Can Small Colleges Afford To Be Technology Leaders?

Can They Afford Not To Be?

Martin Ringle, Director
Computing & Information Services
and Associate Dean of the Faculty
Reed College
Portland, OR

David Smallen, Director
Information Technology Services
and Institutional Research
Hamilton College
Clinton, NY

Abstract

Small colleges, troubled by demands on financial aid, constrained by external pressures to limit the growth of tuition and fees, and driven by increased competition for students, appear poorly positioned to be technology leaders. However, in these difficult times they have opportunities to distinguish themselves through focused applications of information technology resources in support of their missions. Taking a leadership role in technology can have significant payoffs as well as substantial risks. In this paper we examine both the costs and benefits of technology leadership for small colleges.¹

¹ Questions or feedback about the paper is welcomed and should be directed to Martin Ringle at ringle@reed.edu or David Smallen at dsmallen@itsmail1.hamilton.edu.
Institutional Characteristics and Technology

It is important to note that over sixty percent of all institutions of higher education have less than 2,500 students and that small colleges differ from large universities in numerous ways. One of the more important distinguishing characteristics of small colleges is the scarcity of resources they can apply to the pursuit of technology goals. While all institutions of higher education are challenged by the cost of technology, smaller institutions are unable to achieve the economies of scale available to large universities hence they are especially hard-pressed to provide adequate staff support, network enhancements, software customization, and equipment replacement to maintain campus-wide technological currency.

Of equal importance, however, is the fact that small colleges generally emphasize teaching and learning as central features of their institutional missions, while placing less importance on the role of faculty research. Even at selective liberal arts colleges, where the scholarly activities of the faculty are rewarded through tenure and promotion, support for new technology is rarely a top institutional priority. Research universities and other institutions, by contrast, take great pride in their applied research achievements and the creation, acquisition, or deployment of the latest technology.\(^2\)

In a climate of scarce resources and with technology a comparatively low institutional priority, it is not surprising that both the faculty and the administration of many colleges believe that this type of leadership must be found elsewhere. Indeed, when strategic questions about technology arise, small colleges commonly look to large universities for solutions.

The Problem with University Paradigms

The difficulty with seeking technology models elsewhere, however, is that solutions which are appropriate for institutions like Cornell University or the University of Washington do not easily scale to colleges such as Hamilton or Reed. This is true for almost every aspect of technology deployment and support, from methods of funding and equipment allocation to strategies for the development of administrative information systems. There are, of course, exceptions: a graphics workstation for undergraduate chemistry instruction may be equally suitable at Ohio State or Oberlin. In most cases, however, technological solutions at small colleges cannot be obtained by simply "shrinking" the approaches taken by large universities. The list of technical and organizational differences is a long one; consider just a few examples:

In a large university administrative data processing operations often support a multitude of fiscally autonomous and semi-autonomous organizations. The complexity inherent in these types of environments typically demands institution-

\(^2\)Some of the most widely used software packages in higher education were developed, with extensive institutional support, at research universities. For example: B.S.D. Unix (UC Berkeley), X-Windows (M.I.T.), Gopher (Minnesota), and Mosaic (Illinois).
specific financial management software and, not unexpectedly, a programming staff of considerable size. Small colleges, by contrast, tend to have unified, top-down financial organizations, which neither require nor can afford a large staff of programmers. As a result, small colleges tend to rely more on relatively low-cost, off-the-shelf, integrated packages that need little customization and (at worst) a modest-sized programming staff.

Likewise, consider the differences in networking. Computing organizations at large, multi-campus universities often view networking primarily as the provision of backbone services to a hegemony of "LAN fiefdoms." Promoting university-wide protocol standards and maintaining interfaces for e-mail packages and other inter-group software tools, is a full-time challenge. Small colleges, on the other hand, are far more likely to be responsible for designing and maintaining networking for the entire institution. Much of the large-university complexity brought about by interoperability demands is simply absent. As a consequence, many of the hardware, software, and staffing solutions suitable for a large university network are simply irrelevant to small institutions.

Further, universities have a long history of using technology fees and chargeback mechanisms to fund computing services, and restricting computing access to students in particular courses. These practices are foreign to small institutions which generally finance educational programs through tuition charges and institutional funds.

Thus in many cases small colleges must seek technology leadership within their own ranks, or look to collaborative relationships with universities or peer institutions for workable strategies.

**Some Opportunities for Technology Leadership**

Technology leadership defies precise definition. The most obvious type of leadership, the creation of new software or hardware technologies, is beyond the scope of most small colleges. Rarely can these institutions devote significant professional staff or financial resources to such endeavors. The result is that the impact of software development is usually confined to a small number of courses and disciplines at a modest number of schools. Further, hardware and software incompatibilities have limited the portability of such software to other institutions. Traditionally, therefore, the development of new technology has not been an easy avenue of leadership for small colleges.

The World Wide Web – The recent incredible growth of activities on the World Wide Web augurs a significant new opportunity for small colleges. Unlike earlier generations of software, preparation of Web materials may be accomplished without requiring a major investment in a large professional staff. The Web allows faculty at different institutions to build upon the work of others, often collaboratively, to...
enhance the learning environments for their students. This is a particular opportunity for small colleges because of their emphasis on teaching and learning. Further, the relative hardware and software independence of Web activities makes this collaborative process feasible for virtually any college. During the next two or three years, development of Web materials is likely to provide unprecedented opportunities for small colleges to exercise technology leadership, individually and in collaboration with others.

Curricular applications of technology – While large universities excel in many ways, most education professionals agree that the highest quality undergraduate instruction is found in small colleges. Using this as a foundation, small colleges can play a leadership role by finding ways to innovatively apply available technologies to enhance teaching and learning. A technology leader in this regard uses technological resources in new ways to address different learning styles, illuminate difficult concepts, accelerate the acquisition of knowledge, and prepare students for a lifetime of learning. For example, the Reed chemistry department has redesigned large parts of its curriculum to incorporate computational research tools. Molecular modeling packages such as SPARTAN and Midas, together with visualization software developed at Reed, are being used to enrich students’ understanding of basic principles of molecular behavior. Many other departments at Reed, from biology to classics, have used available software packages to promote a higher degree of independent student research.

Hamilton College has likewise been involved in curricular technology initiatives in a number of departments. Its economics department is using simulation software developed at the University of Arizona to help students learn about economic markets through multi-person games. A Hamilton anthropologist and his students participated in Project Solsys\(^5\) to design a space station by collaborating with students at other colleges via the Internet. And members of the Hamilton biology department have been using the BioQuest\(^6\) library, a compendium of computer-based tools, simulations and textual materials that supports collaborative, research-like investigations in biology classrooms and laboratories.

Institutional efficiency – Operating in an efficient manner helps to reduce the costs of achieving the institutional mission. The use of technology has become almost mundane in the daily operations of higher education institutions — we can’t imagine how we could do business otherwise. However, truly innovative applications of technology which redefine, in some sense, the way business is done, are still rare and characteristic of strong leadership. Technologies which enable us to do more effective student recruiting, to track prospective donors with more precision, or to analyze financial aid requirements more reliably, without adding staff, help colleges operate more cost-effectively.

At Hamilton, for example, career services has been substantially transformed by using Web technology. All recruiting opportunities for students are published on the Web. On an average day, more than 30 changes are made in contact persons, telephone numbers, deadline dates, etc.. Over the course of the semester, using the Web allows

\(^5\)Project SOLSYS is coordinated by Northern Arizona University.  
\(^6\)The BioQuest project is coordinated by Beloit College.
career services personnel to reinvest hundreds of hours of staff and student time while making information about recruiting available to students any time of the day or night. But perhaps, the most exciting change is Hamilton’s involvement in a cooperative venture to share the expertise of career services personnel – nationwide – through a Web effort called the Catapult. These activities not only promote efficiency, but improve the quality of services provided.

Access to electronic resources – While some traditional metrics, such as the total number of computers on a campus, may be little more than public relations fodder, the ability to provide students, faculty, and other members of the college community with excellent access to electronic resources presents a genuine opportunity for leadership. Institutions can achieve a good deal of recognition for providing high-speed, reliable, and secure network access from anywhere on campus, including offices, classrooms, labs, dormitory rooms, the library, and so forth. Increasingly, colleges are also providing friendly means of off-campus access to faculty, alumni, parents, donors, and others associated with the college. Swarthmore and Trinity University (TX) have both received national attention for their innovative approaches involving electronic services for alumni.

Organizational innovation – In an era characterized by so many changes and challenges, colleges need to have information technology organizations that are nimble, fluid, and maximally responsive to users’ needs. The days of isolated departmental units for academic computing, administrative computing, telecommunications, audio-visual technologies, library resources, and the like are gradually disappearing. Colleges are recognizing that all technologies and information resources need to be tightly coordinated in order to achieve optimal institutional strategies. Gettysburg College, for example, has taken a bold step in creating an organization where all library and technology resources report to a vice president for strategic information resources. While this may not be an appropriate solution for all small colleges, it does demonstrate technology leadership in the realm of organization.

Infrastructure – Creating and maintaining a modern technical infrastructure is a resource intensive activity, often beyond the means of small institutions. Even among institutions with considerable financial resources, the expectations for the quality of the hardware, software and networking environment often exceed the institution’s capacity. However, there are a number of strategies that small colleges can use to enhance the likelihood of distinction in the creation of an excellent infrastructure, and to maximize the institutional investment in it.

Controlling the diversity of hardware and software will minimize support costs, particularly the staff resources necessary to answer questions, provide training, and assist with upgrades. Adhering to established standards and mainstream products across the entire institution make it more likely that the infrastructure can be efficiently managed. These are particular opportunities for small colleges that are often unavailable to large universities.

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**Fiscal strategies for technology** — As any college financial officer knows, the cost of technology is one of the major "black holes" of the institutional budget. Colleges that establish creative ways of dealing with technology funding clearly have an opportunity to exercise significant leadership. For example, Hollins College provides a model of how to reduce the cost of campus networking by forming a partnership with a local cable TV provider. Institutions, like Reed, that have managed to increase the availability of computer resources while maintaining a constant technology operating budget level also play a leadership role.

**Benefits and Risks of Technology Leadership**

Pursuing a technology leadership position has both rewards and risks. Many small colleges pointedly avoid being in the technological vanguard and prefer instead to be "early followers" or simply to remain "near the median." We explore some of the potential benefits of pursuing technological leadership and then examine some of the risks associated with being on the "bleeding edge."

**Benefits**

**Enhanced learning environment** — Without question, the most compelling benefit of being a technology leader is to provide students with the best possible opportunities for learning. This is clearly the primary motivation behind Reed’s innovative use of technology in biology and chemistry instruction, of Mill’s use of advanced technology for music composition and synthesis, and of Hartwick’s practice of providing every entering student with a personal computer. If the overriding goal of a small college is to offer students the best possible environment for learning, then being a pioneer in instructional uses of technology can help to achieve that goal and thus to underscore an institution’s curricular strengths.

In the coming years, as enrollment and financial pressures on small colleges mount, it will become increasingly critical for these institutions to distinguish themselves from one another by more than geography, architecture, or cost; successful institutions will be those that are perceived as having particular unique — or at least highly competitive — programs in specific curricular areas. Some in higher education believe that in addition to having the best faculty, colleges will also need to have the best information resources and technology in order to justify claims about disciplinary strengths. They further believe that being a technology leader in this regard is — or will soon be — a prerequisite for instructional excellence, hence a key component for fulfilling one’s institutional mission.

**Campus-wide services** — Basic to the integration of technologies into the campus environment is providing excellent support services. Institutions can demonstrate technology leadership in the way they provide services that address important needs in the campus community. Thus, for example, Occidental College has provided students with a graphical utility for remote registration which is friendly, efficient, and radically superior to the traditional methods of registration. Others colleges that have reviewed the Occidental approach view it as a valuable model for the design of their own registration systems. Hamilton’s collaboration with Cornell University’s
Institute for Social and Economic Research (CISER) has provided faculty and students with access to vast social science databases and the expertise to use them — access and skills that would otherwise be unavailable in a small college setting.

**Attracting outside funding** – During the 1980s individuals, private foundations, and government agencies provided substantial funds to allow colleges to take advantage of new technologies. While the availability of such funding has declined, and competition for it has increased, there are still many opportunities to obtain sizable grants. Many technology grant decisions, however, are based on the likelihood that the recipient will be capable of doing something truly innovative and that other colleges will be interested in the results. Establishing a reputation as a technology leader, in almost any of the categories mentioned above, can help an institution to attract external funding. Reed, for example, by serving as a model of technology innovation among liberal arts colleges, has received millions of dollars in grants in the past ten years to underwrite substantial portions of its network, microcomputer labs, advanced workstation facilities, software acquisition, library automation system, and other electronic resources. Likewise, Hamilton (in conjunction with Colgate University) recently received a Mellon Foundation grant for infusion of information technology into modern language instruction. The award was based partly on each institution’s commitment to work collaboratively as a way to maximize the use of electronic resources.

**Developing favorable relationships with technology vendors** – A similar benefit applies to vendors of software, hardware, and services. While the prolific equipment grants of the 1980s, like foundation funds, are no longer abundant, there remain numerous opportunities for a college to acquire new technology at little or no cost by having a reputation as a technology leader. Recognizing the ongoing importance of "reference sites" among different sectors in higher education, vendors continue to be willing to make special allowances for schools that are perceived to be leaders in one area of technology or another. In addition to grants and deep discounts, technology leaders also benefit from favorable vendor relationships by learning of new products early in the development cycle and, in some cases, by having input into both product and marketing strategies. Technology leaders which are invited to participate in focus groups or educational advisory boards, or who serve as beta- or early-support-sites, may play a small but nonetheless important role in shaping the direction of future educational technologies.

**Recruiting** – Using technology to improve the learning environment, the quality of campus life, extra-mural funding, etc., may contribute to the ability of a college to attract and retain outstanding students and faculty. Several years ago, the claim that a decision of whether or not to attend or work at a particular college was based on the availability of electronic resources was most likely the product of a chief information officer’s overworked imagination. Today this is no longer true. At Reed, for example, prospective students (and their parents) frequently inquire about dormitory networking, electronic library resources, access to the Internet, etc., during the application process or a campus visit. Likewise, prospective faculty members often raise detailed questions about electronic resources they may require for instruction or research purposes. While a variety of other factors are undoubtedly critical to the decision of whether to attend or work at a particular college, the lack of sufficient...
technological resources may be instrumental in a decision not to attend (or work at) an institution.

Service to peers – Finally, we must recognize that when a small college investigates a new technology, organizational structure, or fiscal strategy it enables other colleges to evaluate the results without putting themselves at risk. In the words of a familiar truism, "it's a dirty job...but somebody's got to do it." By taking the lead in a particular area of technology, colleges help one another to define collective technical strategies.

Risks

Along with the opportunities and possible benefits of technology leadership come risks. Small colleges, in choosing an information technology leadership strategy, must do so with a full assessment of the possible risks — that is, with their eyes wide open. Given the constrained financial environments these institutions face, resources must be invested wisely, and technological applications are but one investment opportunity. Further, leadership is not an all-or-nothing concept; colleges have the choice to lead in some areas and not others.

Underestimating support requirements – The most fundamental barrier to technology leadership is the lack of adequate support staff. A robust infrastructure (e.g., hardware, software, networks), often a central part of a leadership environment, must be supported by substantial staff resources. These are usually difficult to provide when institutional staffing levels are constrained and institutions are trying to find ways to reduce operating costs. Institutions commonly focus on the creation rather than the maintenance and support of a campus infrastructure, since this is generally what foundations and vendors will fund. Seeking "soft" funding for leadership activities can encourage institutions to think of technology acquisitions as "one-time" expenditures. Vendors, unfortunately, encourage this thinking, since they are generally interested in the short-term promotion of their most recent products by the institution. The immediate result is often large infusions of hardware and software to campuses, with only short-term support from vendor personnel. The end result can be disappointment when continuing staffing needs become apparent.

Infrastructure needs are also driven by factors outside of the institution’s control. For example, the release of a new version of an operating system may create broad incompatibilities in the computing environments of colleges and universities. While ultimately, these changes may be beneficial to the institution, short-term problems can result. Since much of the new hardware (and related software) is ordered by colleges during the summer months, support staffs are forced to scramble to prepare for the arrival of machines that will not work with existing software applications and network operating systems. In many cases, institutions that standardize on a particular operating system to reduce costs have to deal with major problems just when an academic year is about to begin. The result is serious, sometimes overwhelming stress on support staff.

Finally, corporate mergers and takeovers, which have accelerated in recent years, can cause further instability in support costs. Institutions that make major investments in leading-edge hardware and software can find a company upon which they rely
taken over by another company or out of business entirely. The result can be a significant degradation or elimination of support.

**Haves and have-nots** – Targeted and substantial investments in technology leadership in one area of the college can create internal tensions if other areas do not feel well served. For example, technology leadership in the modern languages can create campus problems, if other areas, such as the humanities, do not have adequate support for basic operations such as Web browsing or electronic mail.

**Automation and cultural change** – A common risk of using information technologies to improve efficiency is that the focus will be on automation rather than redesign. That is, instead of analyzing administrative processes to make them simpler, more efficient, or more cost-effective, emphasis is placed on using technology merely to speed up existing procedures without considering their real usefulness.

Further, any effort to improve efficiency will result in cultural change. For example, using electronic mail and bulletin boards to enhance and simplify communication on campus requires participation by the entire community if full benefits are to be achieved. Some individuals will see this kind of change as undesirable, resulting in a less "personal" approach to providing educational services. Change is a disorienting process for many, and cultural change, especially at small institutions with long academic traditions, is particularly difficult. Managing that change carefully must be a primary consideration for institutions attempting to be technology leaders. If handled badly, such changes can result in a backlash that could seriously impede future technology innovations.

**Marginal investments** – Small colleges already have many of the characteristics of the ideal learning environment for students. In particular, these institutions provide small classes, opportunities for frequent and substantive interactions between faculty and students, opportunities for all students to be involved in co-curricular activities which complement classroom learning, and a variety of support services to assist student learning. These are among the most important reasons why students and their parents are attracted to these institutions. Applications of technology can provide opportunities to further enhance these characteristics. However, equating instructional excellence with information technology leadership is risky. The fundamental decision an institution must make is which areas of technology leadership are likely to improve the campus learning environment.

**Some Final Thoughts**

The competition for students among higher education institutions is fierce, and institutions have to balance their investments between technology and competing interests. Among these interests are: financial aid for attracting a diverse student body; improving salaries to attract the most gifted teachers, scholars, and support staff; creating an attractive social environment; and renovation or replacement of physical plant facilities to provide modern learning environments. While it is true that technology investments, at some level, are necessary to provide the tools necessary
for students to be prepared for life beyond college, decisions about which college to attend are far more idiosyncratic than analytical. A focus on technology leadership beyond a certain point may not be as important as other investments. It is well known, for example, that the quality of a student tour guide, interactions with faculty while visiting a campus, the social climate on a campus, and the sense of whether the student "fits" at the institution play major roles in the student's selection of a college. While a certain level of institutional technological sophistication is expected, and perhaps even sought, it is not the ultimate determining factor.

Major investments in becoming a technology leader must therefore be weighed carefully against the backdrop of other institutional priorities. Not every small college can or should be a technology leader and those that strive for technology leadership should bear in mind that being a leader is best pursued by excelling in a particular area (or areas), not by attempting to conquer every possible technological frontier. In the end, however, small colleges must seek leadership from within their ranks if they are to help one another find solutions to technological problems.