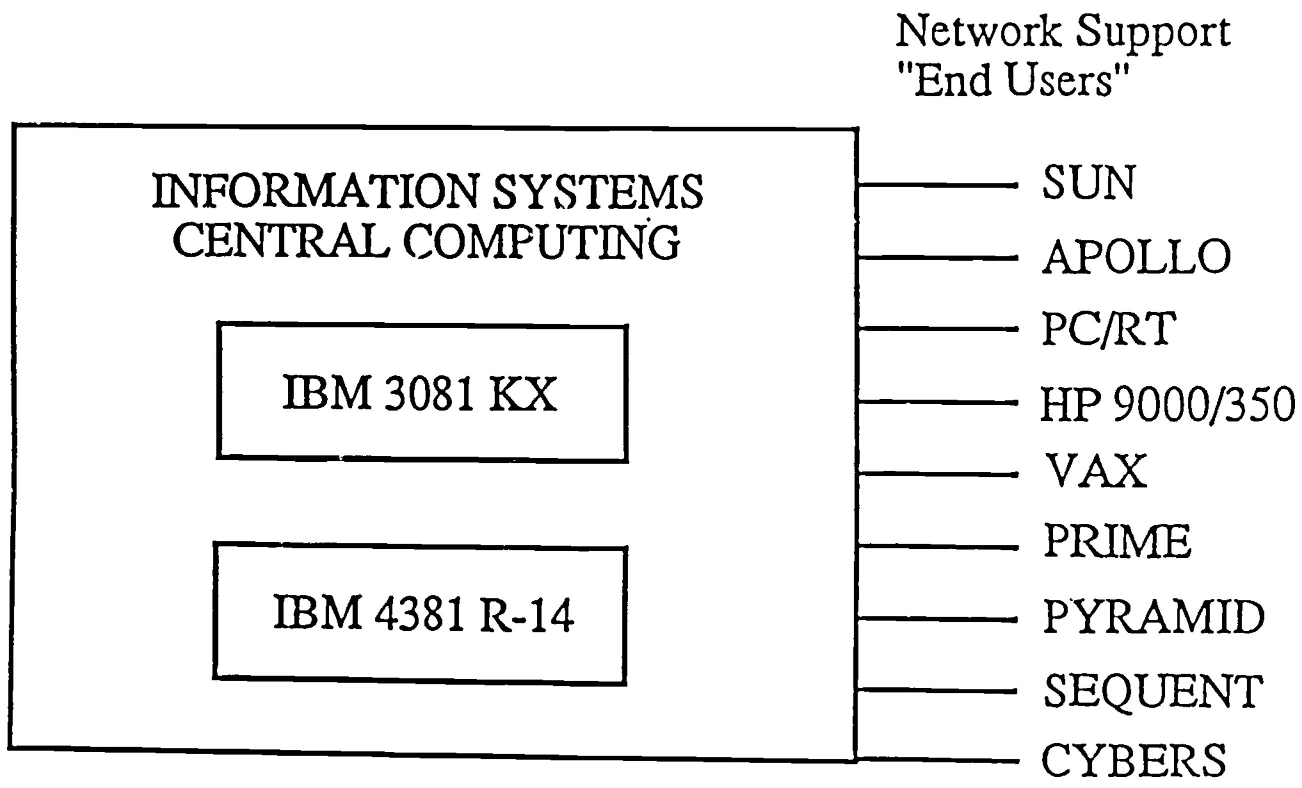
ACADEMIC COMPUTING EQUIPMENT 1986



1987/88 vs 1988/89 Student Workstations
Totals 87/88 = 874 Stations
Totals 88/89 = 1,060 Stations



ACADEMIC COMPUTING
1988



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NEW TECHNOLOGIES ARE PRESENTING A CRISIS FOR MIDDLE MANAGEMENT

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The implementation of the Long Range Information Systems Plan (LRISP) at the University of Miami has brought to the forefront the crisis of competent middle management.

It is fallacious reasoning to assume that new systems will reduce overall personnel costs and they should not be implemented with this as a reason. The number of personnel lines may be reduced but, the people on the lines will need more intensive training.

While we are not suggesting middle management be the primary focus of a business, we must pay enough attention to these managers' functions to ensure that they work together with the business units as part of an integrated whole. Middle management is the glue that holds a University together and, as such, must be made a more integral part of the business decisions. This paper will discuss ways in which the middle manager can become more involved and useful to the organization.

NEW TECHNOLOGIES ARE PRESENTING A CRISIS FOR MIDDLE MANAGEMENT

The University of Miami is in the fifth year of its seven year Long Range Information Systems Plan. The original plan outlined forty four (44) applications, most of which have been installed in an integrated on-line database environment. Last year, the University, with the aid of Information Resources, in a remarkably aggressive endeavor, implemented eight (8) additional on-line administrative systems, increasing the technological impact across its administrative and academic management units.

In an era when emphasis is placed on productivity and streamlined operations in universities and corporate America, middle management has had to assume new responsibilities, sometimes seemingly abstract, but always complex. In order to survive, middle managers have had to begin to incorporate into the organization the changes introduced by the new technological trends. "The number of changes organizations must endure in order to remain stable and/or grow in today's environment is beyond precise calculation," according to O. D. Resources, an Atlanta based consulting firm that has done extensive research on this area.

This paper deals with the challenges facing departmental middle management, both from the functional integration of the administrative systems and the technological impact on the University's working behavior.

Background

The philosophy of the department of Information Resources team of managers is to be facilitators, coordinators and advisors to our clients. We accomplish this by,

1. Including on our advisory committees and application project teams representation from all of the University's major academic and administrative units,

2. Giving free training classes to faculty and staff in supported software,

3. Training clients on the administrative systems and having an information center with a "help" desk available for advice on purchases and configurations.

4. Maintaining open "information channels" through publications of a bimonthly newsletter and frequent broadcast distribution of technical updates to all University personnel (faculty, staff, administration).

The progress of the Long Range Information Systems Plan (LRISP) is overseen by a high level committee called the Computer Advisory Committee (CAC). Also, every systems project has an Information Analyst from the principal user area and a Steering committee with members from administrative and academic units affected by the new on-line system under development.

All of our administrative applications are integrated under a monolithic database. The development of the application on-line systems priorities were set with input from the user community and our systems analysis staff. The application on-line systems are classified in two categories: basic foundation and distributed systems. The foundation systems were those application systems required as a building block to subsequent systems. For example, "Campus Directory" was the first foundation system implemented. Its functional objective was to build the demographic information of the University in order to develop subsequent administrative and academic on-line application systems. The distributed systems are those on-line application systems with specific departmental functionality. Although these systems can be perceived as standalone applications systems, they are not because of the database integration. For example, the Purchasing System, slated this year for departmental implementation, must be integrated with Accounts Payable, Receiving and Financial Reporting Systems.

Who Is the Middle Management?

Because of any University's organizational structure, there is a basic problem in organizing a technological effort affecting a large group of people. There are two types of departments affected directly by new applications in our institutions: administrative academic units and administration units. These units vary in size, reporting relationships and functions. At the beginning of the long range projects, top management, within the departments, was doing most of the thinking and directing while middle management and staff carried out its intentions. As the project implementation advanced, however, the situation became more complex. The accelerated implementation of on-line application systems created new challenges for the middle managers. This management level needed to train their personnel and migrate to the new on-line systems, while maintaining the expected service levels. This necessitated some significant changes in the basic role of the middle manager.

A resultant change from these challenges relates to the middle manager's function. Typically, departmental units will replace a manual operating system with a sophisticated self-contained on-line application system. The repercussions of this changing technical environment may create new and higher levels of stress for the middle manager. How is he to manage an organization which is growing both in numbers and in subfunctional specialties? At this point, middle management has acquired the technological resources to operate as a business within a business. Excuses have been reduced. Since the manager now has the wherewithal to be responsive to top management, as well as to the organizational needs of his unit, he is struck with the realization of conflict between the goals he has set for his unit and the new goals being set for him by top management. Since management's pent-up thirst for more information can now be met by the middle manager, he can and should perform more of a staff role than ever before, while still fulfilling his line function. He must change the way he does business.

Middle Manager: Integration

Bringing new technology into an organization has always been difficult. Change is stressful. Differentiation creates the need for another process in the organization in which the middle managers play a key role. This is the process of integration.

Since all of the University's application systems are integrated under a common database environment, the data attributes are shared by different applications. Consequently, there are a sequence of activities which have to be performed in a highly coordinated manner to achieve ultimate productivity. Integration and coordination, while necessary at all levels in the institution, are generally regarded as primary functions of middle management. The middle manager must wrestle with the need to accomplish more, utilizing the same or less resources.

There are reasons for neglecting to manage the changes introduced by technology. They include the comfort of doing things as they have always been done; the past disappointments with computer systems; the low level interest of managers for computer technology; the resentment of this technology; the rapid pace of change it introduces, and the myth of intelligent machines surrounding computers during their first years of existence. These reasons are vanishing as computer applications are more prevalent and middle management is more conscious of the potentials of the technology.

It is only a recent realization that the middle manager has become an important contributor to the integration, installation and implementation of the on-line application systems. Systems used to be developed by computer staffs in a semi-ivory tower. Now, it is understood, client participation must occur when the systems are installed. The departmental staff is impacted by the new technology, and those most familiar with the routine tasks feel threatened by this new technological phase. After discerning the resistance to absorb changes, the middle manager must assume the responsibility for working with the staff, being a champion of the new system and providing the proper direction, education and training. It is important to emphasize education does not mean getting an M.B.A.. Education of the manager as to the organization's goals, objectives, culture and real business must occur. Too many managers do not realize their role in "the big picture." To middle management falls the task of promoting technological change as part of the integral function of the work unit.

Middle Manager: Keep Communication lines Open

During the systems specifications phase, an individual from the sponsoring department (Information Analyst) participates in the design, development and implementation phases. At the same time, a steering committee reviews the functional specifications. While the project is still in the development stages, a great deal of information exchange is generated between the principal sponsor and the project team. Unfortunately, it took the University management some time to learn that these vital communication links were not being accomplished. The assumption that the users would be able to explicitly communicate their needs through the Information Analyst or the steering committee was misleading. The echo of this dilemma surfaced after the implementation, when middle management realized the new on-line application systems did not provide the expected functionalities.

In essence, the system's sponsor and the system's everyday users needed different output from the system. In his book Systems Analysts and Design, Dr. James C. Wetherbe describes "the five common mistakes made in the determination of information requirements:

"1. The systems analysts assume managers know what information they need.
2. The systems analysts do not determine requirements for the complete set of decision makers.
3. Systems analysts tend to determine requirements for managers one at a time whereas they should do it as a group process.
4. Systems analysts ask the wrong questions to determine information requirements.
5. The systems analysts expect managers to analytically determine their exact detail requirements and get it right the first time."[1]

Thus, them that say may not know and them that know might not say.

Another problem affecting open communications among managers is the political issues surrounding the project development. Recognizing the organization's political environment and dealing with the issues must occur before the end-product is affected. However, since the disposition of the technical staff does not lend itself to involvement or interest in political issues, this kind of negligence can significantly influence the functionality of the end-product. In any case, the unfortunate result of poor communications is all around dissatisfaction at best, and an unusable system at worst.

Middle Management: Confronting the Issues

Some of the changes in the environment are visible, such as on-line application systems, while others are not, such as those involving work-force values. The University of Miami has been beset with new challenges testing the mettle of even the most forward-thinking middle manager. Few in the community believed that the systems would become a reality. Even fewer believed these systems would be implemented faster and more inexpensively than projected. As a result, the middle manager was the least prepared and most affected by the successful development.

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[1]James C. Wetherbe, Systems Analysis and Design (St. Paul: West Publishing Company, 1988), pp. 122-123.

Role

We need to build the middle manager's confidence. By improving top management's ability to cope with future university problems, middle management will be given a greater importance in its communication with top management. Feedback mechanisms must be installed and prioritized. In most areas, this does not currently exist. When the steering committee members are selected to gather the need analysis, the middle manager and his key staff must be allowed input. After all, the success of the new technology is contingent on the implementation and the proper use of the technology. To give middle management the responsibility for implementation without the authority to suggest changes or improvements in the system results in level of organization stress that hamper the effective use of new technology. Writing a beautiful computer system that does not meet the client's needs results in lack of use, lack of goodwill and a lose/lose scenario.

Training

There are differences in morale and feelings of success among staff. Middle management has to be sensitive to the skill levels of its staff. Are they computer literate or not? Is training possible? Can they be spared for additional training? Remember, a department can have access to several on-line applications. If the department is organized by functions, the staff can be trained on all of the systems, or merely the ones most relevant to their job performance. Training, while costly, is inexpensive in comparison to the tangible and intangible losses caused by lack of training.

Development

One area that needs special attention is career enhancement and advancement. How do we prepare our middle management to replace our upper management? If the top echelon has the opportunity to advance, has middle management been given the proper training or consideration to advance? If a management position is available, often a national search is launched. Should we not make sure qualified personnel have the opportunity for career path advancement? Hiring from without, rather than within, can create the perception of lack of respect, raising the questions of honesty and straightforwardness of top management. Disloyalty can be, and often is, a two-way street. Top management feels that middle management is only interested in salary raises or promotions. However, we have found in our own organization, intangibles such as participation in decision making, better communication, effective technical and managerial training have far reaching results on middle management.

Success

Another term worth mentioning is "success." How do you measure or signal success? The University's organizational structure does not allow us to have a standard yardstick. The top management in different divisions may use the performance appraisal or salary increases to signal success to the middle manager. Middle management in turn may see it differently. Greater status in the organization, participation in decision making, and respect could be used by middle management to measure its success.
Thus, "Success", to the middle manager, may mean something different from top management's definition. Clear communications, with goals and objectives, must exist before a mutual definition of "success" can be agreed upon. A wrong perception is as hazardous to the health of the University as a real inaccuracy.

Summary

There are external and internal conditions affecting the morale of the personnel within an organization, such as a university. The implementation of eight (8) different on-line application systems can, and will, make any middle manager reach deep into his reserves for help. The external pressure exerted by these new systems cannot be controlled by any middle manager. However, these systems generate new internal challenges and opportunities. He must motivate and be a motivator. He must communicate and be a communicator. The middle manager must be an idea implementor and an idea initiator. Most of all, he must be treated and perform as part of the solution, not part of the problem.

The key to overcoming the crisis in middle management is participative decision-making, respect from top management, good training in preparation for future promotions and help in achieving goals. Top management needs to be less political and more functional. In short, all management levels must work together reducing the autocratic control, creating a more flexible environment, inducing a better team player image, increasing the utilization of resources and improving the financial position. In order to have a winning organization, success, as perceived by all management levels, must occur. To succeed requires a commitment by all parties to work together incorporating the technological changes, even if it means changing the way business is done.

An Information Utility:

The Light, Gas, and Water for Information Services

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This paper presentation traces the development of an "information utlity" at the University of Tennessee, Memphis and the establisment of the UT Memphis Biomedical Information Transfer (BIT) Center. The leadership of UT Memphis recognized that information was as important a commodity as money, people, and physical space, and, additionally, timely and effect access to information was central to the successs of the institution. In January 1988, Chancellor James C. Hunt established the UT Memphis BIT Center under the direction of a vice chancellor.

The BIT Center model is analogous to the municipal utility model but instead of providing light, gas and water, the BIT center provides computing, networking, telecommunications, technology training, and institutional research. The BIT center pulls together under one umbrella, most of the activities which impact on information and provides for a coordinated and focused effort on the merging technologies.

INTRODUCTION

This paper chronicles the steps taken by the University of Tennessee, Memphis over a four year period to establish an information utility which provides information systems and services to not only the immediate campus but also to the Memphis medical community. The institution moved from a health science center woefully lacking in the use of information technology to an information intensive health science center, by pulling together under one umbrella organization, Information Systems and Services, those activities relating directly to information--academic and administrative computing, database development and coordination, institutional research, telecommunications(voice, data,video), library information system, and information technology support. In 1982, Chancellor James C. Hunt and his staff recognized that the success of the institution, and perhaps, even the survival of the institution depended very heavily on whether the university could incorporate the use of information technology into health science education, biomedical research, patient care, and public service and whether the university could successfully manage these information resources.

Nontraditional academic departments along with the Biomedical Information Transfer (BIT) Center were established to support the health science education, biomedical research and patient care efforts, and to provide computer literacy, computer training, instructional development, and other information technology support functions.

A campus wide computing and networking strategy was formulated, calling for the creation of a strong central site facility, the implementation of a high speed communication network and the adoption of a state-of-the-art workstation. A satellite teleport (uplink and downlink capabilities) was installed and plans for teleconferencing, teleteaching and telemedicine were developed.

Three years of planning, evaluating, implementing, adjusting, and the adoption of a new technology are detailed.

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.

CEO's COMMITTMENT AND VISION

In 1982 Dr. James C. Hunt, M.D., was named the Chancellor of the University of Tennessee Memphis. Dr. Hunt had spent some seventeen years at the Mayo Clinic in various leadership roles and brought to the Memphis campus a vision of the future which would very much depend on advanced technology and in particular, information technology. Dr. Hunt would commit time, energy and resources to an effort that would catupult UT Memphis into the information technology arena. He was convinced the success of the university would depend heavily on its ability to effectively manage information.

One of the goals set forth by the leadership of the university was to become an information intensive campus. In the early part of this decade, several universities aspired to become computer intensive campuses. UT Memphis attempted to take the effort beyond the compter and to focus more on making all forms of information easily available to faculty, staff and students in an electronic mode.

STEPS TAKEN TO ESTABLISH AN INFORMATION UTILITY

A. <u>Creation of Service Departments</u>

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.

B. Telephone Business

In 1982,the University made the decision to go ino the telephone business. The entire campus was trenched and voice lines were installed along with a modern voice switch. At the time the cable for the voice network was being installed, the decision was made to lay a pair of coaxial cables for use as a data/video network, anon. This was a wise decision in that the university was able to install a data/video network backbone for about one-third of what it would have cost had the university done it separately.

C. Task Force on Biomedical Information Resources

In 1984, Chancellor Hunt appointed a blue-ribbon committee comprised of biomedical researchers, health science educators, chief information officers from local industries, and leaders in Memphis' telecommunication industry. This group was given the name Task Force on Biomedical Information Resources and was asked to explore the role information technology should play in the future of the University of Tennessee, Memphis. The Task Force issued the following recommendations:

The University of Tennessee, Memphis should respond to the current window of opportunity to become a biomedical information management and transfer hub of national and international prominence by developing the capability to create, store, retrieve and transfer biomedical information to and from any where in the world.

The University should establish an administrative unit, called Information Systems and Services, which pulls together academic and administrative computing, voice, data and video communications, technology support services, and institutional research and database coordination.

The Chancellor should establish the office of Vice Chancellor for Information Systems and Services and appoint a senior administrator who would have authority and responsibility for Information Systems and Services.

D. Computing and Networking
In 1985, the decision was made by the campus leadership to establish a first-rate central site computing facility and to activate the data/video broadband local area network.

INFORMATION SYSTEMS AND SERVICES (ISS)

In January 1988, university leadership created the adminstrative unit, Information Systems and Services (ISS). ISS pulls together under one umbrella those activities directly related to information technology. A vice chancellor position was created to provide leadership and management for ISS.

There are two elements in the ISS organization: the advisory comittee structure and the administrative structure.

A. The Advisory Committee Structure
The Vice Chancellor for Information Systems and Services will be assisted in the coordination and management of the campuswide information utility by the following committee system.

As required by an evolving and dynamic information utility, a campuswide committee governance system functions to establish policy and procedure for the management of information systems and services. Information Systems and Services has developed a participative organizational decision structure composed of three interrelated ISS committees, each of which is integral to the successful implementation and operation of information systems and services at the University of Tennessee, Memphis. The system includes the Information Technology Steering Committee (ITSC), the Academic Information Advisory Committee(AIAC), and the Administrative Information Advisory Committee (AdIAC).

At the apex of the governance system is the ITSC, chaired by the Associate Vice Chancellor for Information Systems and Services. This committee also includes the Vice Chancellor for Business and Finance, the Vice Chancellor for Facilities and Human Resources, the Associate Vice Chancellor for Administrative Affairs and the Dean of the College of Graduate Health Sciences. The ITSC will meet monthly or more often if needed and is responsible for information systems and services planning and policy. The purpose of the committee is threefold:

(1) Recommend policy to the Chancellor regarding academic, patient care, and administrative computing, information systems, telecommunications systems, and technology support services.

(2) Assist in the refinement of the strategic plan for information systems and services for the University of Tennessee, Memphis.

(3) Provide guidance to the Associate Vice Chancellor for Information Systems and Services as to the best usage of resources allocated to Information Systems and Services.

Supporting the ITSC in the academic area is the AIAC which meets monthly or more often if needed, and is made up of representatives from each of the colleges and a representative from the Library. Chaired by the Director of Computing Systems, the committee serves in an advisory capacity to the ITSC by providing communication and feedback loops to the academic and research communities making recommendations concerning service levels and computing needs of faculty, researchers, and students. The charge to the AIAC is:

(1) To recommend priorities for all new applications development or modification for academic projects.

(2) To monitor academic computing projects.

(3) To develop and implement procedures needed to carry out academic information resources policy issued by the ITSC.

(4) To suggest to the ITSC issues which need policy development regarding academic information resources on the UT Memphis campus.

(5) To participate in the development of academic information resources education/literacy training programs for the UT Memphis community.

(6) To recommend to the Associate Vice Chancellor for Information Systems and Services evolutionary strategies for the enhancement of academic user services.

Concerning administrative and patient care activities, the Administrative Information Advisory Committee(AdIAC) provides input to the ITSC. This committee will meet monthly and includes representatives from the central administrative units, colleges, library, chancellor's office, the University Physicians Foundation (UPF), and the BIT Center. This committee will be chaired by the Director of Information Systems. The charge to the AdIAC is as follows:

(1) Recommend priorities to all new applications development or modification for administrative and clinical computing/office automation projects.

(2) Monitor progress and offer constructive criticism on all administrative and clinical computing/office automation projects.

(3) Devise and implement procedures needed to carry out administrative and clinical information systems and services policy derived by the ITSC.

(4) Suggest to the ITSC issues which need policy development regarding administrative and clinical information systems and services at UT Memphis.

(5) Participate in the development of ISS education/training programs for the UT Memphis administrative and clinical community.

(6) Recommend to the Associate Vice Chancellor for Information Systems and Services evolutionary strategies for the enhancement of administrative and clinical user services.

The Administrative Structure

The organization chart for Information Systems and Services (ISS) provides an overview of the current administrative organization reporting to the Chancellor at UT Memphis.

The Vice Chancellor for Information Systems and Services occupies a senior management position with line responsibility for computing, telecommunications, technology support and information systems development and staff responsibility for strategic planning, promotion and coordination in the field of information systems and services. The position exists to advance the use of information and related technologies; to manage and coordinate various centrally provided information services; to develop and monitor policies and approaches to hardware and applications, and to foster, guide, and support decentralized yet linked information resource initiatives.

The Information Systems and Services administrative unit is the result of the reorganization of units and responsibilities that heretofore resided in: College of Graduate Health Sciences, Facilities and Human Resources, and Administrative Affairs.

The University of Tennessee, Memphis, recognizing that information is a valuable commodity, as valuable as money, people and physical space, has created an administrative unit similar to other units of the university such as Academic and Student Affairs, Business and Finance, Administrative Affairs, Facilities and Human Resources, and Development. This unit is known as Information Systems and Services(ISS) and will be directed by an Associate Vice Chancellor. ISS is the management (planning, organizing, and operating) of the resources (human, financial, and physical) concerned with supporting (developing, enhancing, and maintaining) and serving (processing, transforming, distributing, storing, and retrieving) information (data, text, video, and voice) for the University. The purpose of ISS is to encourage the most effective allocation of information resources to meet primary health science education, biomedical research, and patient care goals, to provide efficient use of allocated resources, and to provide accountability and stewardship for the investment in these resources.

COMPUTING SYSTEMS

This division includes those activities formally comprising the Health Sciences Computing Center except for the user services group which will become part of Technology Suppcrt Services. Computing Systems will perform the following functions: academic/scientific computing, corporate administrative computing, local administrative computing, and computer operations/systems.

INFORMATION SYSTEMS

This division currently has one employee. In time, Information Systems will provide and/or assist in the following services: serve as clearing house for information for the university, perform institutional studies and surveys, coordinate database development, serve as gatekeeper of databases, assist in the long range planning function of the university.

TELECOMMUNICATIONS SYSTEMS

Telecommunications Systems will plan, install, manage, maintain, and coordinate all aspects of the three telecommunication utilities: SL-1(voice) network, NETONE(local area data and video network), and the TELEPORT(satellite uplink and downlink). Telecommunication technologies are very interwoven, with voice, data, images and video moving over the same medium in some instances. This ditvision will provide one stop shopping, installation, software maintenance, and support for all three technologies. An individual who has experience in all three technologies, will serve as section director, providing overall direction and planning for these technologies.

TECHNOLOGY SUPPORT SERVICES

This division provides the following services: office automation support, microcomputer hardware and software support, all forms of computer/information technology training, lowend computer hardware maintenance, troubleshooting of information technology related problems. Also, this section develops and manages the technology demonstration center.

BIT CENTER

ISS will operate within space and facilities known as the Biomedical Information Transfer (BIT) Center. ISS pulls together in one building those persons delivering services in academic and administrative computing, information systems (institutional research and modeling, database coordination, academic and patient care information), telecommunications and information technology support.

The BIT Center operating as an information utility offers the following services on a chargeback basis:

Computing cycles
Voice transfer
Data/Video transfer
Information systems development
Information systems documentation
Information systems training
User support/Technology training

Currently the BIT Center is recovering about 75% of the Telecommunications Systems' budget, 30% of Computing Systems' budget, and about 12% of the Technology Support Services' budget. These figures don't include amortization for equipment. The plan is to increase recovery by Computing Systems to about 40% of gross budget and to increase Technology Support Services recovery to about 25%.

It is expected that the growth of state funding for the BIT Center will slow over the coming years and significant growth will come through recovery and cooperative arrangements with vendors.

WE CAN'T DO IT ALONE

It has become apparent to the leadership of ISS that the University must have outside help in order to reach its goal of becoming a leading biomedical transfer center. The BIT center has developed mutually beneficial partnerships with several key technology vendors. These vendors are Apple Computer, Digital Equipment Corporation, Siemens Medical Systems, South Central Bell, and U.S. Sprint.

CONCLUSION

The leadership of the university and ISS recognize the importance of effective utilization of information. The BIT Center will provide users with the latest information technology tools assisting them in the creation, analysis, transfer, storage, and retrieval of information, thus giving the university a strategic advantage. A strategic advantage at a health science university means UT Memphis will be more competitive for the best health science students, nationally recognized biomedical researchers and quality patient care providers.

THE SHORTEST DISTANCE:....INFORMATION TECHNOLOGY NAVIGATION

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Abstract

The theory and practice of information technology planning and policy formulation continue to be dominated by approaches that are excessively linear and rational in their orientation. This tendency is especially evident in higher education settings. Adoption of a more adaptive multi-dimensional approach seems warranted.

Complete reliance on classical "end-ways-means" thinking results in overquantification, limited planning horizons and organizational inflexibility. In turn, the developmental dynamic (and inherent instability) of the information technology environment is often not taken into consideration. Moreover, relatively high levels of ambiguity and potential for conflict within this environment are generally not addressed in conventional approaches.

A multi-dimensional approach that is sensitive to environmental conditions, organizational values and human behavior is clearly much needed in the domain of information technology activities. Utilizing the notion of organizational frameworks (or "lenses" through which to view organizational processes), a dynamic model of planning and policy formulation is presented.

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THE SHORTEST DISTANCE:....INFORMATION TECHNOLOGY NAVIGATION

By way of introduction to my remarks, let me jump to the end. What I want to convince you of, or at least stimulate your thinking about, is the somewhat heretical contention that information technology professionals spend far too much time cooking up elegantly-structured optimal solutions to problem situations that are conceived in such limited rationalistic terms as to be seriously unreal. This, in my opinion, is some large part of why we experience so much disappointment and failure in computing and other technical domains. We really must adopt a more sophisticated and sensitive approach to the planning and policy issues confronting us now and in the years ahead if we are to be considered credible. As with most things of value, this will take some work.

Some of you may be wondering about the title of this presentation, "The Shortest Distance:....Information Technology Navigation." It refers to what any schoolboy knows: that the shortest distance between two points is a straight line. I'm sure that the brighter ones can even prove this geometrically! Experienced navigators dealing with real-world terrain, however, will tell you that this abstract principle almost never works out in practical terms--it seems that swamps, rivers, mountains or any number of other obstacles nearly always get in the way--thus requiring a more realistic and pragmatic approach to the problem of getting from here to there.

For purposes of this discussion, we might characterize <u>intellectual</u> geography much the same way as well. Seldom do ideas and concepts (to say nothing of genuine insights) flow one from another in a completely logical and orderly progression. Despite our best efforts, often our most reasoned arguments and well-laid plans simply do not take us where we wish to go. And so it would seem quite commonplace to conclude that the world of everyday experience--both in physical and intellectual terms--usually turns out to be a bit less ordered and predictable than many of us might expect or perhaps wish.

Being presumably engaged in the business of the real and present world, information technology professionals might be expected to reflect a well-developed sensitivity to this type of pluralistic interpretation of how things work in everyday life; all too often, however, we do not reflect anything even close to such sensitivity. Indeed, a case could be made that information technologists are among the last groups of professionals to relinquish what are essentially out-dated and misleading if not downright erroneous views regarding the role of rationality in getting things done and working effectively with others. Why such a tiresome and outmoded perspective on the part of those who consider themselves so forward-looking (almost by definition) and a continuing source of technological enlightenment?

Before attempting to address this question, though, perhaps we should refresh ourselves as to the main features of the rational (sometimes called economic) model as articulated in the literature of management and related disciplines. At the heart of this approach is a rational or normative decision-making process consisting of the following components, or something very similar:

* Problem Definition
* Solution Criteria
* Alternatives Generation
* Alternatives vs. Criteria
* Choice
* Implementation
* Monitoring, Feedback/Evaluation

While these categories of activity might be expanded or contracted as the situation warrants, the rational approach in the domain of planning may be expressed in a more abbreviated fashion, contemplating a model comprised of only three essential elements:

1) Ends ⟶ 2) Ways ⟶ 3) Means

As any elementary management textbook will tell you in one form or another, strategic planning is a process by which corporate objectives (ends) are established, strategies (ways) for achieving these objectives identified, and necessary resources (means) gathered for implementing the plan. The order of this activity is generally considered integral to the process.

Although the logic and positive applicability of this "end-ways-means" approach is readily understood, it is by no means unassailable within the context of contemporary management thought regarding planning (see, for example, Hayes). Indeed, the exclusive or exaggerated reliance on rationalistic models is under increasing scrutiny in even much of the popular literature as excessively and unnecessarily limiting in scope and substance. That, it can be argued, has been a central point of a number of works since the trailblazing effects of such books as <u>In Search of Excellence</u> and <u>Megatrends</u> in the early 'eighties. Perhaps we should all be paying more attention to these kinds of observations in terms of their meaning for our professional activities and ways of doing business. Especially, I would submit, information technology professionals.

What are some of the more prevalent drawbacks t the rational/linear methodology or way of looking at things that may be of interest and use to us? In general, overreliance on this perspective yields at least the following kinds of negative outcomes:

* Overquantification of Goals
* Unrealistic Planning Expectations
* Organizational/Individual Inflexibility
* Insensitivity to Environment
* Inability to deal with Ambiguity/Conflict

Put into the context of information technology management, it is not all that difficult to see how these outcomes might be even more pronounced (and therefore even more in need of our attention) in a strictly rationalistic and technically-oriented approach to problem solving.

Let us look to the domain of computing for a moment to understand some of the difficulties involved. In terms of goal definition--call it "target environment" or what you will--the immediate tendency is to describe things in numbers: so many gigabytes, megaflops, MIPs, etc. Or statements such as, "capable of supporting X number of simultaneous on-line users with an average response time of Y." And so on and so on. The point here is not that these numbers are unimportant or unnecessary to an informed process, but rather that too often they are considered goals in and of themselves. Thus, sometimes a false sense of security develops from overreliance on quantification from the outset that can make for potent problems down the line.

In a related manner, an exclusively rationalistic methodology produces unrealistic planning expectations. That is, the (false) definitiveness resulting from this quantitative approach can easily mislead; if, as is usually the case, the planning horizon is too short, the overall utility of the effort is questionable. On the other hand, the belief that current sets of numbers can be extended and somehow massaged realistically within a five to ten year timeframe and that this yields something called "strategic planning" is both naive and nonsensical. We are all justifiably weary of meaningless five-year plans.

Not surprisingly, this monochromatic approach to information technology management issues reflects a rigidity--both individually and organizationally--that can be unnecessarily limiting and ultimately harmful to the enterprise. This inflexibility, in turn, perhaps inevitably results in a more or less pronounced insensitivity to the environment, whether local or extended. Given these kinds of outcomes, we might naturally expect that the ability to deal effectively with organizational and interpersonal ambiguity and conflict would be seriously impeded.

Taken all together, these and related negative/counterproductive outcomes of the rationalistic model serve to make life considerably more difficult for the information technology professional (and, I might add, for other organizational colleagues). If the nature of the environment were relatively stable and the nature of the task relatively noncomplex, this state of affairs might be regrettable but nonetheless survivable. But as we know all too well, this most definitely does not describe the field of information technology. As the issues grow more complicated and the pace quickens, we simply must get smarter.

Perhaps one very human reason why most of us are so taken with rationality, logic and order is the sheer appeal and comfort of objectivity in a seemingly anarchic and chaotic world. Put another way, it is often easier to understand and deal with the objective domain than to comprehend and act on the subjective. Thus, we frequently attempt to ignore and isolate that which we ought to be embracing. Nevertheless, we may point to some respectable progress in this area.

As was previously mentioned, the implications of the movement away from an exclusively rationalistic approach have become quite evident in recent management scholarship. One of the works in which the importance of the subjective is addressed most directly is entitled (appropriately or not, depending on one's point of view) Radical Management. The subtitle is perhaps more revealing: "Power Politics and the Pursuit of Trust." In any case, the authors state their perspective regarding objectivity/subjectivity clearly and directly:

> Skills to decode and respect the subjective element are what managers operating with a rationalistic mind-set most critically lack. Without these skills, solving problems is like playing cards without a full deck. Situations involving subjectivity arise, but management lacks the orientation to acknowledge their presence and is stuck either misframing problems or forcing solutions which, at best, are only partially correct. Some of the critical skills lacked by managers operating with the rationalistic mind-set are:
>
> 1. Skills to decode and respect the subjective interests of each individual.
> 2. Skills to decode and respect the way the system actually functions.
> 3. Skills to decode and respect the behavior of an individual who lacks a meaningful relationship with the system. (pp. 208-209)

The notion of "misframing" problems (and implicitly, solutions) is of considerable interest as we attempt to articulate alternatives to an exclusively rationalistic approach. In this regard, item 2. above is perhaps most relevant to our concern in a general organizational (as opposed to individualistic) sense. When we think about multiple frameworks or "lenses" through which to view organizations, issues and problems, we are in a much better position to see "the way the system actually functions." The extent to which we possess such understanding will in large measure determine our effectiveness as individuals and professionally.

What kinds of additional frameworks by which organizational processes are interpreted can be identified? Typlogies vary, but the approach taken by Bolman and Deal (1984) seems quite appropriate for our purposes. Utilizing their schema, organizations can be viewed or interpreted through four distinct frames or components: 1) structural; 2) human resource; 3) political; and 4) symbolic. In terms of our present discussion, the structural category may be considered as reflecting the rationalist, linear approach, the political as an adaptive mechanism; and the symbolic as an interpretive vehicle. These frameworks yield valuable additional perspectives and enable us to think about things of concern to us in much richer and more fruitful terms.

One way to explore the attributes of these frameworks is to describe how standard organizational processes might differ according to the perspective adopted. For example, the following abbreviated format yields potentially useful distinctions.

	Structural Linear	Political Adaptive	Symbolic Interpretive
Decisions	Rational sequence to produce right decision	Opportunity to gain or exercise power	Ritual to provide comfort and support until decision reached
Goals	Keep organization headed in a direction	Provide opportunity to make interests known	Develop shared values and symbols
Planning	Set objectives, coordinate resources	Arenas to air conflicts, realign power	Ritual to signal responsibility, produce symbols, negotiate meaning
Communication	Transmit facts and information	Vehicle for influencing others	Telling stories
Conflict	Authorities resolve	Bargaining, forcing or manipulating	Shared values; conflict to negotiate meaning

Another, less academic method of coming to terms with the concept of employing multiple frameworks in looking at things is to cite a concrete situation reflecting this dynamic. Along these lines, let me relate briefly a true story that illustrates the point. About 18 months ago, a university with which I am familiar came to the realization that a substantial UNIX engine would have to be acquired to meet current and projected faculty needs in Engineering and Computer Science particularly. A tremendous amount of analytical work was accomplished in the technical domain within a very short period and a recommendation to purchase Company ABC hardware was made in July, with immediate installation in mind. The rational/linear process had clearly yielded the "right" answer or best solution to the problem as defined.

The problem with this "problem as defined," however, was that it represented only one aspect of the whole situation. As is most often the case, many other "sensibilities" were also involved. First, there was the timing/consultation issue: would July be a good time to finalize this decision, with very little or perhaps no faculty input? Second, there had been a fairly long history of some animosity and conflict between the central computing services operation and the affected academic departments: would an immediate purchase help or hinder this situation? Third, the notion of forming tangible partnerships between the institution and appropriate vendors had recently quite consciously been embraced by university policymakers: how might the present procurement opportunity fit in? Many other questions of this type came to the fore as well, making for a fairly rich mixture of things to consider.

To make the proverbially long story short, the senior institutional officer responsible for computing decided to pursue these and related multiple agendas in the process of addressing the original, so-called "objective" UNIX issue. In so doing, the university came to grips with a number of longstanding problems in the political and symbolic domains. The actual "go" decision with Company ABC was not formalized until late November, so some time was lost. On the plus side of the ledger, enormous progress was made not only substantively but also politically and symbolically--positive accords were reached among parties internally and a highly successful joint venture between the university and the vendor was undertaken and completed as a result of this multi-dimensional approach.

Now before we get too carried away with building fancy matrices and telling retrospective stories that illustrate the wisdom of our approach to a specific problem situation, perhaps we should pause and recognize a crucial point: that we must conscientiously avoid the trap of substituting one recipe-type approach with another. Put differently, we must understand that the limited "one best solution" methodology is essentially false and almost always leads to trouble. To be sure, we all wind up employing recognizable strategies to address defined issues and problems in ways we hope will be effective, but the fact is that few of us enjoy a 100% success rate. This merely underscores the reality that most professional concerns and problems are highly contextual in nature, thereby necessitating a dynamic, multi-dimensional methodology if we are to play the game with anything resembling respectable odds.

Clearly, then, information technology professionals need to consider carefully and perhaps rethink their conceptions about contemporary management and what will be required in a future that works. In this regard, let us briefly contemplate several relevant observations put forth in recent research and conceptual efforts within management literature. In an interesting paper on the dynamics of decision making, Einhorn and Hogarth (1987) explore the notion of what they call "thinking backward:"

> Thinking backward is largely intuitive and suggestive; it tends to be diagnostic and requires judgment. It involves looking for patterns, making links between seemingly unconnected events, testing possible chains of causation to explain an event, and finding a metaphor or a theory to help in looking forward.
>
> Thinking forward is different. Instead of intuition, it depends on a kind of mathematical formulation: the decision maker must assemble and weigh a number of variables and then make a prediction. Using a strategy or a rule, assessing the accuracy of each factor, and combining all the pieces of information, the decision maker arrives at a single, integrated forecast.
>
> Although managers use both types of thinking all the time, they are often unaware of the differences. Moreover, this lack of awareness makes decision makers stumble into mental traps that yield bad decisions.

What seems especially useful for our purposes is the concept of using metaphors as a means of understanding a complex and ever-changing environment. Implicitly, this encourages us to adopt a fluid, adaptive approach based on multiple inputs instead of confining ourselves to a strictly linear rational methodology.

Along these lines, in another critique of so-called "scientific" management, Isenberg (1987) contends that

> ...what managers need is a synthesis of rationality and entrepreneurial (or opportunistic) resourcefulness. Strategic opportunism is a way of approaching the complex, uncertain task of management both creatively and vigorously.
>
> ....
>
> Thinking both strategically and opportunistically is clearly not easy. It requires a tolerance for ambiguity, intellectual intensity, mental hustle, and a vigilant eye for new ideas. It requires, in other words, a tough-minded approach to an inherently messy process, the ability to take action in the midst of uncertainty, to 'sin bravely.'

Again, the point here is that a monochromatic view of the world is not only less interesting, but also much less effective.

* * * * *

What does all of this mean for information technology management professionals? In my own mental framework, the word "freedom" comes most readily to mind. What we have before us, if we will only recognize it, is the opportunity to free ourselves from all sorts of negative and fundamentally mistaken perspectives. Freedom from a "closed system" approach. Freedom from a "black box" mentality. Freedom from the "one best solution" myth. Freedom from endless numbers and technical jargon. And, on the other side of the coin, freedom to engage all the insight, understanding and creativity we can muster in attending to the professional tasks confronting us.

It is my firm conviction that information technology professionals have a special obligation to adopt richer, more flexible approaches to solving human and organizational problems. Certainly, a valid and appropriate technical/rational component is central to any problem-solving process, but there are nearly always additional factors to consider. Conventional perspectives are rapidly becoming dysfunctional. In a world increasingly dependent on innumerable forms of technology, we must insist on a full spectrum of perspectives by which to manage the enterprise.

Successful information technology navigation requires us to recognize that the shortest distance between two points is often not a straight line.

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ACCESSING INFORMATION FOR DECISION MAKING:

A TOOL KIT APPROACH

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ABSTRACT

This paper describes a pilot project undertaken within the Maricopa County Community College District in cooperation with Information Associates (IA). The intent of the project was to identify an architecture and tools for the deployment of Decision Support Systems (DSS) and Executive Information Systems (EIS) which fully exploited current technology, while providing maximum flexibility for the inclusion of promising new tools and solutions. The project included an effort to identify the information requirements of planners/decision makers, and the evaluation of an IA product which integrates summary data stored on mainframe systems with a menu-driven microcomputer environment for user-driven data analysis and graphics creation, using popularly accepted PC software.

The discussion here includes background on the project, observations on DSS/EIS technology, outlines the planning and progress of the project, and concludes with some ideas and modifications to the project plan that resulted from implementation. The contents of this paper are directed at Chief Information Officers, Vice Presidents for Planning, and Institutional Researchers.

INTRODUCTION: THE MARICOPA ENVIRONMENT

An Expanding System

The Maricopa County Community College District (MCCCD) is the third-largest multiple campus community college district in the nation, with roughly 75,000 persons enrolled each semester. Serving a large county with a population of nearly 2 million, the Maricopa Colleges employ about 2.000 full-time faculty and staff, with 2,500 part-time faculty. Both academic and vocational programs are offered at seven colleges and three new education centers, which are rapidly expanding into full-fledged colleges.

The MCCCD Information Technologies Services division (ITS), under the leadership of Mr. Ronald Bleed, is responsible for the development and maintenance of administrative computing hardware and software, a voice/data/video microwave telecommunications network, and support for academic computing. Over twenty Digital Equipment Corp. VAX systems are connected to a comprehensive Ethernet backbone, which is accessible via more than 2,000 terminal server ports and telephone data adapters. Over 6,000 terminals and PC workstations are available to academic and administrative users. ITS is accountable to an Information Technologies Executive Council (ITEC), which is comprised of several college Presidents, Vice-Chancellors, and a faculty member.

Project Background

In the early 1980's the Maricopa County Community College District began implementing an agenda of changes in Information Technology that included: 1) the shifting of appropriate computing resources from a central site to member colleges, 2) full exploration of expanding microcomputer technology, and 3) new online information systems supplied by Information Associates (IA), a major vendor of administrative software for higher education. All of the IA-supplied systems are maintained and enhanced at the MCCCD central office; representatives from the colleges serve on user committees which evaluate and prioritize all requested modifications to the Student Information System (SIS). The other administrative systems, including Financial Records (FRS), Human Resources (HRS), and Alumni Development (ADS) are housed at the district office. Most of the colleges have their own computer centers and run copies of the SIS system maintained by ITS, with wide latitude for ad-hoc reporting and development of auxiliary systems as resources permit. As part of a joint development agreement, IA has several employees on-site at MCCCD. The MCCCD-IA partnership is considered an important element in the success of current ITS development efforts.

Converging events in 1987 increased momentum and interest in areas which generally fall under the rubric of decision support systems. The college and district-wide strategic planning process was evaluated and formalized, and a Coordinating Council for Strategic Planning (CCSP) was created to generate planning policies and to formulate a district strategic plan. The Governing Board also charged the affiliated colleges to develop appropriate strategic plans. More recently, the budget development process has been restructured to build more explicit linkages between the strategic planning process and the annual budgeting cycle, with more emphasis on long-range planning as an integral part of the budget process. The various users participating in both the strategic planning activities and the budget process (deans and other administrators) voiced needs for better integration and availability of information in forms specifically tailored to the forecasting, planning, and other strategic activities being emphasized. Existing reports addressed operational concerns, and did not deal with the longer timeframes and comparisons of summarized information now becoming more essential to the decision making environment.

In addition, some administrative decision makers were becoming ardent users of personal computers, and the proliferation of microcomputers in all levels of the organization, along with more "user-friendly" software, created a demand for downloadable information that could be manipulated directly. With the online systems maturing into reliable, well understood tools for collection of data, ITS needed an overall scheme for disseminating such data to meet the new needs.

New IA System Developed

The stage was set, it seemed, for the suggestion from IA representatives that MCCCD assist in the testing and evaluation of a new IA product designed to meet some of the needs described above. Current product literature describes the new system:

> The Information Associates Executive Support System is an information access solution that builds a planning database on your mainframe and provides access to the information through user friendly menus on a microcomputer. It can be used to develop an information system that provides your executives with the information needed for strategic planning and decision making.

Maricopa was selected as a beta site for the IA "ESS" product for a number of reasons: 1) the on-site staff resources afforded us as part of the IA/MCCCD joint development contract, 2) the opportunity to test the product in a community college environment, and 3) the perception on Maricopa's part that more advanced decision support capabilities were needed. The timeline for evaluating ESS and generating feedback for IA called for a full implementation of the system, but it was later decided to defer actual implementation temporarily, for reasons not apparent when the project plan was drafted. To understand the issues involved in this project, some more general background drawn from recent MIS/DSS literature is needed. Information systems theory and folklore characterize the realm addressed by this project as vulnerable to difficulties in planning and implementation.

DECISION SUPPORT: WHAT IS THE QUESTION?

Nature of Decision Making

The phrase "Decision Support System" is subject to such broad, conflicting definitions that many lose sight of the real issues involved in making current information systems more useful in the management and strategic planning processes. Decision Support, considered along with the more recently developed tools commonly referred to as Executive Information Systems, is the obvious evolutionary step to emerge from the current median of administrative computing, often labeled Management Information Systems (MIS). Automating the flow of operational data and providing management with obvious, critical, summary reports or selected detailed data suggests the next phase, which is using information to support more difficult, less structured decisions where knowing what to ask is often part of the question. Questions can also range from one-time issues to more complex operational decisions that warrant a permanent procedure for monitoring a new found (or at least newly quantified) institutional parameter.

Although these kinds of needs can exist at many levels of an organization, a case can be made for targeting the needs of executive management first, since the decisions made at that level have the most profound budgetary and policy ramifications. There are many possible "strategic indicators", summaries and ratios which portray and portend the effectiveness of the institution in pursuing its mission. Any technical effort to deliver that kind of information (the goal of the recent crop of Executive Information Systems) must be relatively easy to use in order to achieve acceptance with such a clientele. By definition, the problems addressed are completely anticipated, and may suggest new lines of inquiry without necessarily providing tools to pursue them. The best of such tools not only provide "warning lights" to signal potential problem areas, but allow a user to delve deeper into supporting information, seeking explanations for performance beyond defined bounds.

Immediately, one can see that the domain of these kinds of problems strains traditional MIS/DP methods and techniques, which are optimized for rapid processing of high volume, repetitive tasks. Tools for the decision support process address more dynamic needs and must allow more complex operations to support sophisticated analysis. They require a longitudinal orientation that operational systems typically do not address due to storage efficiency questions. There is an ad-hoc component to the decision making process, and a degree of functional user knowledge and involvement required, that makes enabling the end-user for flexible, direct access to the data the real imperative.

Microcomputer Resources

As such, the arrival of the microcomputer, and the consequent flood of new tools like spreadsheets, presentation graphics tools, and user controlled database management, has helped advance the state of the art considerably. The new tools utilize the local processing resource to enhance the user interface, and provide quality graphical output. This is very important, since the decision making process, at the levels that DSS/EIS must address, is greatly simplified by reducing problems at various stages to graphical representations. A picture is worth a thousand words, or maybe a hundred spreadsheet cells, to coin a phrase. Highlighting critical variables in graphical form helps users visualize both the intermediate results which guide refinements in question formulation, and the more final impressions on which decisions must be based. In addition, the realities of decision making include attempts to influence others, which suggests "presentation quality" high resolution color graphics as the eventual form for system output.

Fourth Generation Tools

Without too much elaboration, it can be seen that the decision making process demands support tools or systems characterized by a degree of flexibility, adaptability, ease of use, and fast iterative development. These elements helped shape the "fourth generation" languages now considered desirable for most MIS applications. What is easy for the programmers is (to an extent) also easy for the end users, as the rapid rise of relational database technologies and associated access tools indicates. The value of these tools on both the mainframe and workstation computers is two-fold. First, ad-hoc access to both internal (mainframe) data as well as anecdotal or external data is enhanced, since it is more cost effective to develop systems to deal with such data. Secondly, the rapid development aspect allows more complicated decision needs to be supported with limited resources.

With all that background, one can understand the problems a software developer would have providing tools to support the often ephemeral, generalized process of decision making. In fact, it is rare to see a product touted as a "Decision Support System," per se. What are available are tools useful for constructing applications helpful to decision makers in a more rapid, cost effective manner. Current systems are making increasing use of microcomputers to perform the user interface and graphics tasks which are workstation fortes, and use larger host systems to store volume data.

PROJECT PLANNING AND IMPLEMENTATION

Another Ingredient

The availability of IA's ESS greatly influenced the discussion within ITS concerning the need for decision support capabilities. At the same time, the somewhat broader question of end-user/ad-hoc access to information generated interest in fourth generation languages as possible solutions to meet widespread needs. As a VAX/VMS shop, and an IA customer with no real interest in switching to a proprietary database without IA support, the conclusion ultimately reached was that the FOCUS 4GL system from Information Builders, Inc. was a mature product that enabled use of existing RMS ISAM data files and provided much needed reporting facilities.

While FOCUS includes a proprietary database, it also has interfaces to many popular database systems, which protects MCCCD's investment if IA adopts any of several database solutions in the future. FOCUS has graphics, modeling, and application development features that were considered promising. IBI was perceived as a large enough vendor to ensure future enhancements, and was committed to an ambitious SQL-compatibility project. IA was working with IBI to investigate whether FOCUS might fill a niche for other IA customers; eventually, a marketing relationship was formed between the two vendors, putting Maricopa in a position to benefit from IA support of FOCUS with all IA products.

Armed with FOCUS and motivated to move immediately based on the proposed beta-test of ESS, a project plan was devised with the following phases:

1. Planning
2. Preparation
3. Design
4. Information Collection
5. Review
6. Training

The project officially commenced in January 1987 and completion was targeted for the fall of 1988. In order to track the progress of ESS at Maricopa a closer examination of the project plan is appropriate.

Planning Phase

Information Technologies Services developed Strategic and Operational Plans to complement the District and College plans described above. The ITS Strategic Plan was organized to reflect goals appropriate to each area of institutional function:

1. Instruction
2. Instructional Support
3. Student Services
4. Institutional Support

One of the goals identified under the Institutional Support function was titled "Utilization of Information Resources", and was further described:

> To more fully utilize existing information resources, new and improved tools of access, manipulation, production, and dissemination will be made available.

Clearly, the acquisition of FOCUS and was a major step toward fulfilling that goal, and was included as one of the detailed objectives under that goal. Another objective for that goal was created to cover the DSS/ESS project. Titled simply as "Develop Decision Support System", the objective read:

> To provide information appropriate for decision making, the Information Technologies Department, in cooperation with IA, will design and implement a decision support system.

It is worth noting that at the time the objectives were set and the plan developed, there was a perception that "executive support" was less encompassing than the results MCCCD hoped to achieve. Therefore, the use of ESS as an acronym was dropped in favor of DSS, and later PSS, for Planning Support System.

Preparation

In August, 1987, a group from IA made a site visit to MCCCD to present an overview of the ESS product designed by IA. MCCCD obtained the specified IBM-PC compatible workstations (PS/2's were chosen due to IBM discounting), and designated PC software was ordered. IA had determined their product would use "ubiquitous tools," microcomputer packages that were de-facto standards due to wide acceptance. These components included:

1. dBase III+ -- data translation, selection, reporting, storage
2. Lotus 123 -- spreadsheet analysis, data conversion, graphics
3. HAL -- a simplified user interface to Lotus 123
4. Crosstalk -- communication with mainframe, data downloading
5. Harvard Graphics -- presentation quality color graphics

IA devised a very easy to learn and user-oriented menuing system for the PC workstation. In order to minimize the training needed to use ESS, the system allowed users to "point and pick" the data of interest to them, and automatically invoke other components. The mainframe components of the system were designed to create a "Planning Data Base" (PDB), a generalized repository of longitudinal, time-stamped summarized data. The data was to be captured, at user defined intervals, from various operational systems, or external sources. The menuing system and mainframe PDB software cooperated to download data to the microcomputer transparently, relieving the user of a potentially confusing step.

A project team was identified and given responsibility for the evaluation and possible implementation of ESS. The addition of FOCUS as a resource lead to an expansion of the team, as hopes were raised that FOCUS might enhance the process of "harvesting" information from the operational systems. By December 1987, software was delivered from IA for both the mainframe and workstation components. ITEC approved the DSS project structure, signaling design to begin.

DSS Project Team:

Director of Computing Services
V.P Management Services Division (IA)
DSS Technical Lead (IA)
FOCUS Technical Lead
District Institutional Researcher
College Institutional Researcher

Design Phase

The MCCCD project team began the process of identifying Strategic Indicators and how they could be incorporated into the DSS system. The Coordinating Council for Strategic Planning (CCSP) was targeted as the appropriate user group to guide the DSS effort. During this phase, IA provided training to members of the team and continued consultation on site. A "Delphi Technique" approach was used to solicit user input; selected administrative users were asked to brainstorm a list of pressing questions and concerns with their staffs and forward them to the project team. The questions were then collated and organized using an institutional model developed to identify key strategic indicator areas.

As mentioned previously, ESS is based on mainframe and workstation components. The mainframe portion consists of twelve online screens used to describe, control, and enter data manually. The online portion uses existing IA "Series Z" features such as an active data dictionary, help screens, etc. Batch programs are provided to mass-load data, report on PDB contents, and to extract data for downloading under interactive workstation control. Controls are designed into the system to ensure that data is loaded into the system at the time intervals defined for each "request", (summary item type), and that no gaps in the data develop due to undetected operational problems.

IA devised a scheme for classifying ESS data that would enable information from all areas to be organized in a uniform, easily understood manner, based on generalized data attributes:

Information Level	Description	Example
Data Type	Selection	Internal Data
Category	Selection	Enrollment Trends
Population	More Selection	Full-time Students
Target	Type of Data	Headcount
Organization	Sort Sequence	College/Dept
Sub-Category	Cross-Tabulation	Ethnicity/Gender

The system as originally supplied included a menu/data hierarchy that was oriented more to the needs of a four-year academic institution than to a community college. Using the supplied structure as a template, each strategic indicator group from our institutional model was mapped to a "category", and the project team attempted to refine the deeper menu/PDB levels to more closely reflect the community college environment.

Information Collection

The project plan then called for loading information into the PDB using data from both internal databases (Student Information System) and external databases (such as metropolitan area demographics). It was here that the first serious obstacle to progress was encountered. After modifications to the batch programs to reduce the burden of loading 10 semesters of history for 7 or more colleges, the team was advised that the only SIS data applicable would be summaries which reflected each semester's data as of our State Census Date, or 45th day, which is obtained each term by freezing the files for several days to run all required reports. Data which did not agree with published 45th day figures would be suspect, and of little value.

The SIS system had been in operation for a number of years, and under certain circumstances, retroactive changes in course status had been applied after 45th day which shifted certain enrollment figures, but which never caused any operational concerns. The policy of allowing such changes was never questioned, as it caused no problems. Attempts were made to program around this problem, to no avail. The alternative of reading 90 sets of 45th day archival tapes to disk, running dozens of harvest jobs for each, and having to repeat the task for any new strategic indicators dampened enthusiasm for the project. Needless to say, a better process for obtaining a reliable "snapshot" of our SIS data as of Official Census Date has been implemented.

It was also noted that the results of the "Delphi" process for gathering user questions were somewhat problematic: less than 25% of the questions could be addressed using existing operational data, and many of the requests were for very sophisticated views of data that were so closely knit with detailed operational data that it seemed more feasible to provide solutions as new layers built upon existing application systems. The concept of a central database of planning data has wide applicability, but there are dangers to isolating information from its immediate context, from both an interpretation and a software maintenance standpoint.

One insight gained from the initial efforts to harvest data for inclusion into the ESS planning database may suggest a strategy that could enhance DSS/EIS implementation in a variety of contexts. Many times, the data in a system must be massaged using various algorithms and logic steps prior to presenting it to users on reports or screens. Users will insist that values stored in a DSS/EIS environment match these familiar pre-digested summaries. Any attempt to harvest the identical data using a 4GL will require duplicating complicated application logic, and create a redundant 4GL program that adds to the maintenance burden. Since users can identify key summary reports which present the data they need from a DSS, why not augment the existing report programs to capture the data in electronic format at the same time that reports are built?

To run a report which creates a dozen or more cross-tabulated views of a database, followed by a dozen more 4GL "harvest" runs to create identical data in a format that can be loaded into a DSS repository, creates unnecessary operational overhead. Often, the only major issue is to identify standard specifications for each data item used in DSS, so that all programs which create a "DSS feed" output file use identical formats and codes for common data items. This philosophy can be extended to pre-translating values from various applications when necessary to ensure that the DSS view of institutional data minimizes encoding differences for information used in several systems, but stored in different ways.

At Maricopa, one particular SIS program creates more than a dozen student demographic reports, for selected credit hour ranges, all in one pass of the database. Adding the code needed to output the same information in a disk file for DSS use took less than a day, and guarantees that DSS information will exactly match hardcopy reports, without depriving SIS users of reporting flexibility.

Review and Changes

Maricopa, as an institution, has not supported a voluminous hardcopy institutional factbook, relying instead on ad-hoc reporting capability to produce summary information as required. Over the years, some of the administrators at MCCCD colleges have built up their own DSS capabilities using spreadsheets, which usually address long-term enrollment patterns, in lieu of a more static factbook. Other institutions, notably the Santa Cruz and Irvine campuses of the University of California system, have pioneered in the creation of "electronic factbooks", which generally provide the same information found in hardcopy factbooks, but in a more dynamic mode that supports DSS techniques. One advantage to these systems is that they are run on mainframe systems, accessible to the entire user community.

These online factbooks de-emphasize the high resolution graphics facilities of a PC for the sake of access to mainframe data to back up summarized factbook information. Since the mainframe supports storage and rapid processing of volume data, it is desirable to add a layer of information in between the operational databases and the high-level summaries of a factbook or EIS. Sometimes termed "analytical databases", this layer provides selected detail information, extracted from operational systems and tailored to DSS needs. Questions raised by factbook or EIS usage can be then be addressed in a timely manner by digging deeper into the analytical database that was used as a source for the EIS level data. This middle territory is the range of questions which good DSS capability will address, often as a result of issues raised by more consolidated information in the executive oriented components of a system.

Although the timeline for ESS implementation has been extended to allow more time for the modified approach to data harvesting, and to allow for expanded DSS capabilities, MCCCD is excited about the potential now developing for addressing a broad range of DSS needs with a flexible, integrated set of tools for the support of decision making. Since one of the goals for the system is for user interfaces to be self-explanatory and require minimal training, it is envisioned that users who want to make use of basic facilities will receive training on package software of their choice through existing channels of course delivery. Specialized training for those capable of using more arcane features of FOCUS or related DSS tools will be handled on an as-needed basis.

CONCLUSIONS

By adopting a philosophy which supports the development of analytical databases, and an online electronic factbook available on the mainframe, Maricopa has positioned itself to benefit from the "best of both worlds". EIS support for users who need the ease-of-use and graphics strengths of PC's, blended with the more generic DSS tools that a mainframe 4GL environment (such as FOCUS) provides, is the architecture for DSS/EIS which evolved out of our DSS efforts. In addition, building a DSS layer and factbook using FOCUS has expanded the "tool kit" to include additional mainframe and micro-based software packages (such as SPSS-X for statistical analysis) in an integrated DSS environment.

With FOCUS-based tools providing an integrated DSS platform, and the potential of the IA ESS system for executive access, MCCCD is moving forward to empower decision makers with the information they need to chart the course of a large, complex institution offering a wide spectrum of educational opportunities. The project has been very successful as a vehicle for bringing to light the complex issues involved in implementing decision support systems.

DEVELOPING DATA ACCESS POLICIES IN A DECENTRALIZED ADMINISTRATIVE INFORMATION SYSTEMS ENVIRONMENT

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Abstract:

This paper describes the development of data access policies in a decentralized environment and the impact of the introduction of a data query tool on those policies. The University is implementing software for the purpose of expanding data access by allowing end users to directly interrogate the administrative information system files. This is in response to the commitment to expanded end user access to administrative data in the University's Administrative Information Systems Long Range Strategic Plan. The current environment is described, including access to data, policies, and the demands of the strategic plan. The proposed policies and procedures are covered with an accompanying discussion of the issues involved.

Background

Decentralized Administrative Computing

Responsibility for Virginia Commonwealth University's administrative information systems has been decentralized since 1985. Until that time, administrative information services were provided by a central administrative data processing unit. As a result of decentralization, Administrative Data Processing staff and associated resources were reassigned to the appropriate major administrative units along with the authority, accountability and responsibility for delivery of administrative information services. The central computing facility continues to operate as a utility servicing both administrative and academic computing needs. Most major administrative systems consist of software packages from a variety of vendors.

Committee Structure

The Computing Policy Advisory Committee (CPAC) makes recommendations on policy, priorities and funding for all computing to the Vice Presidents. The Administrative Information Systems Advisory Committee (AISAC) provides advice to CPAC on administrative computing issues, while two academic computing committees make recommendations on academic computing issues. AISAC has an Applications and Operations subcommittee which both initiates discussion and responds to requests from AISAC.

AISAC has recently been restructured to provide more emphasis on user representation. Prior to restructuring, the committee membership consisted of senior administrative managers, most of whom had administrative systems reporting to them. The present structure allows for three vice presidential "at-large" representatives, three academic or administrative "unit" representatives and the chairman of the AISAC Applications and Operations subcommittee. Of the current seven members, only two have administrative systems reporting to them. The Applications and Operations subcommittee membership, which previously consisted only of application system managers, has been expanded to include two "at-large" user representatives.

Data Administration

The Planning and Budget Division of VCU consists of three Departments, Institutional Studies, Budget Operations and the University Planning Office. This division is highly visible in the committee structure with the Associate Vice President for Planning and Budget serving as a vice presidential designee on CPAC and the Executive Director for University Planning chairing AISAC. The Director of Institutional Studies sits on the AISAC Applications and Operations Subcommittee.

Responsibility for data administration and university wide management reporting has been assigned to the Planning and Budget Division. The committee participation and the assignment of data administration are largely due to Planning and Budget's role as an integrator of information from multiple systems and its inherent interest in the integrity of administrative data.

Data administration in a decentralized environment utilizing packaged software systems requires its own unique definition. Data administration's usual role in the system development process is minimized by the use of software packages. The emphasis at VCU has been on improving the ability of administrative systems to support management reporting and planning efforts at the institutional level. With the introduction of a user query tool, this is expanding to include data administration support to a broader constituency at the school and department levels.

Basis for Change

Current Access to Administrative Data

All of the major systems have CICS on-line inquiry access for their users. The availability of these screens varies widely from system to system, depending largely on the sophistication of the accompanying security software. The inquiry screens provide fast, direct access to single records of a single system. An inquiry screen will present information for only one entity at a time (a single student, staff member or financial account). To obtain information about a group of entities (all accounts for a given department) requires individual inquiries be made for each member of the group and the information manually aggregated. Information requiring data from more than one system requires separate inquiries into each system.

The alternative to use of the CICS inquiry screens is to request programming support from one of the system support groups. Most of the support groups maintain programming staff partially assigned to fulfilling user information requests.

The problems of priorities, volume, and communication of user needs make this route often inappropriate for information that is required quickly and that may require numerous changes in specification before the desired results are obtained. If the information is needed on an irregular basis, each generation requires a request to the support group.

If the information requires data from several administrative systems, the request is often routed to Planning and Budget, where there is experience in data integration. Limited resources in this area result in this kind of support usually being provided only to executive management and university wide committees.

Present Access Policies

As CICS access has been provided to users, security guidelines have been established independently by the major administrative unit responsible for each system. Each area has procedures for obtaining CICS access and forms which must be completed and signed indicating the access to be provided and the user's commitment to uphold the confidentiality of the information. The security is usually built into the system software and the user is provided access to those records which are under their managerial responsibility. The present policies restrict themselves to only those security issues which must be addressed before allowing CICS access.

A few users can directly access system files in batch mode. For anyone whose responsibilities are not at the university level, extract files have been created containing only the data for their area. Creation of the extract requires system support group intervention.

Strategic Long Range Plan

One of AISAC's major achievements has been the development and acceptance of a Long Range Strategic Plan for Administrative Information Systems (July 1987). The 1987 Plan identified increased access to administrative information as a primary issue which needed to be addressed. The ability of each user to independently access data as easily as possible to assist in performing management and operational functions was defined as critical. The intent was to provide ease of access to satisfy the informational and operational decision making needs of the university.

The Plan recognized that expanding user access implies certain responsibilities on the part of the user, and the existence of a need for central administrative controls to establish and enforce administrative policies and procedures that deal with issues such as data ownership, data custodianship, access rules and responsibilities.

To address these issues the Plan called for implementation of technology which would promote universal access and availability of data, and for the recently created data administration function to coordinate the development and implementation of the required administrative policies and procedures.

Introduction of the Query Tool

The AISAC Applications and Operations subcommittee began reviewing options prior to the actual approval and distribution of the Plan. A number of data base products from the major vendors were reviewed by the committee. Most included some kind of "transparency" mode which worked in one of two ways. The first method allows the data base query function to read the existing VSAM files, requiring no changes in application system software and files. This method provides the user access without modifying production software, but in a less efficient manner than a true data base. The second method provides an option to run existing programs against data base files which are structured to appear as the original VSAM files. This provides better query response, but may impact production efficiency and brings future software vendor support into question. Neither method allows the restructuring of the data normally associated with the data base environment. Our dependence on vendor supplied maintenance, the fact that our application software vendors were not yet congregating around a single database vendor (which would allow us to buy their data base versions) and the problems with transparencies resulted in a decision to put the database decision "on-hold" and concentrate on what is required to provide "universal access" while protecting our current system investment.

A committee of system managers and users was formed to state our needs and generate an RFP (Request for Proposals) which described our requirements. This process ultimately led to the purchase of the IMAGINE product from Computer Corporation of America.

The primary factors in the choice of IMAGINE were ease of use for non-technical staff, the ability to read existing administrative system files and the functionality of combining elements from various system files to satisfy a single information request.

With the restructuring of AISAC it was clear the IMAGINE project would be underway prior to the approval of any drafted data administration policies. As an interim measure, a specially selected group of IMAGINE users were asked to specify what their data needs would be, and this information was forwarded to the system managers with a request for cooperation in making the files available.

We have found the system managers to be very cooperative in this process. The debate and disagreements present in earlier discussions over allowing access by "generic users" to "generic data" were absent when discussing specific users accessing specific data with a known tool.

Issues

While we have data security procedures for each of the systems that have provided CICS access, these procedures have been developed in isolation and only address the concerns associated with this type of access. The nature of universal access by query tool requires policy statements that address more than data security. The enhanced access and flexibility require new roles and responsibilities for both users and systems personnel be defined. The issues raised by the introduction of IMAGINE and how our draft policy addresses each of them is discussed in what follows.

Legality and Privacy Issues

Widespread access to larger volumes of data requires restating and re-emphasizing the individual's right to privacy. We must insure these rights in a new environment where a larger audience will have control over the distribution of data. The control points previously provided by limited access to data must be replaced by a widespread understanding and agreement of what those rights are. Individuals within an academic department must understand and uphold those rights as well as the Registrar's Office has done in the past.

Privacy issues and legal requirements for maintaining faculty, staff and student privacy were raised very early in the AISAC subcommittee meetings with a wide range of views being expressed as to what the law required. Since this seemed to be a recurring theme in our discussions, the University's legal counsel was asked to consult with the committee on privacy and the law.

Briefings on the Family Educational and Privacy Rights code (the Buckley Amendment) and the Virginia Freedom of Information Act were given. The Buckley Amendment places clear restrictions on who may have access to student data. For the committee's purposes this was stated as access may be provided to those who have been determined by the institution to have legitimate educational interests. The Virginia Freedom of Information Act, to the surprise of some committee members, deals primarily with the public's right to access and therefore has minimal impact on data access internal to the institution.

The bottom line is that individuals have certain rights to privacy and a right to see their records. Policies should be established using a common sense approach, followed by a legal affairs review of the draft.

Several alternatives were considered for addressing access rules in the policy. These ranged from specifying access rights on a system by system basis to omitting any discussion of specific access rights within the document. A desire to keep the policy as flexible as possible led to the classification of all data in which individuals were identifiable as "confidential". This was seen as not only meeting the basic legal privacy requirements, but also defining an additional level of privacy the institution would support. This does not rule out the extension of the confidential label to other data the institution determines should have limited circulation.

With the definition of a minimum level of privacy established, a university wide minimum level of access needs to be defined. This is done by establishing "standard access rights" for an organizational unit to its data. At a minimum, an organizational unit will be provided access to administrative data for that unit. This in no way limits the custodian from providing additional access to those with a legitimate institutional need.

This standard access right is provided to the organizational unit head, who may in turn delegate this access to subordinates. The unit head, however, retains responsibility for data confidentiality.

Enforcement procedures and penalties are not defined in this policy. A review of other existing policies found the University's Computer Ethics Policy coverage sufficient in this area.

Ownership vs. Custodianship Issues

With direct access to data, the intervention previously required of the systems personnel is absent. This presents the systems personnel with a role different from the "controller" operating mode of the past.

Departments responsible for programming and maintaining administrative systems have been known to behave as though they "owned" the systems under their management. This has often been evident in the unwillingness to allow outsiders access and to share information about the workings of "their" systems. Decentralization can encourage this attitude by bringing programming staff and functional unit staff under the same roof.

Introducing the concept of a data custodian can alleviate the problems associated with an ownership mentality. It must be made clear that, without reducing any sense of responsibility for the systems and the data, it is the University that "owns" the system and the data, and there are legitimate external users of the system and data.

The draft policy defines the data custodian as the "organizational unit assigned responsibility for logical and physical integrity of administrative data". The custodian retains sole rights to any modification of the data.

Control and Accuracy

One of the major impacts on policy presented by user access to data is the risk of misuse or misinterpretation of the data. There are many opportunities for incorrect presentation of data due to subtleties built into the systems that will not be understood by the user. This was not previously perceived to be a problem since the intervention by system personnel who understood the system and the data was always required to produce information.

Elimination of these subtleties by adding or modifying data elements, and ongoing data education for the users are the tactical responses to this problem. From a policy point of view, the user must be made to understand that he is responsible for accurate use and presentation of data. There is an obligation on the part of the user to understand the data with which he will be working. The custodian is responsible for making known subtleties and conditions that can lead to incorrect presentation. This requires a sharing of knowledge about the system that was previously regarded as proprietorial.

Decentralization and Administration

It can be tempting to create a centralized function when considering the control of access to data. Having a single contact for users requesting access and reducing the demands on the data custodians in dealing with each request encourages the establishment of a centralized function.

Our administrative systems have obtained CICS screen access over a period of years, and each has in turn established a process for requesting and granting access as it obtained online features. Since these functions have been established and staffed internally, and in most cases combined with a training and support function for their users, it did not seem reasonable to call for establishing a central function. We therefore plan to recommend the data custodians as access administrators. The current draft policy attempts to limit the volume of routine paperwork for the data custodians by granting standard access without forms and signatures. We hold little hope of retaining this provision in view of past audit concerns.

Accepting the data custodians as access administrators, there is a need for an appeal process when access is denied or when other issues cannot be resolved.

Data Administration was considered as a possibility in reviewing appeals for denied data access requests. This has been done successfully in other institutions, however, data administration was not interested in such a responsibility, since its function had been established as a coordinative one, with an expectation of achieving its goals through persuasion and value of argument rather than stated authority.

Establishing AISAC or the subcommittee as the focus of appeals was considered. The advisory nature of the committees and the frequency of committee meetings eliminated this track.

It was finally decided to recommend the established lines of authority in appealing denied requests. Appeals would be made to the management of the data custodian denying the request. This decision was made based on the assumption that the appeal process should seldom be required. Data Administration was set up as ombudsman for the appealing parties in the hope that a third party could clarify existing positions and thereby limit the number of appeals.

Organization of the Policy

Since the policy is expected to be distributed widely within the university, it is our desire to have it brief and clear. It has been organized into five concise sections. Under "Rights", the rights of users and custodians are defined. Standard access and delegation of authority are also covered. "Responsibilities" deals with confidentiality, official uses of data, providing data to external parties and the responsibilities of users and custodians towards accurate presentation. Request, Denial and Appeal state the procedures associated with gaining access.

Current Status

This policy will be presented to AISAC for their review, comment and to recommend approval of the policy to the University's Computing Policy Advisory Committee.

Conclusion

A good deal of the draft policy is simply formalizing as university wide policy, practices that have developed under decentralization. We have reviewed those practices and determined that with some basic guidelines, determination of confidentiality and granting of access should remain decentralized. We have carefully avoided recommending the creation of a new central authority.

The introduction of "universal access" has required some statements of policy regarding the rights and responsibilities of both users and custodians. Once these statements are made, it becomes a matter of ongoing education to remind everyone of their proper roles.

ADMINISTRATIVE DATA ACCESS POLICIES

DRAFT POLICY

Rights

Faculty and staff requiring administrative data for official university business will be provided access. The term "access" means to read or view administrative data. Access does not include the ability to create or modify data. Creation and modification of data can only be done by the data custodian. A data custodian is the organizational unit assigned responsibility for logical and physical integrity of administrative data.

Data in which individuals are identifiable is designated confidential. This policy guarantees a "standard access" for an organizational unit to its confidential data. An organizational unit is a formally recognized entity of the institution. Standard access does not require a formal request for access.

Individuals provided access may delegate access to subordinates, provided they first notify the data custodian in writing. The data custodian may then require separate requests in the name of the subordinate.

Responsibilities

Individuals provided access to confidential data are required to maintain the confidentiality of the data. Individuals who delegate access to subordinates retain their responsibility for maintaining confidentiality.

Administrative data shall be used solely for official University business.

Only designated offices may provide administrative data to entities external to the university.

Individuals who access data are responsible for the accurate presentation of that data. Data custodians are responsible for making known the rules and conditions which could impact the accurate presentation of data.

Request

Access to "confidential" data which is not provided through the standard access provision requires a written request be made to the appropriate data custodian. Data not designated as confidential does not require a request for access.

Denial

The data custodian must provide, in writing, the reasons for any denial.

Appeal

Denied requests for access may be appealed to the senior level official responsible for the data custodian. All appeals should be made through Data Administration, which will serve as ombudsman.

SURVIVAL SKILL FOR THE COMPUTER CENTER IN THE UNIVERSITY OF THE FUTURE

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ABSTRACT

Computing services organizations in higher education are challenged by complex problems on and off campus. In addition to the usual tight budgets, heavy work loads, personnel problems and rapidly evolving technology, they are experiencing competition for computer resource dollars and authority.

A new insidious problem has developed. That is, establishing an appropriate role for the computing services organization on a campus fragmented by shared resource ownership and distributed decision-making.

Managers of computing resources organizations have not found a simple and sufficient responses to these new challenge

SURVIVAL SKILLS FOR THE COMPUTER CENTER IN THE UNIVERSITY OF THE FUTURE

INTRODUCTION

Two books currently near the top of the list of best selling books are Swim With The Sharks Without Being Eaten Alive By Harvey Mackay and All You Can Do Is All You Can Do by A.L. Williams. The titles are fascinating and, if you think about it for a moment, the books must have been written for managers of computing organizations in higher education!

Sometimes a friend, vendor or business associate will use the term "real world" when referring to enterprises in the private sector. Initially, I was a little put off by those comments but now I realize they may be correct. Higher education computing services management problems are sometimes --- "unreal"!

CHANGING EXPENDITURE PATTERNS

Let's take a look back a few years to get some perspective on changes that have occurred during the past years to create today's "unreal" problems. "In the beginning" the computer hardware choices were quite limited. Initially, computers were all centrally located and under the control of the computing services organization. Minicomputers comprised about six percent of expenditures at the beginning of the 1970's and 19 percent by the end of the decade (Laster, 1988) . However, microcomputers began to appear in the mid-1970's and were 19 percent of computer expenditures by 1980. By 1987, minicomputers had increased to 20 percent of expenditures and microcomputers expenditures equaled mainframes at 40 percent of the market.

The distribution of expenditures for personnel, software and hardware changed over the years. Personnel expenditures remained at about the same ratio to hardware and software ---roughly equal to their sum (Laster, 1988). Software expenditures shifted dramatically though from about 50 percent of hardware costs to about 50 percent more than hardware costs. Of course, the amount of money associated with expenditures increased dramatically. Improvements in technology decreased the cost of hardware and increased its capacity. The infant software industry grew up along with the rest of the computing industry.

What can we expect in the future? Let's take a look at one of the factors that drives the evolution of computing resources, research and development spending. Expenditures on R & D have increased as rapidly a expenditures in the rest of the industry. Therefore, we can expect change for computer hardware and software to continue rapid escalation in the future!

COMPUTING SERVICES ORGANIZATIONS REACTION TO CHANGE

Okay, you'r right! Everyone knows the computing industry is dynamic. So, let's consider a related question, "Have computing organizations changed their business practices at a rate commensurate with changes in technology"? Regrettably, I have to confess that the answer is "no". The user community moved ahead of us on microcomputers with state-of-the-art software products for graphics, word processing, spread sheets, desk-top publishing, databases, etc. Increasing the capacity of micros, refining software products and networking distributed resources in the user community challenge the mainframe and its keepers. Industry trends have clearly undermined the status of computing organizations.

Computing organizations exacerbated the market situation by their reactions to the changing environment. Some characteristics of computing organizations that further alienated the user communities were:

1. Isolation from strategic planning
2. Focus on short-term objectives
3. Intolerance of new ideas
4. Charge-back policies
5. Excessive rationalization
6. Excessive bureaucracy
7. Inappropriate incentives for innovation

I could write a book on each of these "seven deadly sins". Rather than elaborate though, I'll let you conduct your own "trial" and move on. Computing services organizations experienced adverse effects as a result of resisting change. Included are loss of identity, shared authority/control, deterioration of organizational image and political complications. Every computing organization was affected by the changes in the computing environment. The outcomes for each varied according to the institution's and computing organization's responses to the change variables.

CHANGING STATUS OF COMPUTING SERVICE ORGANIZATIONS

Several months ago, our computing services organization had an opening for an associate director for the user services area. When the search committee had narrowed the list of applicants down to five, I interviewed each candidate by phone and called their references. These conversations made me aware of the alienation of many computing service organizations across the nation from the schools/colleges and administrative offices on their campuses. While computer service organizations had the technological resources, appropriate facilities and a well-prepared staff, they needed one more thing ---the opportunity to use them!

Can computing services organizations recover their status in the higher education? To answer that question, let's examine the affect of resistance to change by two vendors of computer products. In the mid-1970, I was a consultant to a Title III project that formed a network of secondary schools in South Dakota. We had an IBM mainframe and I wanted to use their hardware and software. However, the IBM 370/145 mainframe could not match the capabilities of DEC minicomputers. IBM had not recognized the minicomputer market at that time. Reluctantly, We chose a DEC minicomputer and began a statewide project.

The project was successful (at least, to some extent) and continued into the late 1970's when we discovered microcomputers. Again, we encouraged a vendor (DEC) to be responsive to market requirements without success. We replaced the minicomputer with micros from Apple, Commodore, etc. So, what happened to the unresponsive vendors? As you know, IBM belatedly addressed the mini marketplace and came on strong in the micro marketplace. DEC is still trying to scramble into the micro marketplace! Even with the great financial and marketing resources of those giants, it's more difficult to make a market comeback than to be responsive to initial marketing opportunities. Computing services organizations, with more limited resources, are faced with a similar comeback challenge on many campuses!

Technology and facilities are easily managed compared to the computing service organizations most valuable resource, quality staff. Staff resources, however, will be the most critical factor in determining future successes and failures for computing organizations. The computing services organization's staff must be:

1. Responsive to clients needs
2. Promote organizational cooperation
3. Provide positive leader hip.

However, if the computing services organization has lost credibility on campus and/or has been distributed across computer user departments, it is almost impossible to accomplish these "to do's" --- particularly, promote organizational cooperation and provide positive leadership!

A couple of years ago, I moved to a university where the computing services organization had lost credibility. The staff, physical facilities and computer resources were adequate but the computing organization was in conflict with many colleges/schools and administrative units of the campus. Survival of the computing services organization into the future was less of a concern than survival at the present! We had a "hill to climb"!

We went to work on user advocacy and responsiveness to clients' needs to slow the "bleeding". However, more direct action was needed to restore the bridges to the university community that had been destroyed. We needed to foster organizational cooperation and to restore Computing Services' leadership status. A marketing plan and promotional effort was needed.

<u>MARKETING CONCEPTS AND STRATEGIES</u>

Most of us in computing service organizations have little training or experience in marketing so they require some research and creativity. From experience, we are aware of advertisements, free trial offers, news releases, newsletters, catalogs, user conferences, annual reports and others. With the help of a few reference books on marketing, our experiential base and faced with a challenge to survival, learning concepts of marketing concepts are easier to learn!

Let me summarize what we learned. Marketing is a management process of analysis, planning, product/service development and controlled delivery. Marketing is necessary in a "change" environment, depends upon communication of information (promotion), is necessary to assure an organization's future and depends upon the client's needs/wants. There's really isn't much "news" in this summary but a periodic review of marketing concepts could benefit almost any organization!

Our computing services organization's initial marketing efforts met with some success. We were still looking for a way to reach the executive level of the university when one day our idea arrived in my junk mail. That's right ---in my junk mail! As I sorted through the mail in my position next to the wastebasket, I came upon several "free seminar" offers from vendors. The seminars were scheduled in a different city every day and interested persons were invited to attend the seminar of their choice.

Suddenly I realized what a great promotion the "free seminar" was. For a relatively modest cost, vendors got potential customers to give them undivided attention for several hours of sales pitch. Also, the customers paid most of the cost of the promotion by coming to the "free seminar" instead of the vendor sending the marketing staff to potential customers. Out of curiosity let me ask, how many of you have helped some vendor stay within the marketing budget by attending a "free seminar"?

A PROMOTIONAL MODEL

By now you have probably guessed that the next promotion was going to be a "free seminar:"! If I could be lured into a "free seminar" by vendors, then I should be able to get university executives to attend a computing services "free seminar". I tested the idea on one of the vice chancellors and secured his commitment to "sponsor" our Executive Symposium on University Computing (ESUC). Computing Services had a chance to display our wares to the Chancellor and Vice Chancellors. We didn't want to blow it! Our plan for the promotion included these steps:

1. Identify target audience
2. Set promotional objectives
3. Design message
4. Select vehicle
5. Establish budget
6. Select promotional tools
7. Measure promotion results
8. Manage and coordinate

Let's examine the model for the ESUC in a little more detail. Executive level management of the university was the target audience. That's risky and you'd better not do it unless you are prepared to deliver what you are promoting! On the other hand, if support of executive level can be secured, cooperation and support of lower level managers can be more easily attained.

ESUC was a risk that we were willing to take to achieve our objectives!

The next step was to design the message. I formed a team of senior staff members to do that. We selected our best presenters, prepared our message carefully and practiced delivering it in front of the group. The agenda included the following:

1. Welcome and Introduction
2. Institutional Orientation
3. System Integration
   a. Networking/Communications
   b. System Software
   c. Computer Hardware
4. Administrative Applications
5. Support Services
6. Planning for the Future
7. Leadership and Directions

As you can see in the agenda, the ESUC was a marketing effort!

The selected vehicle was, of course, a "free seminar". We were careful to select the time and schedule carefully. I was amazed at how easy it was to get senior executives to attend. Everyone likes something free!

Yes, a budget was needed for the promotion. Pesenters didn't require special funding, but materials and amenities were needed. We wanted to conduct our "free seminar" just like the vendors had taught us!

The promotional tools were designed by the Computing Services senior staff. An associate directors was selected as the coordinator and host. She worked with each presenter to develop materials and then assembled the materials. Invitations, brochures and personal contacts were used to promo our promo! An off-campus site was secured and amenities like coffee and snacks purchased. A packet of all materials was prepared and ready for participants when they arrived.

Measuring the results was one of the most important parts of the ESUC "free seminar". We had the usual evaluation of the presentation. Also, we included an evaluation of campus needs. The "needs assessment" was scored after the seminar and results were sent to each participant to document support for enhancing computing resources. However, the most significant evaluation was a surprise to us. The Vice Chancellor of Academic Affairs asked us to present the ESUC to the Council of Deans. Later, we also presented the ESUC to the Computing Services staff and to the Computing Activities Council.

SUMMARY AND RESULTS

We gave ESUC our best shot and the presentations were well received. In the year since the presentations, significant progress has been accomplished on projects that were identified in the ESUC.

1. A campus-wide computer backbone project is in progress.
2. Writing of a plan for academic and administrative computing is nearing completion.
3. The IBM mainframe computers hardware and software was upgraded.
4. Specialized computer systems have been acquired or are in the acquisition process.
5. New computer labs have been created for student use.
6. Workstations have been acquired for some faculty members and administrators and plans are in place to address remaining needs.
7. Plans to improve the administrative information system are in progress (with budgetary support).

Of course, the ESUC's were only part of an overall marketing effort and a means of informing administrators about future directions for computing on the campus. With all of the projects that are underway now, we may have to let up on the marketing efforts a little so we don't exceed our capacity to deliver. Remember, All You Can Do Is All You Can Do.

I wouldn't want to leave you with misconceptions about how easy all of this has been. Every day is full of new problems and challenges. Don't forget the other book that I referenced at the onset of this paper, How To Swim With The Sharks Without Being Eaten Alive. It has 69 lessons and 19 Quickie observations. I'm in the process of interpreting them from a computing organization's perspective. By the time we meet again, I will have included them in "Survival Skills for Computer Centers In the University of the Future".

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