Restructuring the Information Technology Organization
To Improve User Services and Return on Investment:
Do Compromises Work?

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Abstract

In the last several years, Central Michigan University reached a level of technological
growth, excitement, and frustration that significant changes in both the information
technology infrastructure and organization were necessary. The university employed a
combination of external consultants, an internal technology task force, and electronic “town
meetings” to discuss and recommend a new organizational approach to implement and
support a technology initiative. The resulting initiative will include an expanded campus
network, computing system upgrades, new uses of distance learning technologies, and
increased coordination of user support services. A new matrix organizational structure for
information technology governance was developed that acknowledged the value of both
distributed support and a strong central organization.
Many papers and conference presentations have studied the changing information technology organization. A wealth of information on this topic is available at the CAUSE web site (http://cause-www.colorado.edu/). Factors that differentiate institutions and can 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 16,000 students, located in a rural area in the center of Michigan. It is one of fifteen public universities in Michigan, one of a hundred and five higher education institutions in the state. CMU has a large teacher education program and one of the largest colleges of extended learning in the country. The university also runs a tight economic ship. Among our competitor universities in Michigan, CMU is second to last in student tuition and ranks in the bottom third for state funding on a per student basis.

**Historical Antecedents to Organizational Change**

**Mainframes and microcomputers.** CMU, like most large institutions, has a mainframe and many personal computers. It would be difficult to discuss the impetus for organizational changes in information technology without mentioning this obvious fact. Most people have a good sense of the power of PCs, even if they are not proficient with their operating systems, applications, or operational features and practices. Many correctly perceive a sharp contrast between the usability of the PC and the capability of a mainframe that they understand even less about than their PC. Almost as many have definite ideas and opinions about PCs and mainframes, what they can and cannot do with them. It has become the zeitgeist to call all mainframes legacy systems to contrast them with PCs and client/server computing. The term legacy evolved as PCs became more powerful and were connected to each other in local area networks. CMU has an excess of legacy technology beyond its mainframe that includes some of its personal computers, software, telecommunications equipment, and networking.

This term client/server simply means that data processing is a shared workload of interconnected computers. For large enterprises, client/server computing has become a strategic concern for business productivity and adaptability to change. The most important aspect of this function is empowerment of the user’s desktop computing environment and corresponding opportunities for instructional and business processing reengineering. The limit and costs of client/server evolution are indeterminate since personal computers, servers, and networks are still evolving. Technical details, such as standards, interoperability, and security go beyond client/server functional goals but have potentially significant impact and risk. This topic is central to a discussion of improving user services and maximizing return on investment, but now is merely introduced as historical background on the impetus for changing the information technology organization.

**Development of the campus network.** Significant progress was made in the last three years to create a fiber optic 100Mb/sec FDDI campus backbone network that currently connects thirteen buildings although only a few of these buildings are completely internally wired. The campus network, which now includes about 1,000 nodes, uses primarily Category 5 cable from nodal equipment back to wiring closets. Within-building backbones are multimode fiber. While the current FDDI network was well planned, funding has occurred in piecemeal fashion from faculty grants, departmental or college computer upgrade projects, and state-funded building projects. As use of the network developed, further expansion, management, maintenance, and longer-range planning became a priority.

The current network plan is being revised to upgrade the backbone to a more robust Asynchronous Transfer Mode (ATM) protocol that will provide the capability for both video and data and, eventually voice. In this revised plan, all campus buildings not currently on the network will be added to an ATM backbone. Because of cost, the FDDI backbone will not be upgraded initially but the ultimate goal is to upgrade the entire backbone to ATM. The planned network expansion will include enhanced dialup facilities for off-campus access and network authentication, and software servers to support a distributed computing environment. While the data network was being established, the university’s
Telecommunications department was developing the use of interactive television for distance education. Public Broadcasting was also starting to plan new possibilities for educational programming with the anticipated availability of digital television technology. A long-range technology plan will need to evaluate all these potentially important delivery systems.

Decentralized technology. The university currently spends approximately 35-40% of its technology dollars on personal computing and associated support. As end-user computing became more important over the last ten years, decentralized technologies and support became an increasing proportion of total expenditures. Today the issues for decentralized computing are a combination of basic needs such as training, maintenance, support, and upgrades, and production opportunities, such as instructional application development and distance learning, which require an infrastructure of networking and support to be in place.

Technology outside the walls of the university. The development of the Internet and telecommunications technologies have already had some impact on the university’s historical involvement in distance education. Until now, the program has been effectively distributed via traditional teaching methods to off-campus students at regional centers located primarily in Michigan and also at other national and international locations. Given the rapid growth of distance learning technology, upgrading this long-lived and successful program is recognized as a critical part of our vision of a twenty-first century university. CMU has started to use interactive television and the Internet to improve educational content and further reduce the constraints of geography on distance learners.

Campus technology organizations and technology culture. For CMU and most institutions, rapid technology-driven change and the realities of finite resources have challenged many elements of their institutional infrastructures. We now need to change the organization to adapt to this growth. The trouble is that organizations are often much more slow to change 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 has 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 effect them greatly. There would be no impetus to change the campus technology organization if most users were satisfied with the status quo.

Approaches to Organizational Planning

When Leonard Plachta became president of Central Michigan University in 1992, he brought with him a view that universities must learn to operate more as a business. He has repeated this theme often, stressing the ideas of the student as a customer, and his gospel of efficiency and effectiveness. In one of his first presidential addresses Dr. Plachta stated his belief that technology was essential to achieve many goals for the university.

The student is a customer. This statement has been the subject of a continuing debate in higher education. On one side is the view that the faculty-student relationship is unique, i.e., the faculty mentor is a source of knowledge and wisdom—the most likely to be "right." In business however, the customer is often told that they are right. However, both views agree that the student is important—the raison d’etre. The business analogy merely serves to stress that education is a business that must offer a quality product at a competitive price.

Faculty must embrace the use of technology to improve teaching effectiveness and efficiency. In the past decade, public education has been and will continue to be under very heavy public scrutiny. It is increasingly possible for educational service providers to offer their services/products to a global
student/customer market via distance learning technologies. Those universities/companies that can offer the best products at the best prices will be successful and those who cannot make the adjustment will falter. This has always been the case in business and education is no different. To become more efficient and effective, faculty and staff must (a) have access to technology that is current, works well, and is easy to use; (b) receive appropriate training and support; and (c) be willing to change.

Influence of technology on the university mission statement. In 1994 our academic mission statement was revised 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. It is widely believed 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 and expanding their vision of the campus and student market.

- "CMU will become a leader in classroom learning technologies to enhance the delivery of education to students both on-and-off campus."

- "In order better to serve its students and the wider community, CMU will:"

- "Employ the latest electronic technologies for the processing and dissemination of information; provide access and training in the use of such technologies to all students, faculty, and staff; and develop new modes of instruction and educational outreach using such technologies."

- "Develop and employ alternative delivery systems to meet contemporary educational needs for a wide range of students whose family or career obligations limit their access to a campus."

Assessment and recommendations of outside consultants. A shadowy future of converging multimedia telecommunications and computing requires difficult decisions about technology, people, budgets, and organizations. Which technologies are necessary? How will technology affect both technical and nontechnical jobs? What is the appropriate balance between cost and benefit? What types of organizational changes are needed to maximize return on investment and provide a competitive advantage?

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 the change. The consultant recommended an aggressive transition into a client/server application environment and suggested either (a) reorganizing and refocusing internal technology support or (b) outsourcing. Either of these recommendations suggested considerable change and would impact significantly on the personnel and systems that were in place.

Assessment and recommendations of an internal task force. In January 1995, President Plachta 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. The group did not use the consultant report to guide their work but wanted to be free to explore various objectives and approaches to technology organization. An e-mail list was employed to solicit ideas and opinions from the entire campus. The following set of goals and key activities were developed:

Goals

- 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.
• Provide and encourage the use of technology to improve teaching and learning, research, and service.

• Use technology to facilitate and improve communication and instructional delivery between and among on- and off-campus constituencies.

• Establish a process for ongoing planning and evaluation of technology initiatives.

• Establish funding mechanisms to acquire, support, maintain, and upgrade basic and specialized technology resources.

• Promote the development of user-friendly applications of technology.

Key Activities

• Establish a technology planning and organization structure.

• Upgrade student computer labs.

• Acquire faculty and staff computers.

• Establish a technology training center.

• Integrate instructional development and multimedia functions into the training center.

• Implement a student technology fee.

• Complete the campus network.

• Improve remote computing capability (Internet access, modem pool, off-campus lines).

• Upgrade the mainframe.

• Upgrade residence hall technology.

• Expand and upgrade library facility.

• Mediate additional classrooms.

• Provide an adequate number of sites with access to on-campus cable television and satellite downlinks. Increase the number of sites on demand.

• Obtain servers and migrate applications from the mainframe.

• Upgrade the telecommunications switch as needed.

• Modify the university budget to allow for repair and replacement of equipment and software.

• Institute incentives for using technology.

• Ensure the implementation of technology in all building and remodelling plans.

• Upgrade library technologies.
• Pursue cooperative links with other educational institutions and agencies.

• Evaluate the technology plan and the success of key activities.

• Support the development of distance learning.

An important charge of the Technology Task Force was to recommend an organizational structure for technology support. One potential structure was to centralize all technology resources under one director. While the task force acknowledged the efficiency of the central model they were concerned with its potential lack of responsiveness to changing needs of both academic and administrative constituents. A second distributed technology model could reverse the advantages and disadvantages of the central structure and would be more responsive but was not likely to achieve any needed efficiencies. There was also a concern about how a completely decentralized organization would plan and coordinate "big technology" projects. The task force recommended a matrix organization and governance structure that combined features of the distributed and centralized models with local service providers in colleges and administrative offices that would be secondarily associated with centralized university technology service centers.

The proposed matrix model included a formal Technology Planning Board chaired by a technology administrator reporting directly to the Provost. The Technology 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 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 response to the external and internal assessments and recommendations, President Leonard Plachta presented his Technology Initiative Plan in October 1995. The plan endorsed the general recommendations of the Technology Task Force. It stated that the objective of technology was to "support and improve teaching, learning, research and service and to enhance the productivity of students, faculty, and staff." A matrix model for information technology coordination, including a Technology Planning Board and a new Assistant Vice Provost for Information Technology position, were created. The Technology Planning Board included the membership recommended by the Technology Task Force and the Directors of Computer Services and Telecommunications. The Assistant Vice Provost for Information Technology reports directly to the Provost and serves as coordinator of computer services, telecommunications, and other technology units on campus. Also, the technology budget will be under the control of the Assistant Vice Provost. 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 them in their university studies;

• Develop a plan that would insure that all faculty members will have appropriate computer access.

The Technology Planning Board will also consider partially financing technology improvements with a student technology fee. These broad charges overlap the most pressing technology-related issues reported by many higher education institutions. However, it is difficult to look too far ahead when there are problems that demand immediate solutions. For example, there is great potential for client/server computing to support instructional and business process reengineering. However, client/server solutions require a ubiquitous campus network, hardware and software upgrades, and lots of training. There are many conflicting sources of information about the cost and timeline to move from a mainframe-centric environment to a distributed computing environment. Many analysts agree that migrating to distributed computing environments will: (a) shift cost structures from being capital-intensive to becoming labor-intensive; (b) at least for the short-term, result in high capital costs due to acquisition of more networking, also new clients and new servers; and (c) occur over a period of years rather than months.

**Short and Long-Term Futures**

"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)

Bill Gates aptly described the challenge of technology-driven change. The second quotation characterizes the urgency of decisions that face CMU and other institutions. It is important to rapidly move forward with technology planning while taking immediate action on some very fundamental issues and problems that cannot afford to wait. As the campus network is completed, client/server computing will become possible. The empowerment of desktop computing requires managed and coordinated data, communication, and performance optimization. Client/server architecture is an identifiable solution to these needs. However, there are related issues and questions that will need to be solved as we move forward with our information technology initiative.

One issue/problem is to decide the intermediate to long-term value of a mainframe computer as a server in a client/server network. This would not ordinarily be a pressing issue, but our current mainframe is heavily overloaded and usage of existing applications is still increasing at a rapid rate. There are opinions, both pro and con, about the mainframe issue. On the pro side, the proven security and stability of mainframes, rapidly improving price/performance ratios, and operating system evolution into client/server compliant systems seems to offer assurances that an upgraded “legacy” system may serve a substantial future role in a distributed computing enterprise network and can provide a smooth migration path from the mainframe’s traditional role as an exclusive server to a future role as a data warehouse and one of many network servers. On the con side, there are concerns that mainframe hardware still has a higher price/performance ratio than smaller servers, is less scalable, cannot be distributed, and is therefore, less flexible. With continuing research and development plus heavy competition among hardware and software vendors, the advantages and disadvantages of mainframes vs. other types of servers are becoming increasingly blurred. Regardless, client/server migration is a complex process that involves improving price/performance ratios for technology but increasing costs on the people side.

A related issue is to how to provide for the significant expenditures related to information technology. This is mostly a function of management of resources but is partly a function of level and permanency of expertise needed to migrate into client/server computing, as well as continued growth with changing
technologies. There is little doubt that the cost of technology initiative is high. One way to finance new technology is to discover ways that technology can reduce costs elsewhere. Examples of cost reductions include: relatively 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 by automating 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 in-house information technology staff and external subcontractors. We have taken a very systematic approach in basing these decisions on reliable information. We have learned that external contractors can be used as consultants, project partners, or as an outsource for an entire information technology operation. 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 make most institutions wary about overdependence on outside contractors who have little vested interest in the success of an individual institution. It is one option to consider but should be acted upon only after carefully considering all the short and long-term implications.

Issues to be Addressed

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 vs. performance, obsolescence, and current vs. projected markets and priorities.

Cost of technology modeling. It is essential to understand the real cost/benefit of technology. Since many costs and benefits are hidden or indirect, and because technology involves a combination of one-time and variable length recurring costs, this is a very difficult task. For example, to expand our campus network we not only needed to understand the costs of network technologies, but also physical space, electrical, and engineering requirements for locating the network. In our residence halls, this included additional 117v power capacity needed to support increasing requirements for student televisions, microwave ovens, refrigerators, stereos, hair dryers, and computers. Life-cycles must also be planned for computers, software, servers, and networks although most institutions have not accomplished this. The reality is that technology engineering and support are a combination of direct and indirectly-related investments that must be understood and planned for.

Instructional development, training and incentives. Technology upgrades will accomplish very little if not used effectively to improve instructional and business practices. In a 1993 federal government report, user training and organizational learning were identified as the two most critical technology issues confronting higher education. Besides training, there may need to be related incentives and recognition for innovative and efficient uses of technology. Highly trained users need less support that is one way to justify training costs. Even with trained users some technical support, especially for instructional
development, is needed. However, users must also take a more active role in learning how to use technology.

**Distance learning objectives and strategies.** One technology trend discussed extensively is the involvement with distance education. Historically, the CMU extended degree program, serving more than 12,000 students, has been mostly independent of the on-campus degree programs. Inspired by changing student demographics, increased external competition, and improving distance-learning technologies there is now a sense of common mission and vision between our on- and off-campus programs. The strategic role of distance learning involves selecting the most fruitful technologies to invest in and reengineering instructional delivery. It is important and necessary to assess the relative cost/effectiveness of both traditional and new modes of instruction.

**Continuing reorganization of information technology support.** The status quo of disenfranchised central and decentralized technology support was not working very well. The matrix model for information technology at CMU will try to accomplish more fruitful coordination. A good starting point is 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. 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 that would receive requests for service, try to answer them immediately, then refer them to the local service provider if necessary. The local service provider would provide many general consulting and technical support services and arrange for additional support and services as needed. 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, (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 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 underway 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. CMU is committed to the technology initiative and has the realization that technology will also require continuing and increased investment. Financing technology will be derived from more streamlined instructional and business processes, student technology fees, and more aggressively pursued external sources of revenue. The university will also continue to evaluate the selective use of external consultants and partners as resources for additional expertise and operational economies.

**Footnotes**


