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ABSTRACT

This report is based on a survey of state financial officers and interviews with experts and institutional representatives on the financing of technology in higher education. Surveys were returned from 21 states. Officials saw technology as a key issue for their schools' success, whether it is used for distance education, enhancing student services, or supporting the work of administrators and researchers. An institutional digital divide seems to be developing, with larger and wealthier institutions finding it easier to stay technologically current than smaller and less well-funded schools. Planning and budgeting for technology, while increasingly seen as important, are complicated by the fact that methods of capital financing traditionally used in higher education do not work well in funding technology infrastructure and because higher education officials lack a common language that allows them to communicate clearly about technology. Many college and university officials are not familiar with the innovative funding sources that may be appropriate for some elements of information technology. Based on these findings, the report makes recommendations that can help campus officials and state and federal policy makers develop funding policies for information technology. The report also offers a new lexicon for the components of technology infrastructure to create the necessary common language for communicating about technology. (Contains 21 references.) (SLD)

LUMINA
FOUNDATION FOR EDUCATION
NEW AGENDA SERIES™

Funding the "Infostructure"

A Guide to Financing Technology Infrastructure in Higher Education

2

A Publication of the Institute for Higher Education Policy

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Jane Wellman and Ronald Phipps
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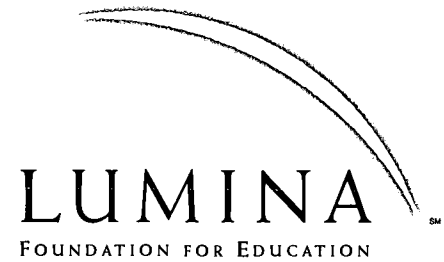
The Institute for Higher Education Policy



Editor's foreword

With this publication, *New Agenda Series*™ takes on the name and independence of Lumina Foundation for Education. Formerly USA Group Foundation, Lumina symbolizes a new beginning for our foundation, and for its newly enlarged mission and scope.

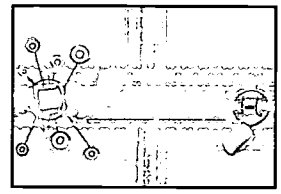
What's in a name? For us, Lumina Foundation signifies the significant change we have undertaken — from a corporate giving program to a private foundation, separately endowed. While we are respectful of our roots, we are now independent of them.

The primary mission of the Lumina Foundation for Education is to expand access to education by supporting research, innovative programs and communications initiatives. The Foundation focuses its work in three areas related to postsecondary education: financial access, student retention and attainment, and nontraditional learners and learning.

Future publications of the Lumina Foundation for Education *New Agenda Series* will therefore reflect the complex and important issues surrounding these three areas.

We hope you continue to benefit from these publications, and share our excitement about our new beginnings. Working together, we hope to shape a brighter future for Americans and their higher education experiences.

Robert C. Dickeson
Executive Editor



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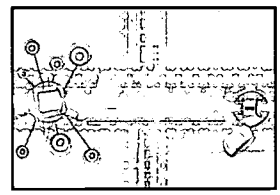


Executive summary

Computer technology is bringing rapid and profound change to higher education, as it has to virtually every aspect of American society. Unfortunately, too many colleges and universities fail to fully realize technology's promise because too few campus officials know how to plan, pay for and maintain the infrastructure that makes technology work.

Though no one can ignore technology's impact on campus, little has been done to estimate the cost of this infrastructure accurately or to establish policies and plans to pay for it. Most of the work that has been done on financing technology is confined to distance learning or educational technology. It does not address the larger topic that all institutions now face: the need to plan for and maintain their technological infrastructure. This report attempts to fill that gap. It is based on a survey of state finance officers and interviews with experts and institutional representatives on technology financing. The findings include:

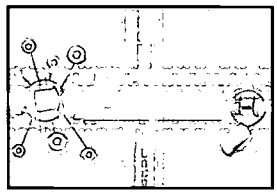
- Officials see technology as a key issue for their schools' success, whether it's used to provide distance learning, enhance student services, or support the work of administrators and researchers.
- An institutional "digital divide" seems to be emerging; larger, wealthier institutions find it easier to stay technologically "current" than do smaller, less well-funded schools.
- Though planning and budgeting for technology are recognized as increasingly important tasks, they are complicated by several factors:
  - Methods of capital financing traditionally used in higher education do not work well in funding technology infrastructure.
  - Higher education officials lack a common language that allows them to communicate clearly about the individual, rapidly changing pieces of the technology puzzle.
  - Officials are unfamiliar with the innovative funding sources that may be appropriate for some elements of information technology.

Based on these findings, this report makes recommendations that can help campus officials and state and federal policy-makers develop regular funding policies for information technology. The report also offers a new lexicon for the components of technology infrastructure, creating a common language that is needed to establish funding policies and plans. This new lexicon is specific enough to allow for clear communication about technology among an institution's various components, yet flexible enough to accommodate technology's rapid changes. The report also identifies a range of options for funding information technology, examining the advantages and drawbacks of each. Finally, the report urges state and

This report offers a new lexicon for the components of technology infrastructure.

federal policy-makers to address the disparities in institutions' ability to pay for technology. These disparities, if left unattended, will erode the capacity of many institutions to provide quality education to future generations of students.

This report can be considered a primer for newcomers to the topic of technology infrastructure financing. We hope it will promote discussion and action about the topic among university officials, policy-makers and researchers. Such discussion and action are sorely needed. The issues surrounding on-campus technology funding will become more complex as the players in the higher education arena become more numerous and diverse. This report — if reviewed by the people who are working to create solutions and by those who need the solutions — can provide context for both groups.



Introduction

Technology is fundamentally changing how higher education works — within conventional classrooms, through distance learning and the ubiquity of e-mail, in research and writing, and in determining how services are provided. Technology also has helped move instructional delivery beyond conventional colleges and universities, extending it to proprietary and vocational institutions and to short-course credentialing provided by corporate education.[1] The changes are so rapid and seemingly inevitable that some experts insist we are seeing a fundamental restructuring in institutional capacity. From this restructuring, three kinds of providers are likely to emerge: conventional, residential campuses ("brick-based" institutions); campuses that augment core services with technology ("clicks and bricks" institutions); and institutions that offer services solely through technology ("clicks" institutions — all clicks, no bricks).[2]

Although the landscape of higher education is being dramatically altered by technology, relatively little attention has been given to financing technology, what it costs and how to pay for it. This information gap persists despite the fact that technology costs are widely perceived to be high and growing, contributing to rising college tuitions.[3] To address this crucial lack of information, the Lumina Foundation for Education, formerly the USA Group Foundation, commissioned The Institute for Higher Education Policy to prepare an overview report on financing technology in higher education.

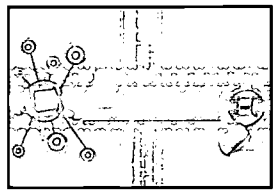
The research for this report was conducted through reviews of printed and Internet-based literature, interviews with individuals in the finance and accounting fields, surveys of state finance officials, and discussions with technology planning officers. A survey instrument was field-tested and distributed to state finance officers in all 50 states. In addition, the survey was used as the basis for interviews with national experts in financing technology.

The survey asked respondents about major sources of revenue in their states for funding technology, the status of planning for educational technology, the use of personnel (including consultants) in financial planning, and ways of defining and characterizing technology infrastructure. (A copy of the survey instrument can be found in the Appendix.) Complete surveys were returned from just 21 of the states. However, follow-up telephone interviews indicated that the majority did not respond because they did not know enough about technology financing in their states to do so — which, in itself, is a telling response.

This report synthesizes the results of the research into an assessment of the issues related to technology financing, including:

- A general overview of the topic and the challenges of assessing costs for technology.
- The emerging issue of a new kind of institutional digital divide.
- A discussion of the problem of needs assessment and planning.
- The problem of terminology for characterizing "technology infrastructure."

Rising out of this assessment, a new definition of technology infrastructure is suggested, one that encompasses the topic, but is sufficiently flexible to allow for the inevitable changes in technology. Different sources of revenue for technology infrastructure are identified, and their relative benefits or problems are discussed. The report concludes with recommendations for policy-makers at the institutional, state and national levels.

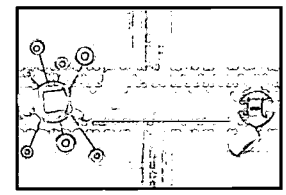


The landscape of technology financing

Financing technology infrastructure is a pressing issue at many of the nation's colleges and universities. In a recent survey by EDUCAUSE, institutions were asked to rank the most serious challenges in higher education information technology and resource management. The results are striking. Among 27 issues ranging from support service demands, to digital libraries to intellectual property, the top-ranked issue was information technology (IT). When asked which issues have the greatest potential to "explode in the future in terms of their strategic impact," distance education ranked first and funding information technology ranked fourth. In response to the question "Which of the issues below are you as an IT leader or administrator spending most of your time addressing?" IT staffing and human resources management ranked first; funding IT again ranked fourth.[4]

Market Data Retrieval (MDR) has been conducting periodic surveys of technology spending at colleges and universities that focus specifically on academic and administrative computer hardware and software. From its most recent survey conducted in 2000, MDR estimates that higher education institutions spent approximately $2.7 billion on computer hardware and software in 1999-2000,[5] the bulk of which (nearly $1.2 billion) was spent on academic computer hardware. Total spending for administrative hardware was projected to be $727.8 million, and spending for all software around $762.8 million. As these figures include hardware and software costs only — excluding building infrastructure, personnel, training, and other costs — they significantly understate total spending for technology.

Kenneth C. (Casey) Green, president of the Campus Computing Project, has developed the most reliable picture of information technology in higher education through comprehensive surveys of institutions in the annual "Campus Computing Report." Aspects of financing and planning for technology are perennially reported as major issues. The 2000 survey lists integrating technology into instruction as the top issue, followed closely by user support, and by financing and replacement of technology equipment.[6] Developing budget models for finance also is listed as a major concern.



A new form of the digital divide?

One of the emerging policy issues affecting technology is that of the "digital divide," or patterns of uneven student access to technology along racial, economic and geographic lines. An examination of institutional financing for technology infrastructure suggests that the digital divide has another connotation in terms of gaps in access to technology capital among different types of higher education institutions. Large, well-financed institutions have greater access to IT funding than do smaller colleges with fewer resources. Snapshots from many sources raise this issue in stark terms:

One of the emerging policy issues affecting technology is that of the "digital divide" ...

- **Disparities in distance learning.** Research suggests significant differences among sectors of higher education in the use of technology for instruction. The most comprehensive national survey of distance-learning practices at degree-granting, public and nonprofit institutions was conducted by the United States Department of Education (USDE) in 1997.[7] This survey reveals that, in academic year (AY) 1997-98, almost 44 percent of all higher education institutions

offered distance-based courses, an increase of one-third since AY 1994-95. Growth has been greatest among types of institutions that already were offering distance learning prior to the AY 1994-95 survey. Public institutions were more likely than private institutions to offer distance-based learning: 78 percent of all public four-year institutions and 62 percent of all public two-year institutions offered some form of distance-delivered courses, in contrast to only 19 percent of private four-year and 5 percent of private two-year institutions in AY 1997-98. Larger institutions were more likely to offer distance education than smaller colleges: 87 percent of institutions with more than 10,000 students offered distance-based classes, while only 19 percent of institutions with fewer than 3,000 students did so.

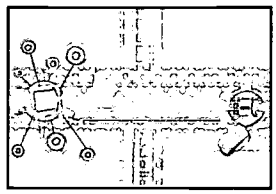
- **Disparities in student and user support services.** Differences in schools' approaches to distance learning may be the result of simple institutional choice rather than lack of funding. However, Green's additional research reveals disparities between research universities and teaching institutions that probably reflect access to resources more than institutional choices. The 2000 Campus Computing Survey reveals public and private research universities have the best ratios of IT staff to full-time equivalent (FTE) students; are most likely to offer admissions, financial aid, course registration and library resources over the Internet; and have off-campus, dial-up Internet services for students and faculty.[8] Small private colleges and community colleges, generally lagging in offering services via technology, are, ironically, the two sectors of higher education that list service to students and teaching as their highest priorities.

Clearly, there are major differences in funding by sector across higher education.

Clearly, there are major differences in funding by sector across higher education, with significant disparities between types of institutions in their access to capital. Gordon Winston, of the Williams Project on Economics of Higher Education, recently has documented these disparities by organizing public and nonprofit private institutions into hierarchical expenditure "deciles."[9] His research shows that well-financed institutions (both public and private) are able to spend more than four times the amount per student that the poorest schools spend. Although students in the higher-spending institutions are charged higher tuition, they receive significantly greater value from public and institutional subsidies than do students in poorer institutions. In fact, the share of total spending that comes from student tuition is highest in the poorest institutions: In the poorest private colleges, students spend an average of 91 cents to receive a dollar's worth of spending from public or institutional sources; in the best-supported public institutions, a student pays less than 8 cents to receive that dollar.

Other researchers, including Michael McPherson, Morton Schapiro and Thomas Kane, have documented that student academic achievement is associated with these spending hierarchies, with the most selective institutions able to pick from among the best academically prepared students.[10] Because of the strong relationship between family income and academic achievement,[11] these patterns too often perpetuate the economic and educational inequalities found at the elementary and high school levels.

The problem of institutional financing for technology infrastructure is not confined to distance learning. Even campuses that have chosen not to offer distance learning must invest in information technology to remain competitive. Students demand Internet and e-mail access to augment conventional classroom, library and research resources. These tools are essential for faculty research as well. Campuses must have access to IT to meet administrative and student services needs, including filing reports with federal and state agencies. In a highly competitive marketplace, institutions that fail to offer students and other clients easy access to their institutions through technology risk losing market share.



Needs assessment and planning

Needs assessment and planning are central to the success of any school's approach to information technology; according to our research and Green's 2000 survey, more institutions and states are doing such planning. Despite this trend, however, most observers say institutions fail to incorporate technology planning into financial planning. As is often typical in higher education, academic and administrative planning are done separately, and financial planning — if it is done at all — fails to match priorities with funding options. Instead, the approach is to document needs, develop plans, and assume that funding will follow — a kind of "Field of Dreams" approach: "If you plan for it, the revenue will come." More important, the financial process tends to be driven by the need for specific technology, not by an overall vision of technology's role in serving the institution's mission. Thus, even when planning occurs, it often fails to address core institutional policy issues about technology.

Institutions often are unable to identify their technology infrastructure needs and match them with appropriate funding strategies. Most conventional higher education capital financing is based on two criteria:

1. The predicted life cycle of the investment (30 years for most buildings, 5 to 10 years for scientific equipment, and between 10 and 50-plus years for infrastructure such as electricity, sewer systems and roads).

2. The expected use of the building for instruction, research, administration or mixed use.

Items with life cycles of more than 10 years generally are candidates for debt-based capital financing; buildings associated with self-supporting auxiliary enterprises (such as residence halls and health centers) are funded through fee-backed debt financing; scientific equipment and ongoing infrastructure generally are funded through operating funds for maintenance and equipment.

Confusion about terminology and difficulty in identifying specific needs hamper institutions' efforts to plan for technology infrastructure. Large institutions and state systems do relatively comprehensive planning, while smaller colleges and universities use more piecemeal, project-specific efforts. In many cases, both large and small systems depend on outside consultants to help with needs assessment and capital financing strategies.

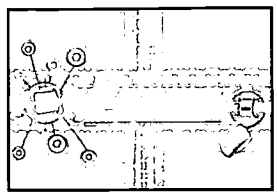
Carol Twigg and Charles Karelis[12] both have observed that institutions tend to fund technology as an add-on, with "new" money lashed onto existing programs. Not only does this practice limit IT's adaptability, it also drives up the cost of technology because it prohibits officials from making conscious choices to use technology as a substitute for labor. Green's observations are similar: Most institutions rely excessively on bond revenues, year-end savings and other forms of "budget dust" to pay for technology. Green argues that the *ad hoc* approach to funding is perpetuated by budgetary and asset-management techniques that have not kept up with the demands of technology. He also identifies four factors that impede financial planning for technology:

1. Failure to establish effective asset-management programs for technology.

2. Failure to adopt a life-cycle approach to technology budgeting in which various types of technology costs are organized and annualized into a portfolio of longer-term costs.

3. Failure to segment these longer-term costs into groups that can be matched to appropriate funding streams (student fees, operating budget lines, annuities from technology endowments, etc.).

4. Failure to develop reliable methods to measure the institution's return on investments in technology.[13]



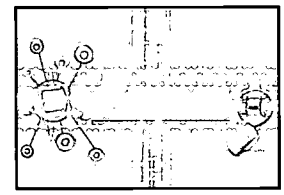
The problem of terminology

One of the primary problems with technology financing is the lack of standard terminology for describing the elements of technology infrastructure. The accelerating pace of change in technology and the arcane language often associated with new advances have hampered the development of a common vernacular. For instance, just a few years ago institutions were buying instructional television and satellite hook-ups as a primary investment in educational technology. These investments rapidly became outdated, replaced by the Internet and the race to wire campuses with fiber-optic cables. The advent of wireless technology suggests another wave of change is upon us. Without funding categories that are broad enough to accommodate change and clearly identify different components of technology infrastructure, many institutions and states will continue to struggle in developing consistent policies to pay for it.

Traditional terms of classification used for budgeting and finance systems are not useful in this arena ...

IT and finance officers identified the absence of a common terminology as a key factor in their inability to track revenues and expenditures. Traditional terms of classification used for budgeting and finance systems are not useful in this arena because they tend to isolate expenditures into specific areas, which include physical plant, infrastructure (electrical systems, plumbing and sewage, heating, telephones), maintenance, administration, teaching and research, and student services. Technology touches all of these categories, and more. For instance, administrative information systems frequently serve central and departmental administration, student services, and faculty research and teaching. Networks used for research also are used for distance-delivered instruction and e-mail. The interaction and overlapping of terms for these new activities and services has led Green to suggest that the term "infostructure" be used instead.[14]

Our research indicates that imprecise terminology significantly hinders campus officials' efforts to plan for technology and pay for it efficiently. There simply are too few commonly accepted definitions of the various components of information technology infrastructure. The resulting confusion too often leads officials to view technology as a bottomless pit that will gobble up money indefinitely. Officials also can be paralyzed by conflicting fears — one that whatever planning they do will be wasted because technology changes so rapidly, the other that if they don't plan for technology — and do so quickly — they'll lose students to other institutions that were able to make the investments more quickly.



Recommended definition of technology infrastructure

Clearly, a new lexicon is needed — one flexible enough to adapt to the rapid changes in technology, yet specific enough to create a framework for program and financial planning. Based on our research, we have developed such a lexicon, or at least the beginnings of one, that organizes elements of technology infrastructure into three broad clusters: *building infrastructure; systems infrastructure;* and *personnel infrastructure*. It was field-tested through focus groups with state financial officers and campus information officials, and their suggestions have been incorporated.

Defining technology infrastructure

Building infrastructure describes those components that need to be incorporated into a facility to make any technology operate effectively. These components include: 1) the conduits/raceways in which computer and network cables are laid in the building; 2) the cables and electrical wiring for computers and other communications technology; and 3) the electrical power and related building features such as electric outlets.

Systems infrastructure connects various technology components. For example, computer network infrastructure consists of the software that runs the networking function linking all computers in a class or college, or to external computers. It also includes hardware that runs the network, such as servers (computers with large information-storage capabilities that allow many users to share information). Modems — devices that allow computers to communicate with each other through phone lines — are another basic component of systems infrastructure, in addition to routers, switches and hubs. Systems infrastructure links data, voice, video and multimedia systems. Wireless technology would be included in the category.

- **Data systems** include computers connected to peripheral devices, such as printers. In addition to administrative purposes, a baseline data system enables instructional computers to communicate with similar devices in the classroom or institution (local area networks). Optimally, a data system also encompasses computer networks compatible with outside sources (wide area networks) such as the Internet, computers within the system office or at other institutions, home computers and a variety of databases. In addition, data systems include a set of software applications and services from external providers, such as licensed library and research services, Internet services and other outsourced network services.

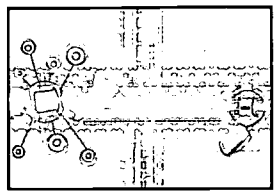
- **Voice systems** include two-way voice communication and messaging (telephone) systems. An optimal system includes sufficient outgoing and incoming lines and capacity to allow for technologies such as voice processing and voice mail.

- **Video and multimedia systems** provide accessibility to televised communication and all forms of video transmission within and outside the institution. An optimal system includes capacity to send and receive instruction (i.e., two-way interactive video classes) within the institution and among other institutions.

Personnel infrastructure includes the human resources necessary for the efficient operation of the overall technology infrastructure. Specifically, personnel infrastructure encompasses the human resources included for: 1) network management; 2) training and technical assistance; 3) course content development; 4) administrative support; and 5) student support services related to technology-aided instruction.

It is vital to include personnel, training and ongoing development as we redefine technology infrastructure.

It is vital to include personnel, training and ongoing course development as we redefine technology infrastructure. Traditionally, the term "infrastructure" in higher education refers only to buildings and equipment. With respect to technology, however, human resources and ongoing education are essential elements. Without people involved in network management, training and technical assistance, course content development, and administrative and student support, the system would grind to a halt. Green's research and our interviews show that most institutions cite skilled people and ongoing training as the highest priorities for building and sustaining technological capacity.



Sources of revenue for financing technology infrastructure

For decades, higher education institutions have used separate and distinct financing methods for their capital and operating budgets. These financing habits simply don't work well for technology. Campus officials need a menu of options to finance technology infrastructure. Decisions about how to fund projects should be guided by a policy framework that matches revenues with needs to ensure that funding is cost-effective, and that technology is integrated financially and academically into the planning for the entire institution.

The literature on technology contains relatively little about sources of revenue, although there has been some attention to "new" sources of revenue through e-commerce, public-private partnerships, and for-profit subsidiaries. In Hezel Associates' 1994 "State by State" analysis, several revenue sources were cited, including foundations, technology companies, federal grants, state grants, student user fees and general revenues. Some states have enhanced general revenue of educational communication through incentive funding programs, incentive regulation and taxes. Missouri's VIDEO program, which relies entirely on a videotape rental tax, represents a unique approach. States such as Georgia and Michigan have realized windfalls for educational telecommunications because of telecommunications rate regulations.[15] Others, including Montana and New Jersey, have provided one-time appropriations for specific projects. Some states, such as New Mexico, have leveraged state funds with federal monies to support networks.

To complement the Hezel analysis for this study, we asked survey respondents how they pay for the different elements of the *infostructure*. Roughly 40 percent of states responded; those responses show a variety of approaches:

- **Building infrastructure**
  Both debt and non-debt instruments were used to finance this component. In addition to state and institutional bonds, state appropriations (both restricted and unrestricted) and student funds were used. Some states also used funds from auxiliary enterprises.

- **Systems infrastructure**
  The major sources of funds for this component were non-debt instruments and included state appropriations (both restricted and unrestricted), student funds and auxiliary enterprises. In some instances, however, state bonds were used, and one state received a federal grant.

- **Personnel infrastructure**
  Almost without exception, the major sources of financing for this component were non-debt instruments — both state revenues and student funds. In some cases auxiliary enterprises were used and, in one instance, local resources were provided.

Mark Luker of EDUCAUSE says many campus administrators inaccurately view technology funding as a capital rather than an operating expense. Capital budgets are designed to pay for major, permanent items (land and buildings) or for periodic expenditures (every 10 years or longer) on items that retain or even increase value over time. Capital budgets are typically funded through bond revenues. Though some elements of technology may appropriately be built into capital budgets (such as when buildings are built or renovated), a substantial portion of technology costs are operating expenses.

Attorney Michael Goldstein of Dow, Lohnes, and Albertson in Washington, D.C., argues that bond financing is generally inappropriate for technology equipment because technology assets typically are replaced or lose much of their value after two years. Goldstein says technology requires repeated "cyclical capital investments," meaning that institutions should look to new sources of revenue through capital markets. To do this, institutions need to assess which areas are likely to grow in demand, have unit cost structures that can be contained, and provide programs or services that allow for-profit subsidiaries without undermining the institution's core identity and values. Non-credit courses, some graduate and certificate courses, and core service areas are identified as potentially appropriate candidates for the formation of for-profit subsidiaries.[16]

In particular, continuing education departments of many institutions are good candidates for the development of for-profit subsidiaries because they are frequently self-supporting, have their own organizational structure, and are only indirectly related to the core mission of the institution.

Description of revenue options

Because the technology infrastructure touches virtually every component of an institution and involves both capital and operating budgets, various funding strategies are needed for information technology. Our research points to a menu of financing options:

- Debt financing (bonds, certificates of participation, revenue anticipation notes).
- Vendor arrangements (discounts, donated services or equipment, leasing arrangements, service contracts, performance contracting).
- Leasing arrangements.
- Revolving funds (seed money repaid either through revenue or budgetary savings).
- User fees (special technology fees, tuition increases).
- E-commerce (revenue-generating activities).
- Creation of for-profit subsidiaries.
- Other organizational and budgetary techniques such as consortia, partnerships and funding through internal recharge systems.

Taking these financing options in turn, we will describe each one, listing the advantages and disadvantages of each. When weighing these options, campus officials should consider the cost of capital (including planning and management costs), statutory or constitutional restrictions on the revenue (such as bond caps), the political cost of obtaining capital (such as through tuition or fee increases), and the culture and mission of the institution.

Debt financing (usually through bonds)

Debt funding through bond instruments is a common vehicle for funding long-term capital investments and improvements at most colleges and universities. There are several types of bond instruments, and the options depend on whether the institution is public or nonprofit, its current financial situation, and its future prospects. The two primary kinds of bonds are *general obligation bonds* (repayable from future general revenues including appropriations, tuition and endowment earnings) and *revenue bonds* (repayable from revenue streams generated from the object of the sale). For example, dormitories traditionally are funded by revenue bonds. Other instruments, such as certificates of participation (a form of lease financing available in public institutions) and revenue anticipation notes (short-term borrowing against future revenues), are also available for shorter-term debt. The National Association of College and University Business Officers' (NACUBO) *Guide to Issuing and Managing Debt*[17] provides a comprehensive review of the types of instruments available, as well as the steps involved in internal planning and outside review needed to bring bonds to sale.

Bond revenues are a time-honored and widely accepted vehicle for financing higher education. They are best suited to investment assets such as land, buildings and some types of scientific equipment that lose value slowly or even gain value over time. Bond capital is more expensive than general-purpose operating revenues because of the associated costs of planning and documentation. The documentation required before a bond sale can add up-front fees ranging between 1 percent and 2 percent of bond sales — in addition to the assessments, management and contract fees. Many small, private institutions lack the resources to secure favorable bond ratings, making the cost of bond capital even higher for them, or completely out of reach. Many states require bonds to be approved by voters. Institutions that face this restriction may choose to use certificates of participation or revenue anticipation notes, which do not require voter approval. However, these instruments are appropriate only for short-term debt when stable, long-term revenue is expected.

Bond capital is more expensive than general-purpose operating revenues because of the associated costs of planning and documentation.

Bond revenues are appropriate to fund the building infrastructure components of educational technology — installation of conduits and raceways in buildings,

for example — because these assets do not need to be replaced for several years. Bonds are less desirable instruments for systems infrastructure (equipment or networks) because these items require continual upgrading and reinvestment. Revenue bonds may be appropriate vehicles for electronically delivered services or programs that ensure future revenues, and bonds can be used to establish revolving funds (see below) to seed projects.

Vendor arrangements

Many institutions collaborate with vendors, which gives them access to equipment and services at reduced cost or creates cost savings through more efficient work. Institutions use contract consultants to help with their planning and needs assessments and to provide training assistance and advice on software packages. Institutions often lack this expertise on staff, or their staff members have other responsibilities. Many institutions report that finding — and especially keeping — technology personnel is a huge challenge in the current market; too often schools can't afford the salaries necessary to retain these sought-after workers. In this marketplace, vendor help with personnel-related needs may be the institution's most promising option.

Many institutions prefer to lease rather than purchase technology hardware because such equipment is often obsolete after three years.

Vendors are most frequently associated with equipment purchase and leasing, servicing, network management, software systems procurement and installation, and training. Most of the states responding to our survey received donated equipment or services or discounts for purchasing, and half of the states say they've used leasing as an alternative to purchasing systems infrastructure.

Many institutions prefer to lease rather than purchase technology hardware because such equipment is often obsolete after three years. Although leases typically are seen as more expensive than purchasing, institutions often are able to negotiate vendor arrangements that include technical support and upgrades, thus adding value.

The clearest advantage of vendor arrangements is that they can provide an institution with skills, equipment and services that may be superior to what it can find internally or finance with institutional resources. Vendors serve many institutions and can spread their costs over several clients to achieve substantial economies of scale. Institutions and states using vendor arrangements say they save money and get good service. Vendors are particularly useful for systems planning and design, and they provide institutions and states with benchmarks based on work outside higher education. Also, recommendations from outside vendors have credibility with state legislatures and finance offices because vendors' assessments of funding needs are considered neutral and more analytically grounded than requests from advocates of the institution. Savings reported from group purchasing and service arrangements can reach 20 to 30 percent. These savings can sometimes be used as matching funds to receive federal and state appropriations. Leasing arrangements offer long-term cost efficiency and provide an option for those who cannot obtain up-front capital.

Vendor arrangements seem to work well in big institutions or state systems, where vendors can sustain business over a long period of time. Size helps generate discounts for purchases and leases as well. Small institutions are not as likely to reap the same economic benefits from these arrangements, even if they receive the service benefits. Another disadvantage of vendor arrangements is that institutions often do not know where to turn for expertise. Some institutions are dissatisfied with the standard software and systems packages now on the market, and many have argued that a national referral service should be created to identify firms with good track records in higher education, as well as networks of institutions that have used the services or products.

State budget policies, including contracting and purchasing policies, may present obstacles to creative financing arrangements with vendors. Some states require state entities to do business only with designated vendors; others prohibit public partnerships with private and for-profit entities. Still others require any contractor to meet public requirements for prevailing wages or follow other policies that deter many private firms. As a result, some public institutions lack the flexibility to pursue a wide range of creative funding arrangements, even if these alternatives can achieve long-term savings.[18]

Vendor arrangements are best suited for systems and personnel infrastructure. Several national vendors have developed considerable expertise in developing systems and personnel infrastructure that is adaptable to virtually any institution. Many institutions lack the expertise to develop or upgrade these components of technology infrastructure.

Revolving funds

Revolving funds often are used to generate capital for technology, system design, planning or equipment purchasing. The fund typically is supported by seed funds, institutional, state or foundation sources — even revenue bonds. The funds operate like an investment fund, making loans that are repaid from revenue or savings from technology projects.

Revolving funds are limited in their appropriate use. They are best suited either for areas that can generate revenue (such as some instructional programs) or where savings from technology can be captured and counted as revenue. A revolving fund can serve as an incentive fund at a state institution or large research university — something campus officials can use to increase participation in technology.

Revolving funds might be useful for renovations in dormitories or bookstores, where new technology can be used to increase revenue and cut costs. If technology is used to increase enrollment by offering distance-education courses, fees from these new students can be used to repay the fund. Revolving funds are less appropriate for ongoing personnel and support costs. They may be most compatible with continuing education programs, which already are set up to run on a current cash and revenue basis in most institutions.

Supplemental user fees

The 2000 Campus Computing Survey and our research confirm that most institutions have implemented special supplemental student fees to generate revenue for technology. According to Green, this is particularly common in research universities and public four-year colleges, but less common in private four-year institutions and community colleges, perhaps related to the disparities in funding between these sectors. Supplemental fees take two basic forms: 1) Technology fees are charged to all students at the time of enrollment (sometimes at reduced rates for part-time students); and 2) user fees are charged to all clients of services offered by the institution. An example of a user charge is a fee paid by off-campus clients for remote access to the institution's information systems. It also is likely that some institutions have chosen not to add supplemental fees, but have included technology costs in their justification for tuition increases.

The biggest advantage of supplemental fees is that they provide a stable and recurring source of revenue. Fee-based systems also make it easier for institutions to track technology expenditures and savings realized through technology because most institutions already use separate accounting systems for fee-funded activities. The disadvantage is that supplementary fees are controversial: They add to the overall price of education. Many public institutions — community colleges, in particular — have state-imposed policies that restrict supplemental fees. Institutions that are trying to hold down tuition and fees but want to improve student access to technology may require all new students to purchase laptop computers rather than funding the purchase of laptops through the fee structure.[19] This requirement is arguably a *de facto* technology fee, although it would not be recorded as such.

Supplemental fees are most appropriately used to pay for direct services where the client, whether students or others, can readily identify the benefits of the service. Supplemental fees also may be used to offset ongoing technology costs in such areas as admissions, registration and access to information about financial aid. In a state like California that permits student "fees" only when they are not attributable to the "direct" cost of instruction, student fees are commonly used to pay for student services.

E-commerce and for-profit subsidiaries

E-commerce is an umbrella term that encompasses many ways to generate revenue over the Internet, although it is also used to characterize all forms of Internet-based transactions. Two examples: charging advertisers to post notices on the campus Web site, and marketing goods and services from the campus bookstore to off-campus customers. In addition, institutions are beginning to create for-profit subsidiaries to exploit new markets — either through e-commerce or by revamping traditional instructional and service programs into profit-making ventures. These practices are still relatively uncommon in higher education, but they are generating a good deal of interest and discussion.

E-commerce and for-profit subsidiaries provide vehicles for revenue from markets traditionally considered off-limits to higher education, and both can expand an institution's client base. They can generate revenue to pay for any portion of technology infrastructure — buildings, systems or personnel. E-commerce profits might also be used to repay revenue bonds. For-profit subsidiaries may be good vehicles to fund, not just technology infrastructure, but also specific programs and services such as housing and food services, or continuing education. Goldstein's analysis suggests that many activities now outsourced to vendors are candidates for profit-making activities. He also identifies non-credit courses, some graduate and certificate courses, and core service areas as possible candidates for for-profit subsidiaries.[20]

Revenue from an e-commerce venture or a subsidiary may be unstable and hard to predict, particularly at the outset.

Revenue from an e-commerce venture or a subsidiary may be unstable and hard to predict, particularly at the outset. Also, e-commerce and for-profit subsidiaries can be controversial for individuals and institutions that are uncomfortable moving into the profit-making marketplace for any reason. Green reports significant resistance to e-commerce in higher education — highest in research universities, and less prevalent in community colleges.[21] E-commerce not only challenges conventional ways of managing resources, it also can raise questions about an institution's identity and mission. The traditional *ad hoc* nature of technology financing means that many institutions — or sub-units within institutions — enter into these arrangements without fully considering their effect on internal financing, accounting and governance.

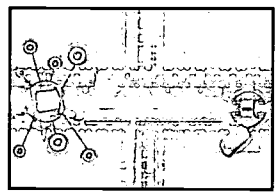
Such ill-considered action is usually a mistake. Though it's relatively easy for an institution to create a for-profit subsidiary and jump into for-profit ventures, it's more difficult — and far wiser — for officials to first identify the programs or services that can generate profits *and* serve the institution's mission. Also, before entering into e-commerce or subsidiary ventures, campus officials should take pains to adopt an appropriate accounting system. This system must ensure that adequate money is reinvested in the business, used to repay loans or used to pay investors. Officials won't be able to take all of the profits and plow them back into cash-strapped academic programs as they do now with most subsidized programs. Institutions accustomed to spending according to Bowen's Law — "Raise all the money you can, and spend all you can" — will need to get used to the idea of managing cost centers and generating revenues for investors.

Consortia

Although these are not, strictly speaking, "revenue sources," cooperative agreements or consortia are another option for institutions seeking new ways to finance technology infrastructure. The large majority of states in our survey said they use consortia or systemwide strategies for purchasing technology infrastructure or services. Members of the consortia include other higher education institutions, state government and the private sector. Though most states agreed that consortia help save money, they cautioned that these arrangements might delay projects because they require cooperation and standardization among several organizations.

Budgeting techniques

Internal recharges for central service functions are another frequently used approach to paying for systems and personnel infrastructure. Recharge systems allow budgeting for infrastructure by helping to manage the resource and identify costs. In an internal recharge or "charge-back" system, technology services are provided centrally, but the resources to pay for them are distributed to the individual departments. Departments pay on a fee-for-service basis, and charges are assessed by the information service department.



Conclusions and recommendations

This project began as an effort to highlight the ways that technology infrastructure is paid for in higher education and to address potential policy issues associated with changing those financing patterns. Finding revenue to pay for technology is just one issue related to technology finance, and it is not the first issue that should be addressed. Before looking for money, campus officials should focus on planning and terminology and on creating a system that properly matches revenue with technology components.

Most institutions continue to fund technology through a series of *ad hoc* initiatives. These initiatives rely heavily on add-on revenues, foundation grants and one-time government supports. Planning for technology, when it is occurs, rarely combines program planning with realistic ways to pay for it. Institutions want to be able to keep up with the latest developments, but they cannot predict those developments. High-tech language is one source of confusion. Another is the failure to create clear distinctions among the costs for building infrastructure, systems, hardware, training and personnel. Inadequate planning and imprecise terminology contribute to *ad hoc* patterns for matching revenues with components of technology. This can lead to the excessive use of bond revenues to pay recurring operating costs. Such ill-considered funding for technology actually increases the cost of technology because it treats it as a perpetual add-on.

Financial inequities between well-subsidized and undercapitalized educational institutions are nothing new. The demand for high-tech programs and services on all campuses, however, has exacerbated these inequities. Small liberal arts and community colleges — any of whom serve economically disadvantaged students — are particularly hampered. They are often geographically isolated and have marginal access to capital. The virtually prohibitive expense of developing comprehensive, high-tech programs and services to compete with larger institutions may limit the future of these smaller schools.

Financing technology also raises issues of institutional governance and mission. Many institutions adopt revenue strategies with little planning when they create for-profit entities or form affiliations with business partners. These new ventures force changes in institutional accounting habits and affect the decision-making process by introducing new economic interests that can change core institutional values. Technology funding is particularly challenging for the roughly 3,500 public and nonprofit independent colleges and universities that are most likely to operate either through "brick" or "click and brick" means in the future. Unlike the newer, for-profit providers of higher education, these institutions have used fairly stable public and nonprofit traditions of fund accounting and program budgeting. Few of these institutions are accustomed to funding initiatives through for-profit subsidiaries, public-private partnerships or cross-regional consortia. The task is easier in large research-oriented institutions whose officials are used to internal experimentation and decentralization, and have experience in managing outside partnerships.

Colleges and universities must think of technology, not as an add-on, but as an ongoing part of the way the institutions must do business — in distance learning, teaching, research and service functions. Institutions must keep pace and find ways to pay for high-tech advancements. To do that, they must develop regular policies for financing technology, beginning with an effort to match different components of technology infrastructure with appropriate sources of funds. New strategies will be needed to maintain the capacity of technology infrastructure for personnel and ongoing training.

Nomenclature

Establishing a common language for discussing technology is a prerequisite to developing systematic technology-financing policies. This new language must be adaptable enough to accommodate the inevitable changes in technology, yet specific enough to allow planning and funding policies to be developed. The language also should clearly identify and distinguish cost centers in buildings, networks and personnel — including training and development. We recommend our new lexicon as a starting point for institutional and state-level audiences, and for national organizations such as NACUBO.

Planning

Those who choose and finance campus technology should follow time-tested procedures for strategic planning. They must:

- Identify strategic priorities for the institutions or states, built on existing strengths.
- Articulate the role of technology in achieving these priorities.
- Estimate the costs of the initiatives.
- Develop revenue strategies to fund these initiatives.

Planning should include all aspects of technology infrastructure — systems, personnel, support, training and development. Decisions about distance learning, e-commerce and educational partnerships will shape the future governance structure of the institution. Institutional leaders and governing boards should address these issues as part of the planning process. It's important that leaders make conscious, informed policy decisions about how technology should complement and facilitate an institution's strategic initiatives.

Revenue policies

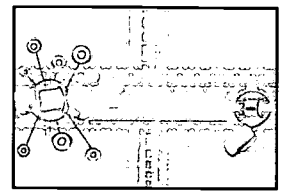
State and institutional leaders should identify revenue policies for technology infrastructure. States should evaluate how their institutions are paying for technology, and they should revamp funding policies to take advantage of new revenue sources. Policies on purchasing and leasing, vendor relationships, and alliances with for-profit entities should be reviewed and updated as necessary. Statewide policies should be developed that match revenues with components of technology to ensure that activities are funded cost-effectively.

The institutional digital divide

The institutional "digital divide" should be addressed through state and national policy-makers. Imbalances in access to technology capital will hamper the long-term ability of small private institutions and community colleges to offer high-quality education. Most funding methods favor large, well-financed institutions — both because money attracts money, and because unit costs are lower in large-scale projects.

State and national leaders need to support cooperative arrangements, new sources of funds, and regional and national networks that link these institutions with one another. Even if new revenue sources are not available, expertise is a precious form of technology capital that can and should be shared.

This paper is itself part of that sharing effort. In it we have laid out a definition of technology infrastructure, pointed out disparities among higher education institutions, discussed planning and needs assessment, identified an array of financing options and offered recommendations. In doing these things, we have tried to highlight the opinions and suggestions of the best thinkers and experts in technology financing, and we hope this paper will contribute to a continuing dialogue on this important topic. □



References

[1] See Clifford Adelman, "A Parallel Postsecondary Universe: The Certification System in Information Technology," Office of Educational Research and Improvement, U.S. Department of Education, October 2000.

[2] Arthur Levine, "The Future of Colleges: 9 Inevitable Changes," *The Chronicle of Higher Education*, October 27, 2000.

[3] See, for instance, the analysis of the National Commission on the Cost of Higher Education in *Straight Talk About College Costs*, Washington, D.C.: Oryx Press, 1999. The commission attempted to find reliable estimates of spending on technology, and concluded that none existed, but that the costs were substantial and likely to continue to increase for the foreseeable future.

[4] James Roche, *Checking the Radar: Survey Identifies Key IT Issues*, EDUCAUSE Current Issues Survey, 2000.

[5] Market Data Retrieval, *Technology in Education 2000*, www.schooldata.com/publications.html.

[6] The Campus Computing Project, 2000 *National Survey of Information Technology in U.S. Higher Education*, October 2000; www.campuscomputing.net.

[7] USDE, *Distance Education at Postsecondary Institutions: 1997-98*. National Center for Education Statistics, Washington, DC, 1999.

[8] *Campus Computing 2000*: Presentation to Educause 2000, October 12, 2000, Kenneth C. Green.

[9] Winston, Gordon C., "The Positional Arms Race in Higher Education," Williams Project on the Economics of Higher Education Finance, April 2000.

[10] For example, see Michael McPherson and Mortimer Schapiro, *The Student Aid Game*, Princeton University Press, 1998; and Thomas Kane, *The Price of Admission*, Washington, D.C., The Brookings Institution Press, 1999.

[11] This relationship has been recently documented by Patrick T. Terenzini, Alberto F. Cabrera and Elena M. Bernal, *Swimming Against the Tide: The Poor in America*, New York: The College Entrance Examination Board, 2001.

[12] Carol Twigg, "Can Education Be 'Productive'?" *Educom Review*, 28, no. 6, November/December 1993; and Charles Karelis, "Education Technology and Cost Control: Four Models," *Syllabus*, February 1999.

[13] Kenneth Green and Robin Jenkins, "IT Financial Planning 101: Developing an Institutional Strategy for Financing Technology," *NACUBO Business Officer*, March 1998.

[14] Kenneth Green, "Building a Campus Infostructure," *Trusteeship: Special Issue on Educational Technology*, Association of Governing Boards, Washington, D.C., available at: http://www.agb.org/spectech.cfm.

[15] Hezel Associates, Education Telecommunications: *The State-by-State Analysis 1994*, Syracuse, New York: 1994.

[16] Michael Goldstein, "Strategies for Extending Learning Resources in an Information Age," in *Postbaccalaureate Futures: New Markets, Resources, Credentials*, Kay J. Kohl and Jules B. Lapidus, eds., American Council on Education, Oryx Press, 2000.

[17] *NACUBO Guide to Issuing and Managing Debt*, National Association of College and University Business Officers, Washington, D.C., 1994.

[18] See Jerry Mechling, "Information Technologies and State Governments: Challenges for Political Leadership," Discussion Paper, *Program in Strategic Computing and Telecommunications in the Public Sector*, John F. Kennedy School of Government, Harvard University, 1995; and Lewis M. Branscombe, "Information Infrastructure for the 1990's: A Public Policy Perspective," in Building Information Infrastructure, *Program in Strategic Computing and Telecommunications in the Public Sector*, John F. Kennedy School of Government, Harvard University, McGraw-Hill, 1992.

[19] See *The Chronicle of Higher Education*, "Massachusetts May Require Public College Students to Own Laptops," November 3, 2000.

[20] Goldstein, 2000, op.cit.

[21] *Campus Computing 2000*, Presentation to EDUCAUSE, op. cit.

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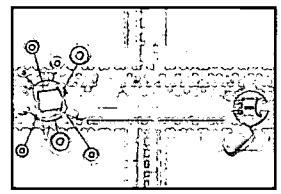


Appendix

Interview format

Individuals interviewed for this project were sent a project description and a copy of the survey prior to the interview. Most of the interviews were conducted by telephone, although several were done in person. The interviews, although structured to provide answers to the following questions, were open-ended so as to promote substantive discussion.

1. What has been your experience with technology financing in higher education? For example:
   - Work as a consultant.
   - Have been an information technology officer.
   - Worked on the funding/budget side primarily.

2. Has your experience been primarily with public or private institutions? Big, medium or small?

3. We are trying to get a handle on annual national spending for technology in higher education. Do you have any sense of what that might be?
   - If yes: what is the number?
   - Do you base that estimate on: a report or reports, your own work, best guess, etc?
   - If no, why do you think this is so hard to estimate? (Definitions of what "counts" as technology; "buried" expenditures; reliance on one-time funding; other).

4. How do you characterize the approach taken by higher education to funding technology? (The following prompts were used if the respondent did not offer an answer:)
   - Aggressive, forward-looking and visionary.
   - Confused, but forward-moving.
   - Poorly focused. Planning (when it happens) is on needs assessment and not on revenue strategies.
   - Episodic, uncoordinated, poorly done.
   - Other.
   - Do you think that the approaches to financing technology taken in higher education help to reduce the costs of technology, or drive up the costs of technology, or have nothing to do with costs?

5. In your experience, what are the barriers faced by most institutions in funding information technology? (If more than one apply, please give some sense of relative ranks or dimensions.)
   - Issues of expertise, for example:
     - Inadequate attention to planning and articulating the role of technology in the institution.
     - Poor capacity to measure needs for technology.
   - Issues of terminology and measurement, such as:
     - Inability to break down the elements of technology among hardware, infrastructure and networks.
   - Institutional habits and ways of doing business, such as:
     - Separation of academic and administrative planning.
     - Inability to benchmark costs and identify savings from technology.
     - Separation of capital and operating finance.
     - Resistance to creative finance, including e-commerce, revenue centers, or private capital.
     - Policies that discourage lease and service arrangements.
     - Policies that discourage participation in cooperative arrangements.

6. Are large institutions or those that are part of systems advantaged in finding resources for technology? Is this primarily because of economies of scale, or access to expertise, or access to capital?

7. Do you think that small private colleges are operating at a serious disadvantage with respect to funding technology?

8. What are the sources of revenue that you have worked with (or helped to identify) to fund information technology?

9. Other comments?

Survey on how technology infrastructure is financed

The following survey seeks to determine how technology infrastructure is being financed at higher education institutions. The Institute for Higher Education Policy, which is conducting this survey, would like to thank you for taking the time to assist us in this important research. Upon completion, please return this form to us using the envelope provided. If you would prefer, you may fax us your response at (202)861-9307. We will provide you a copy of the results upon completion.

Name: _____

Affiliation: _____

Title: _____

Address: _____

_____

Phone: _____

Email: _____

Assessing Methods of Financing Technology Infrastructure

The Institute for Higher Education Policy is conducting a study to learn how institutions are financing technology infrastructure; what the terms mean; how institutions assess their funding needs for technology infrastructure; and how they are finding revenues to pay for the needs. Please use the following working definition of "technology infrastructure:"

Definition of Technology Infrastructure

Building Infrastructure consists of those components that need to be incorporated into a facility to make any technology operate effectively. They include: (1) conduits/raceways through which computer and computer network cables are laid in the building, (2) the cables and electrical wiring for computers and other communications technology, and (3) the electrical power and related building features such as electric outlets.

Systems Infrastructure links up various technology components. For example, computer network infrastructure consists of the software that runs the networking function. It links all computers in a class or in a college, or the computers in the college with computers in the outside world, as well as special pieces of hardware such as servers (computers with large information storage capabilities that allow many users to share information) whose purpose is to run the network. Internet service providers (ISPs), licensing and authentication systems are another element. Modems-devices that allow computers to communicate with each other through the phone lines-are another basic component of systems infrastructure, in addition to routers, switches, and hubs. Systems infrastructure links data, voice, and video and even multimedia systems. Wireless technology would be included in the category.

- Data Systems include computers connected to peripheral devices, such as printers. In addition to administrative purposes, a baseline data system enables instructional computers to communicate with similar devices in the classroom or institution (local area networks). Optimally, a data system also includes computer networks compatible with outside sources (wide area networks) such as the Internet or state-wide networks, computers with the system office or at other institutions, home computers, and a variety of databases. Also included in data systems are a set of software applications and services from external providers, such as licensed library and research services, Internet services, and other outsourced network services.

- Voice Systems include accessible two-way voice communication and messaging (telephone) systems. An optimal system includes sufficient outgoing and incoming lines and capacity to allow for such developing technologies as voice processing and voice mail.

- Video Systems provide accessibility to televised communication and all forms of video transmission both within and outside the institution. An optimal system includes capacity to send and receive instruction, i.e., two-way interactive video classes between classrooms both within the institution and with other institutions.

Personnel Infrastructure includes the human resources necessary for the efficient and effective operation of the Technology Infrastructure. Specifically, personnel infrastructure encompasses the human resources included for (1) network management, (2) training and technical assistance, (3) course content development, (4) administrative support, and (5) student support services related to technology mediated instruction.

1. Have you done a comprehensive assessment of your needs for technology infrastructure in the past five years?
   Yes _____ Some (planning, not comprehensive) _____ No _____

2. How have you identified your needs for technology infrastructure (check all that apply)?

   _____ Formulae
   _____ Standards
   _____ Comprehensive planning process
   _____ Contracted with consultants for needs assessment
   _____ Statewide needs process
   _____ Have not completed a comprehensive assessment of needs; have moved forward on a project specific basis.

3. In your needs assessment, did you perform separate assessments for the different elements of technology infrastructure such as those identified in the foregoing definition?

   _____ Yes, we identified needs separately for different elements
   _____ No, our assessment did not generate estimates of needs for the different elements of technology infrastructure

4. Please discuss briefly the problems (if any) of terminology, including alternative definitions for terms and use here: _____

5. If you have used funding formulae or standards to assess your technology infrastructure needs, how helpful have they been in accurately identifying your needs? _____

6. Did you contract with an outside consulting firm for your needs assessment? Yes _____ No _____

7. Did you include identification of revenue sources as part of the needs assessment process? _____

8. How are replacement costs built into the budget and financing models? _____

9. Have institutions in your state considered affiliating with, or creating, a for-profit entity to take advantage of new financing mechanisms? Yes _____ No _____

10. Do you require standarized systems for technology (e.g. common platforms or software)? Yes ____ No ____
    If yes, were costs a reason for standardization? Yes _____ No _____
    If no, do you have general policies on compatibility? Yes _____ No _____

11. Have you used consortia or systemwide strategies for purchasing technology infrastructure or services?
    Yes _____ No _____

    If yes, please comment on the usefulness of these strategies in terms of efficiency, cost-effectiveness, enabling access to expertise, or other attributes _____
    _____
    _____

12. Do you receive donated equipment or services, or discounts on purchases from vendors or contracts?
    Yes _____ No _____

    If yes, describe briefly _____
    _____

    Do you monitor the value of costs avoided from donated services or equipment? Yes _____ No _____

13. Have you used leasing as an alternative to purchasing of systems infrastructure? Yes _____ No _____

    If yes, please indicate the factors that influenced your decision to lease (check all that apply):
    - _____ More cost effective over the long term
    - _____ Concern about rapid obsolescence
    - _____ Unable to obtain up-front funding to purchase
    - _____ Service and training discounts with lease agreements
    - _____ Superior equipment
    - _____ Other

    If no, please indicate the reasons for purchasing rather than leasing (check all that apply):
    - _____ More expensive to lease
    - _____ Better prices in package
    - _____ Required by regulation or policy
    - _____ Other

To better understand the ways in which technology infrastructure is being financed, we ask that you check the boxes that correspond to the funding mechanisms institutions in your state use.

14. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Building Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

15. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Data Systems Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

16. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Voice Systems Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

17. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Video Systems Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

18. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Network Management Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

19. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Training and Technical Assistance Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

20. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Course Content Development Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

21. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Administrative Support Infrastructure*.

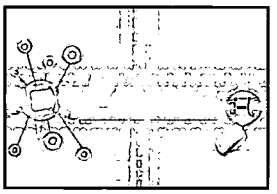
NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted		Student funds a) restricted b) unrestricted		Auxiliary enterprises	Donated funds	Federal contracts or grants	Revenue from a for-profit entity	Local resources	Other
DEBT INSTRUMENTS	State bonds	Local bonds	Institutional bonds	Other						

22. Using the definition provided, please indicate the top three financing mechanisms, in terms of dollar amount, that institutions in your state have used for *Student Support Infrastructure*.

NON-DEBT INSTRUMENTS	State funds a) restricted b) unrestricted	☐ ☐	Student funds a) restricted b) unrestricted	☐ ☐	Auxiliary enterprises ☐	Donated funds ☐	Federal contracts or grants ☐	Revenue from a for-profit entity ☐	Local resources ☐	Other ☐
DEBT INSTRUMENTS	State bonds ☐	Local bonds ☐	Institutional bonds ☐	Other ☐						

Additional Comments

Please use this space to expand on answers provided in the above questions.



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