A Planning Process Addresses an Organizational and Support Crisis in Information Technology

by Keith R. Nelson and Richard W. Davenport

Many papers and conference presentations have reported on restructuring information technology organizations in higher education. Factors that differentiate institutions and influence their information technology capabilities and organizations include size, status, funding level, and mission. Central Michigan University (CMU) is a public comprehensive institution with approximately 17,000 students, located in the center of Michigan. It is one of fifteen public universities in Michigan, and one of 105 higher education institutions in the state. CMU has a large, nationally recognized teacher education program and one of the largest colleges of extended learning in the country, serving more than 12,000 additional off-campus students. The University has most recently become known nationally for its guaranteed four-year degree program and its leadership in the charter school movement.

Recent changes to CMU’s information technology governance structure were prompted by increased user demands for technology throughout the University over the last few years. The institution was not prepared for such a groundswell of interest and demand, nor was it prepared for the shockingly high costs involved in meeting the demands. In solving the crisis, CMU involved a combination of external consultants, an internal technology task force, and electronic town meetings to recommend and discuss new organizational approaches for achieving and supporting a technology plan. A strategy emerged for an...
expanded campus network, computing system upgrades, new uses of distance learning technologies, increased coordination of user services, and a long-range financial plan. A new matrix organizational governance structure for information technology emerged that recognizes the value of both distributed support and strong central coordination.

Historical antecedents to organizational change

A number of factors contributed to CMU's need to restructure for technology planning, coordination, and support.

Rapid and uncoordinated growth of microcomputing

Demand for computers had reached epic proportions during the last few years. Every unit at the University was frantically involved in providing hardware and software, with little assistance and coordination. It was estimated that purchases from the various units totaled more than $3 million per year, with little attention paid to coordinating efforts. The campus mainframe was overtaxed, resulting in long and frustrating response times. Students, faculty, and staff were dissatisfied with the mainframe and for the most part resorted to innovative ways of accomplishing their needs without the assistance of a central computer. Most people had a good understanding of the power of PCs, even if they were not proficient with their operating systems, applications, or operational features and practices. Many correctly perceived a sharp contrast between the usability of a PC and a mainframe, but were not very computer literate with either one. A serious situation was building and about to explode unless something was done quickly to resolve the unmanaged growth in distributed computing.

Development of the campus network

Significant progress had been made in recent years to create a campus backbone network that consisted of 1,500 nodes and connected thirteen buildings (although only a few of those were completely internally wired). While the network was well planned, piecemeal funding from faculty grants, departmental or college computer upgrade projects, and state-funded building projects was sporadic. As use of the network developed, further expansion, management, maintenance, and longer-range planning became a pressing need. In short, the incomplete campus backbone severely limited the University's ability to address its constituents' needs.

Decentralization of technology funding and support

As end-user computing became more important, decentralized technologies and support became an increasing proportion of total information technology expenditures at CMU, with approximately 35–40 percent of its technology dollars being spent on personal computing and associated support. The issues for decentralized computing became a combination of basic needs (such as training, maintenance, support, and upgrades) and production opportunities (such as instructional application development and distance learning) that required an advanced information technology infrastructure.

Technology outside the walls of the University

The developing uses of wide area networks and telecommunications technologies had already had some impact on the University's historical involvement in distance education. Until recently, the program was effectively distributed via traditional teaching methods to off-campus students at regional centers located primarily in Michigan, but also at other national and international locations. CMU was using interactive television and the Internet to improve educational content and further reduce the constraints of geography on distance learners. Unfortunately, campus expertise was lacking in the art of teaching and production for distance learning. CMU did not have a program for developing distance learning faculties and technologies.

Technology change, cultural change

For CMU, like most institutions, rapid technology-driven change and the realities of finite resources challenged many elements of our institutional infrastructures. Organizations need to change to adapt to this growth, but the trouble is that organizations often change more slowly than technology. An appropriate funding model is a very critical part of the challenge. When funds are plentiful, it is much easier to achieve cross-organizational collaboration, and priorities are relatively easy to negotiate on an informal level. Very few institutions, especially public institutions, are beyond the point where funding and costs are not under tremendous scrutiny. Information technology is characterized by high visibility, high cost, and merging functions of voice, video, and data. There is also a history of decentralized user constituencies that want control over resource decisions, including technology, that affect them greatly. There is usually no impetus to change a technology organization if most users are satisfied with the status quo; that is,

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“...building and about to explode unless something was done quickly to resolve the unmanaged growth in distributed computing.”

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2 David J. Ernst, Richard N. Katz, and John R. Sack, Organizational and Technological Strategies for Higher Education in the Information Age, CAUSE Professional Paper Series #13 (Boulder, Colo.: CAUSE, 1994).
Planning Process ...

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typically, conditions need to reach a crisis proportion to facilitate rapid change. Such was the case at CMU.

Approaches to organizational planning

Several options for organizational planning were open to CMU. The University considered addressing the most immediate needs by stepping up the networking process and supplementing support for the mainframe. Investment in client/server technology was another option that would help alleviate but probably not solve all of the University’s needs. Additional monies could be channeled into several areas simultaneously until funding was exhausted, but this seemed like a meaningless approach to planning. Alternatively, CMU could start by examining its mission statement and vision to determine how information technology fit into institutional goals. The institution needed to step back and assess its current situation. Several steps were followed to begin the intensive planning process.

Influence of technology on the University mission statement

One of the first steps taken was the revision in 1994 of our academic mission statement to include goals related to the use of technology. This increased technology emphasis reflected a broad-based understanding of how technology can improve academic outcomes. There is widespread belief that technology is escalating the limits of information access and capacity, and creating new opportunities for communication and collaboration. The revised mission statement speaks directly about the role of technology and underscores the faculty commitment to reengineering instructional processes.

Assessment and recommendations of outside consultants

A shadowy future of converging multimedia telecommunications and computing requires difficult decisions about technology, people, budgets, and organizations. In 1994, the University sought the advice of a technology consulting firm to assess the current environment and make recommendations about technology change and organizational strategies for how to accomplish these changes. The consultant recommended an aggressive transition into a client/server application environment and suggested either reorganizing and refocusing internal technology support, or outsourcing. Either of these recommendations would impact significantly on the personnel and systems that were already in place. Which technologies were necessary? How would technology affect both technical and non-technical jobs? What was the appropriate balance between cost and benefit? What types of organizational changes were needed to maximize return on investment and provide a competitive advantage?

Assessment and recommendations of an internal task force

In January 1995, CMU’s president appointed a task force on technology that comprised representatives from many campus constituencies. The task force worked on an extremely ambitious timetable, committing a large part of their weekends for several months to discuss and plan technology from an internal perspective. An electronic mail list was used to solicit ideas and opinions from the entire campus. The final report of the task force delineated a set of goals and key activities for technology (see Table 1).

The task force recommended an organization and governance structure (shown in Figure 1) that combined features of the distributed and centralized models with local service providers in colleges and administrative offices. The proposed matrix model included a formal Technology Planning Board chaired by a technology administrator reporting directly to the provost. The planning board would include deans (or designees) and vice presidents (or designees) from all the major divisions of the University. The technology administrator would be responsible for the various technology support services, and would promote technology on campus. The planning board would be responsible for strategic planning for technology at the University, including proposals for funding and the schedule for completion of key activities. A second layer of the proposed matrix was the role of technology coordinator. As envisioned by the task force, technology coordinators from each division would have more of a technical management relationship with the directors of the centralized service “centers”—for computing, telecommunications, and instructional support. This matrix of directors and coordinators would form collaborative operational-level teams of local and centralized service providers.

The resulting organizational structure

In the fall of 1995, the president presented his Technology Initiative Plan, which endorsed the general recommendations of the technology task force. According to the plan, the objective of

3 Nancy Cooley, “Planning for the Integration of Information Technology at Central Michigan University,” unpublished EDUCOM ’95 I-Tech preconference presentation.
technology was to “support and improve teaching, learning, research, and service and to enhance the productivity of students, faculty, and staff.” The resulting organizational changes followed the recommendations of the technology task force, with some changes. The president created a new position of assistant vice provost for information technology, reporting directly to the provost and serving as the technology coordinator for computer services, telecommunications, and instructional support services. Most of the academic deans appointed their associate deans to serve on the Technology Planning Board. The planning board also included the directors of computer services and telecommunications. The resulting structure was less hierarchical than the model in Figure 1 because the deans’ technology coordinators usually became the planning board representatives. Initially the Technology Planning Board, chaired by the assistant vice provost, received the following charges:

- Develop a plan to complete the campus computer network
- Develop a comprehensive plan for a technology training center to be integrated with the library instructional resource center and the new technological library expansion plan
- Develop a job description for a new coordinator of distance learning
- Consider a comprehensive plan to provide every CMU student with a personal computer to assist the student with his or her University studies
- Develop a plan that would ensure that all faculty members would have appropriate computer access

These charges addressed some of the most pressing technology-related issues that have been reported by many higher education institutions. However, it is difficult to look very far ahead when there are often more basic and immediate technology needs to resolve. While there is great potential for client/server computing to support instructional and business process reengineering, client/server solutions require a ubiquitous campus network, hardware and software upgrades, and considerable training. There are many conflicting sources of information about the cost and timetable to move from a mainframe-centered environment to a network-centered, distributed computing environment. Many analysts agree that migrating to distributed computing environments will (1) shift cost structures from being capital-intensive to labor-intensive; (2) at least for the short-term, result in high capital costs due to acquisition of more networking, new clients, and new servers; and (3) occur over a period of years rather than months.

Table 1

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<th>President’s Technology Task Force</th>
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<td><strong>Key Goals</strong></td>
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<td>- Encourage students, faculty, and staff to learn and use basic technologies needed in contemporary society, as well as specialized technologies appropriate to their disciplines and roles</td>
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<td>- Provide and encourage the use of technology to improve teaching and learning, research, and service</td>
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<td>- Use technology to facilitate and improve communication and instructional delivery between and among on- and off-campus constituencies</td>
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<td>- Establish a process for ongoing planning and evaluation of technology initiatives</td>
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<td>- Establish funding mechanisms to acquire, support, maintain, and upgrade basic and specialized technology resources</td>
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<td>- Promote the development of user-friendly applications of technology</td>
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<th><strong>Key Activities</strong></th>
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<td>- Establish a technology planning and organization structure</td>
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<td>- Upgrade student computer labs</td>
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<td>- Acquire faculty and staff computers</td>
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<td>- Establish a technology training center</td>
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<td>- Integrate instructional development and multimedia functions into the training center</td>
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<td>- Implement a student technology fee</td>
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<td>- Complete the campus network</td>
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<td>- Improve remote computing capability (Internet access, modem pool, off-campus lines)</td>
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<td>- Upgrade the mainframe</td>
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<td>- Upgrade residence hall technology</td>
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<td>- Expand and upgrade library facility</td>
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<td>- Provide additional technology-based classrooms</td>
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<td>- Provide an adequate number of sites with access to on-campus cable television and satellite downlinks. Increase the number of sites on demand</td>
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<td>- Obtain servers and migrate applications from the mainframe</td>
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<td>- Upgrade the telecommunications switch as needed</td>
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<td>- Modify the university budget to allow for repair and replacement of equipment and software</td>
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<td>- Institute incentives for using technology</td>
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<td>- Ensure the implementation of technology in all building and remodelling plans</td>
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<td>- Upgrade library technologies</td>
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<td>- Pursue cooperative links with other education agencies and institutions</td>
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<td>- Evaluate the technology plan and the success of key activities</td>
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<td>- Support the development of distance learning</td>
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Balancing long-range planning with strategic action

“As it is, we are right on the edge of what works.”
(Bill Gates, 1995)

“If you come to a fork in the road, take it.”
(Attributed to Yogi Berra)

The first quote, from Bill Gates, aptly describes the challenge of technology-driven change. The second quote characterizes the urgency of decisions that face CMU and other institutions. It was important to move forward rapidly with technology planning while taking immediate action, and some risks, on very fundamental issues and problems that simply could not be postponed.

One of the first challenges addressed was determining the intermediate to long-term value of a mainframe computer as a server in a client/server network. The central mainframe had become heavily overloaded, and usage of its existing applications was still increasing at a rapid rate. There are many opinions, both pro and con, about mainframe versus client/server technology. On the pro side, mainframes have provided security and stability, rapidly improving price/performance ratios, and operating systems that are evolving into client/server-compliant systems. These attributes offer assurances that an upgraded “legacy” system can serve a substantial future role in a distributed computing network environment. The mainframe can be smoothly migrated from its traditional role as an exclusive server to its new role as a network server and data warehouse repository. On the con side, there are concerns that mainframe hardware has a higher price/performance ratio than smaller servers, is less scalable and less flexible, and doesn’t fit the client/server architecture.

An initial strategic action was to replace the old mainframe with an upgraded model. A key assumption was that the mainframe would continue to provide valuable service for at least five years, long enough to justify its initial cost. The new model is over 90 percent smaller, uses about 93 percent less power, has lower software and maintenance costs, and is about three times more powerful than the old mainframe. The new system also provides a rapid, seamless solution to a problem that was affecting the productivity of most administrators, faculty, and students. The physical replacement of the old system was accomplished within four hours. The only initial difference noticed by thousands of users was vastly improved performance.

Figure 1: Matrix organization recommended by the Technology Task Force

projects while the planning board was producing a strategic plan to address the more comprehensive, future-oriented charges. These projects included (1) critical systems, such as a telephone registration system that was close to becoming unserviceable, (2) network access issues and demands that were beginning to affect academic programs and individual productivity, and (3) even more basic infrastructure problems—such as a lack of sufficient electrical power—in many campus buildings. Before creation of the Technology Planning Board, the administration was responding to these needs on an ad hoc basis, without a comprehensive strategic technology plan. There was an understandable reluctance to spend limited funds without knowing all of the technology needs.

The solution was to prepare a presentation to the Board of Trustees, describing the process that led up to the University plan for technology, and the major components of the plan. The proposal suggested that the institution proceed cautiously with projects that were crucial, but to make certain they were consistent with the long-range goals. For example, several buildings had been connected to the campus backbone network, but many departments or individuals within the buildings had never been connected. Therefore, one project was to complete hookups within partially networked buildings, adding over 400 more users to the network. The Trustees supported the recommendations and encouraged continued planning for information technology.

A third challenge, which was already being addressed, focused on providing an appropriate level and quality of technology for students. The Technology Planning Board assessed student technology needs and devised a life-cycle student technology model that addressed shared student computers, student access to networks, classroom technology, maintenance, upgrades, and support. A similar assessment and model are currently being completed for faculty and administrative computing needs. The goal is that every faculty, staff member, and student will be included in the plan. The life-cycle student technology model yielded a proposed student technology fee that would provide a sustained and specified quality of technology and support for all students.

The remaining steps in the solution are to obtain funding and align the student technology model, which is to some extent theoretical, with a more costly list of real student technology requests from the various campus constituencies represented on the planning board. For example, the model provides for a ratio of 15:1 shared student computers that are fully maintained, up

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One obvious way to reduce technology costs is to standardize hardware and software as much as possible.

Further issues to be addressed and challenges to be met

Nearly two years after CMU began the technology initiative, there remain a number of issues and challenges still to be met, from funding to training to determining the best way to provide ongoing technology support in a distributed environment.

Technology funding

Achieving adequate funding is partly a function of management and coordination of resources. Other funding issues include the high, but perhaps temporary, levels of expertise and funding needed to migrate into client/server computing and other new technologies. There is little doubt that the cost of technology initiatives is high. One way to finance new technology is to discover ways that technology can reduce costs elsewhere. There are many examples of cost reductions: lower support costs with centrally managed network-accessible data; reduced use of paper; and, as distance learning technologies grow, travel costs can be lowered and physical space can be reduced. Technology can also result in lower personnel costs through reengineering and streamlining people-intensive processes. This last point is especially important, since the most significant cost of higher education involves personnel.

For most institutions, the complexity of technology growth has required very serious consideration of an appropriate balance between inhouse information technology staff and external subcontractors. In our systematic approach, we have learned that external contractors can serve as consultants or project partners, or an entire information technology operation can be outsourced. Such contracts, however, are often finite-term relationships. The transitory nature of most contractual relationships and the importance of mission-critical information systems is a serious concern that should cause most institutions to be wary about dependence on outside contractors, who do not necessarily have a long-term interest in the success of an individual institution. Nevertheless, use of subcontractors is still one option to consider, but should be acted upon only after carefully considering all the short and long-term implications.

Technology standards and trends

One obvious way to reduce technology costs is to standardize hardware and software as much as possible. In most higher education environments, it is virtually impossible to standardize on one platform or configuration. However, arbitrary heterogeneity may result in higher support costs and thus be a false economy. No matter how efficient technology investments are, they will not produce satisfactory returns without anticipating medium- and long-term pedagogical, economic, cultural, organizational, market, and technology trends.

One example of where many of these issues surface is in the area of distance education. There are many potential delivery systems available for distance learning, including interactive television, satellite links, and the Internet. Each of these systems can deliver instructional materials. However, it is important to analyze how comparable outcomes could be achieved with conventional or more cost-effective solutions. The ultimate evaluation of any technology or trend is that whoever can provide the best product for the best price will be the most successful. Every technology purchase is a strategic decision that must balance price versus performance and obsolescence, and current versus projected markets and priorities.

Completing and upgrading the campus network

The current, partially completed FDDI campus network at CMU provides some users shared Ethernet to the desktop. There is great impetus to make the network accessible for all faculty, staff, and students. A network planning team created by the Technology Planning Board recently participated in a network design workshop to create a network plan. The plan will accommodate current and future multimedia application needs, preserve the investment in the existing network, and meet application needs in several years that include advanced technologies for a new music building and a technological library addition. The network team comprised campus network experts and key user constituencies. The design workshop also was done in consultation with an external network consultant.

Instructional development, training, and incentives

Technology upgrades will accomplish very little if not used effectively to improve instructional and business practices. A 1993 federal government report identified user training and organizational learning as the two most critical technology issues confronting higher educa
technology.9 Besides training, there may need to be related incentives and recognition for innovative and efficient uses of technology. Even with trained users, some technical support is needed—especially for instructional development. However, users must also take a more active role in learning how to use technology. A recent incentive program created by the president involved an internal grant process to encourage and support instructional technology development that would (1) develop faculty knowledge and skills in the utilization of technology, (2) improve the quality of education provided, (3) improve the efficiency of educational offerings, and (4) improve the availability of educational offerings from CMU.

Faculty and administrative technology
Faculty and administrative access to technology represents another major part of the technology plan. The Technology Planning Board has also created faculty, administrative, and library planning teams to address these issues. Besides the needs for networking, training, and support, these teams are planning for personal computers and academic/administrative systems. These plans will be aligned with overall strategic goals and other parts of the technology initiative planning.

Distance learning objectives and strategies
Historically, the College of Extended Learning has been mostly independent of the on-campus degree programs. The strategic role of distance learning involves reengineering instructional delivery and selecting the most fruitful technologies for investment. It is important and necessary to assess the relative cost-effectiveness of both traditional and new modes of instruction. The University is now in the process of hiring its first University-wide director of distance learning to provide leadership to all segments of the institution and to cultivate strategic corporate and academic distance-learning partners.

Continuing reorganization of information technology support
The matrix model for information technology organization at CMU has been moving to accomplish more fruitful coordination than was possible with the former environment of a diminished central computing organization and unmanaged distributed computing. A good starting point was to view support from the users’ points of view.

One solution we are considering is similar to an approach used at Brigham Young University, which involved assigning each faculty and staff member to a local computer support representative.10 This local service provider would be a generalist who would be the primary contact person for all technology needs. Complementing the local service provider would be a central service provider who would receive requests for service, try to answer them immediately, then refer them to the local service provider as needed. The local service provider would provide general consulting and technical support services and arrange for additional support and services.

The most important aspects of this user support function are (1) effective communications between the central and local service providers, (2) efficient support from the central service providers to reduce unnecessary load on the local service providers, and (3) access to technical information, documentation, problem histories, frequently asked questions, and deeper levels of support for the local service providers at their remote points of service.

Conclusions
The various planning processes employed at Central Michigan University yielded similar conclusions about the strategic importance of technology growth, broad goals, and an organizational structure for achieving those goals. Details of this organizational change will need further and probably continuing refinements. Some activities, such as expanding the campus network, are already under way and are prerequisite to proceeding with both instructional and business process reengineering. The newly created Technology Planning Board will have an opportunity to establish technology priorities, increase efficiency, and achieve the best return on investments. The matrix organization will also have a very exciting opportunity to provide improved user services by coordinating the efforts of local and central service providers.

Experiences in the first six months of the new organization have been encouraging. Progress and planning are occurring simultaneously. The matrix organization is beginning to function as a technology roundtable11 that is consensus building in nature and greater than the sum of its parts. CMU has committed to its technology initiative and realizes that this commitment will also require continuing and increasing investment.