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Enterprise Systems in the Future of Higher Education

_The future is like heaven; everyone exalts it, but no one wants to go there now._
—James Arthur Baldwin

The preceding parts of this study demonstrate that enterprise resource planning (ERP) systems have played a remarkable role not only in the recent history of information technology management in higher education, but also in the history of higher education itself over the past decade. As John Curry of the Massachusetts Institute of Technology (MIT) put it, “Our task as administrators is to provide an effective, efficient infrastructure for keeping the administrative parts of the institution running.”

Curry knowingly understated the case. Indeed, higher education over the past decade has witnessed significant growth in the number of enrollments and in the amount of research it is expected to support. This growth trend is not likely to change, particularly for institutions located in Sun Belt states that anticipate massive increases in enrollment in the near future. In this light, efficiency and effectiveness equate to the ability of the institution’s administrative systems to support greater transaction volumes and to meet the business demands of both an increasingly entrepreneurial professoriate and those of regulators and stakeholders who will hold colleges and universities to account for their actions. These demands require the administrative systems to be robust, reliable, and flexible. The promise of enterprise systems, in the eyes of both the buyers and the sellers of these systems, was precisely about robustness, flexibility, reliability, and scalability.

Specifically, those who invested in new enterprise systems in the past seven years have believed that these systems provide a robust, flexible, and reliable foundation for their institutions’ core activities. Increasingly, knowledgeable implementers in higher education are describing new enterprise systems as standardized platforms to deliver both decision-making information and new and improved institutional services.

**A Standard Launch Pad**

Clearly, robust performance, application integration, technical reliability, and scalability were the touchstones of near-term success. For many, this success was defined narrowly and practically. Do the systems work? Is payroll accurate? Do key processes meet the institution’s basic audit requirements? Are these qualities and performance attributes enough? The answers are mixed.

For some institutions, the renewal of the institution’s administrative information, pro-
cesses, and systems is justifiable solely on the basis of prudent risk management. As University of Washington Executive Vice President Weldon Ihrig observed, “If we did transactions today the same way we did them 10 years ago, I’d have 465 more people working for me. You can look at it as cost avoidance for future growth, so you can handle more without the same rate of increases in staffing. Going back 10 years and trying to measure the number of people employed then shows that today the same or fewer number of folks are able to handle a larger number of transactions.” California State University Executive Vice Chancellor and CFO Richard West put it another way: “While we are not efficient organizations by traditional [economic] definitions, there is value in the way higher education works. One aspect of the ERP investment is simply thinking in terms of capital replacement. Just as with new classrooms, the cost is lower to replace now than it is to defer action into the future.”

All of those who are selling—and many of those who are implementing—new enterprise systems believe that in addition to mitigating the risks of system failure or modernizing higher education’s capital stock, renewing this technology base is the foundation for potential changes in how higher education accomplishes its mission from an administrative viewpoint. ERP provides a set of tools that empowers people to change the way they do their work.

Seventy-eight percent of ERP implementers responding to the survey agreed or strongly agreed that their new ERP systems “will cause more processes to be integrated, with a high level of data integrity.” When asked what changed as a result of the ERP implementations, 69 percent of the respondents noted that central, departmental, and college workloads had increased. Also, 66 percent believed that the nature of the work had changed significantly. There are new divisions of labor and dependencies within the institution and between central and departmental offices. There is a need for a higher level of technical skills and, concomitantly, a greater need for ongoing and timely training. There is an expectation of a greater level of decision making locally, which is tied to expected service improvements. Further, 64 percent of the respondents agreed or strongly agreed that the ERP system “will become an excellent decision support tool that will be used extensively by management,” and 55 percent agreed or strongly agreed that they are “finding new and innovative uses for the ERP system which had not been anticipated” when these projects were started.

Eric Stine, director of higher education sales for SAP, concurred: “Currently ERP is viewed simply as a platform—technology as an end in and of itself—to power basic administrative processes.... We are moving into an era where the university community will build on that platform. The result will be technology as a means to an end—a way to more efficiently, effectively, and profitably achieve long-term goals.”

Viewed in this way, the investment in renewing enterprise systems can simultaneously reduce the risk of technical obsolescence and, for some, position the institution for change. While many of higher education’s preeminent implementers of packaged ERP systems in the past seven years have concluded that it is better to implement a program of process reengineering after implementing a relatively unmodified software code set, these leaders have not abandoned the idea of enterprise systems as enablers of significant institutional change. As Curry put it, “ERP in the 1990s was an opportunity to make a step up [in capabilities], rather than continue to evolve.”

New York University Associate Provost and CIO Marilyn McMillan aligned the in-
crements with the steps: “We want to be able to transform the institution. When I say that the purpose of modernizing the enterprise systems is to keep the institution running, I mean, as it transforms itself.” This observation is critical for those colleges and universities viewing themselves as adaptive organizations. Institutions of higher learning have survived in recognizable form for more than a millennium. This survival is due precisely to the institutional capacity of colleges and universities to adapt to changing circumstances, academic priorities, economic pressures, and political contexts. Adaptation, in this light, is as McMillan described it: the process of ongoing renewal and transformation.

From an institutional point of view, then, the renewal of higher education’s administrative information systems is often characterized as a process of
◆ immediate-term dislocation and destabilization,
◆ near-term restabilization, and
◆ intermediate-term positioning.

From this perspective, the investment in ERP is neither revolutionary nor transformational. It is an investment in risk reduction, in cost avoidance, and in laying the foundation for potential institutional change.

Chapter 4 emphasized that an ERP implementation was as much or more about people than technology. The same holds true for the future. Once institutions have implemented new technology platforms, the challenge is not only to sustain those systems but to find new ways to effectively use them. And much of that task is adapting and creating new business processes to serve the mission of the universities and colleges.

Consistent with Yogi Berra’s observation that “the future ain’t what it used to be,” higher education’s expectations of ERP are not what they used to be. These expectations have ranged from the “Y2K solution” to “new technology foundation” to “engine of institutional transformation.” These disparate definitions and expectations make it difficult for those who implement these systems—and those they report to—to evaluate the success of these efforts in a consistent fashion.

The failure to understand the investment in enterprise systems in these ways has led to some failures to manage institutional expectations of these investments. It also creates a perception either that there is no way to discuss the possible return of these investments or, worse, that there is no institutional return at all. In these ways, investments in enterprise systems truly do conform to models for the replacement of other capital assets, notably buildings. In the short term the construction or renovation of a building disrupts the campus, changing pedestrian pathways, creating safety risks, or even taking valuable campus space out of useful inventory. The opening of new or remodeled buildings restores basic functionality to the institution, albeit at diminished capacity initially, as occupants learn to use the new space in new ways. Finally, investments in new buildings create the potential for new instructional or research breakthroughs. Note, new research laboratories do not create great science. They enable great research. Similarly, new enterprise systems do not themselves create great institutional administration. Instead, new commercially acquired enterprise systems—in the short run—accomplish six critical objectives. They
◆ reduce the risk of near-term obsolescence;
◆ standardize institutional data and transactions;
◆ force a disciplined program of updates, modifications, and compliance-driven enhancements;
◆ position the institution for changes in scale;
◆ position the institution for externally in-
spired innovations in technology and/or process; and
◆ spread the cost of innovation across the vendors’ entire customer base, reducing costs on an apples-to-apples basis if not on the basis of total costs of ownership.1

Of course, officials at the University of California at San Diego, the University of Texas at Austin, the University of Washington, and other leading institutions that have chosen not to implement packaged ERP systems are correct to point out that the achievement of these objectives comes at a price:
◆ A program of ongoing system investments may better reflect the income needs of suppliers than the needs or spending capacities of colleges and universities.
◆ Vectors of change that are externally inspired may or may not translate in higher education.
◆ Potential loss of opportunity to invest in other elements of the overall IT environment might result.
◆ The institution’s destiny becomes uncomfortably interlocked with the destiny of its software suppliers in unprecedented ways.

In essence, investments in ongoing upgrades and maintenance, in the context of vendor information systems, cease to be discretionary investments. From many perspectives, such as those of an institution’s business officer and those responsible for these systems, this shift is an important one—and generally a good one. If funded, this new fixed obligation eliminates the deferred maintenance of institutional information systems. Such funding can also provide a means of leveling off costs from year to year, preventing the ballooning of costs for major enhancements that can arise from institutionally maintained applications. From the other perspective, the reliance or dependence on the vendor marketplace can jeopardize an organization’s ability to defer system maintenance in favor of other, potentially more important, institutional priorities.

Standard Launch Pad for What?
The capital replacement/risk management rationale for higher education’s aggressive investment in new enterprise systems is widely understood by the business officers and information officers who drove these initiatives. While most agree with Contra Costa Community College Chancellor Chuck Spence that “implementing these systems typically means that one takes one step backwards in order to move two steps forward,” there is less agreement or shared understanding about the nature of the leap forward that these new systems will enable. This lack of shared understanding is natural, since the vectors of change that individual colleges and universities choose will reflect many variables unique to those institutions, such as competitive standing, financial and managerial wherewithal, history, stakeholder politics, leadership, and so on.

Notwithstanding these idiosyncrasies, common themes about the future of higher education and its enterprise systems do emerge. Metaphors abound, including
◆ the integrated academy/collaborative governance,2
◆ the boundary-less and mobile enterprise,3
◆ new business architecture or information organization,4
◆ adaptive enterprise,5 and
◆ the accountable and continuously improving academy.

These organizational metaphors, while different in their particulars, envision a technology-enabled service environment that empowers the organization’s key stakeholders (customers, students, faculty, staff, parents, legislators, governing boards, and others) by providing easy access to accurate,
current, and meaningful information. These metaphors also have in common a number of service attributes and strategies:

- self-service,
- personalization,
- mobility,
- integrated data and services,
- accountability,
- easy access to information,
- information utility,
- nimbleness and flexibility, and
- security.

These attributes in turn call for the creation of loosely coupled organizations that accomplish their purposes by rapidly and nimbly adapting to opportunities and threats. Adaptable organizations are often conceived as self-correcting systems integrated by common purposes through the stakeholders’ continuous and secure access to enterprise information.

To the extent that these metaphors and attributes describe in part higher education’s evolving service-delivery vision, the technologies that support this vision represent the institution’s evolving enterprise technology vision. In this context, ERP assumes a richer and better contextualized meaning than in the 1990s. Developing the full potential of the enterprise system investment in this decade is more a matter of leadership and organizational culture. The evolution of institutional culture, processes, and systems might be summarized as in Table 5-1.

Table 5-1. Evolution of Enterprise Systems and Practices

<table>
<thead>
<tr>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
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<tbody>
<tr>
<td>Centralized services</td>
<td>Decentralized services</td>
<td>Confederated services</td>
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<td>Information on schedule</td>
<td>Information on demand</td>
<td>Information in anticipation</td>
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<td>Integration via interfaces</td>
<td>Integration via integrated</td>
<td>Integration via data</td>
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<tr>
<td>among systems</td>
<td>systems (ERP)</td>
<td>(Web Services) independent of</td>
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<tr>
<td>Information is scarce, is the</td>
<td>Information is plentiful but</td>
<td>systems</td>
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<td>source of power, and is</td>
<td>complex as shadow systems</td>
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<td>rationed</td>
<td>proliferate and support</td>
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<td>decision making</td>
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<tr>
<td>One-size-fits-all services</td>
<td>Telephone and Web-based</td>
<td>Tailored services mapped to</td>
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<td>mapped to campus organizations</td>
<td>services mapped to organizations</td>
<td>how institutional stakeholders use services</td>
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<tr>
<td>Culture of compliance</td>
<td>Post-processing transaction</td>
<td>Process models and simulations, performance dashboards, and balanced scorecards support accountability and continuous improvement</td>
</tr>
<tr>
<td>demands multiple process</td>
<td>notifications and</td>
<td></td>
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<tr>
<td>checks, slowing process</td>
<td>authorizations enhance</td>
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<tr>
<td>cycle times and increasing</td>
<td>process flows</td>
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<td>transaction costs</td>
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<tr>
<td>Tailored software</td>
<td>Standardized software</td>
<td>Software components that can be integrated to yield tailored solutions</td>
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If hardware can be likened to the camera, then enterprise software can be thought of as the lens, which can magnify, reduce, color, and enrich the objects of investigation; that is, the data or services. Of course, the camera and its lenses are only tools. The leadership challenge for higher education is to answer the question, Who is the photographer?

As technologies improve, the future of enterprise systems in higher education will be shaped and bounded, more than ever, by leadership imagination and by the ability of institutional service providers to span boundaries and to work in new collaborative arrangements. Indeed, while the motivational focus of institutions that implemented new ERP systems in the 1990s was largely capital replacement and renewal, much of the literature suggests that in the first decade of this century higher education will focus on

◆ continuing efforts to improve services to students, faculty, staff, patients, and other stakeholders;
◆ organizing these services and systems to liberate the consumer from temporal and geographic constraints and from the service provider’s office of origin;
◆ exploiting the untapped functionality of the ERP systems;
◆ extending the usefulness of the ERP systems with new technologies such as portals, workflow, and others;
◆ pursuing standardization of systems, transactions, and institutional processes;
◆ establishing institutional performance frameworks and metrics and aligning ERP systems to produce meaningful performance information;
◆ expanding data warehousing and reporting capabilities generally;
◆ aligning staff and training to the new organizational, technical, and service realities; and
◆ rethinking the institutional vision, governance structures, and new organizational (and interpersonal) interdependencies.

The Integrated Academy and Collaborative Governance

As many colleges and universities either complete the implementation of new packaged ERP systems or develop robust Web interfaces to existing systems, one significant area of attention in the near term is the integration of institutional information and services. In many ways, the 1990s and the ERP movement can be characterized as an era that promised integrated systems. As these systems are implemented, as they mature, and as new capabilities such as Web services begin to allow disparate systems to become more loosely coupled, the dialogue is shifting from one centered on integrated systems to one centered on integrated services and integrated data.

Indeed, as recent data from the Campus Computing Project show, while many campus technologists continue to focus on how to finance the replacement of aging equipment and on upgrading the institution’s administrative systems, more are beginning to focus on aspects of integration, particularly on the integration of IT into the classroom (see Figure 5-1). In only three years, Kenneth C. Green’s data show that the percentage of higher education courses using course management systems has risen from 17 percent to 33 percent at both public and private universities.

The integration of institutional services in new ways has become a major focus of activity. University of Delaware Director of Management Information Systems Carl Jacobson described exciting possibilities of Web services as “a class roster service that provides class rosters to online grade books...
and campus-wide learning management systems, or a student loan tracking service that allows students to monitor the status of guaranteed student loans. In the current technology environment, it is possible to deliver traditional campus services in radically new ways. Take, for example, the bookstore. The question for many is whether campus stores should acquire new relevance by developing online, Web-based approaches like Amazon.com. From an integration perspective, the answer may be no. Campus bookstores have neither the scale, purchasing clout, brand power, nor technical know-how of Amazon and other online booksellers. What the bookstore of the future can do to prosper is to form new relationships with those providing core student services. With these internal alliances, we can anticipate the emergence of something unique, valuable, and highly integrated from the viewpoint of the student. When a student finishes registering for classes, he or she can immediately be offered the opportunity to browse or buy new or used books through the campus portal. When books are ordered, the student’s account can be debited, and the books can arrive on his or her doorstep the next day. Of course, this will demand more than new systems. This will require a realignment of the relationships among campus service providers and their relationships with their customers. While this example is personalized by the portal, its potency really lies in the integration of the enterprise student system with local systems operated by the campus store.

Internally, colleges and universities, particularly research universities, are often likened to medieval fiefdoms overseen by powerful deans. In larger institutions, and particularly in research-intensive universities, academic schools and colleges maintain a variety of locally operated information systems (admissions, registrar, grants management, and so forth) that support primarily locally operated institutional processes. Enterprise systems—and particularly the emergence of Web services—make it possible for institutions to create new confederated services based on the enterprise management of data and the consensual integration of central and unit systems and processes.
As suggested in Figure 5-2, the example of today's bookstore—even when highly automated—is an example of locally owned data and locally owned processes. Sales, marketing, cashing, inventory, order entry, and other store processes reside on locally developed systems and interact with the central campus only insofar as financial data is moved to the campus general ledger. In the future, it is possible that data and systems can be confederated under imaginative leadership and emerging technologies in ways that will enable the deployment of new customer friendly and highly integrated services.

Such leadership imagination, technical leadership, and standards-mediated confederalism will also enable rosters to interoperate with grade books and learning management systems in the ways that Jacobson envisioned. Of course, the key integration that will likely occur over the next period will be the integration of systems, data, and services related to students' roles as learners and to faculty members' roles as teachers and researchers.

Technologies Supporting Integration and Collaborative Governance

Integration is the compelling reason for higher education’s current and ongoing preoccupation with portal technology. Portals represent the technical and—from the consumer’s viewpoint—navigational framework that integrates institutional information and services. Integration of information is also accomplished through large-scale efforts in data warehousing and online tools to support decision making. These techniques leverage the ERP systems’ tendency to rationalize institutional data by making data from disparate systems easily accessible in forms that reflect the new interdependencies associated with most college and university activities.

The Boundary-less Enterprise

Another of the dominant organizational metaphors impelling investments in enterprise information systems is that of eliminating boundaries. When Internet2 President and Chief Executive Officer Douglas Van Houweling accepted the EDUCAUSE 2002 Award for Excellence in Leadership, he remarked, “I have been fascinated with technologies because of their potential to expand boundaries and to eliminate barriers.” The idea of the organization without boundaries was popularized by Jack Welch of General Electric. In fact, a goal of most highly networked service organizations is to render boundaries of distance and time irrelevant except to the extent that these attributes
of a given service add value from the consumer’s standpoint. In higher education, time and place have long been dominant elements of service delivery. At the University of Minnesota, for example, the student services departments created “one-stop student services” to enable students to conduct their services in the most convenient manner. It was a 180-degree switch from the harried days of students navigating uncoordinated administrative department hours and deadlines.

As new technologies, service-delivery strategies, and efforts at integration mature, and as boundaries dissolve, leading visionaries anticipate moves from scheduled, periodic broadcasts of campus information (such as newsletters or month-end closing statements) to information on demand. One goal is to eventually create an information utility in which intelligent network agents retrieve the readily available information in forms and on schedules that meet the needs of college and university stakeholders. Just as airlines now transmit changing flight information to voicemail boxes, personal digital assistants (PDAs), workstations, fax machines, and elsewhere, college and university service providers will organize technologies and services to provide up-to-the-minute information and services to their stakeholders. In this context, members of the institutional community can look forward to dynamic systems that feed critical pay, benefits, parking, financial aid, loan balance, and other information needed for students, staff members, or faculty members to do their work on a 24 x 7 basis.

**Technologies Supporting Boundary-less or Mobile Enterprises**

Eliminating boundaries and increasing mobility are the compelling reasons for higher education’s current and ongoing preoccupa-

**The New Business Architecture**

New enterprise systems and allied technologies also provide the foundation for what some describe as new business architecture. The University of California’s new business architecture “recognizes the need for a new framework for its business operations, one that focuses on the critical role of individual staff [members] in delivering services to the university. It outlines a new work environment. . . .”

This organizational vision integrates elements of other visions and organizational metaphors:

- a collaborative environment where staff have ready access to the tools necessary to do their jobs efficiently and effectively;
- a workplace that allows staff to maintain high levels of job satisfaction while providing the highest levels of customer service; and
- an environment where technology solutions minimize time spent processing mundane, routine transactions.

The University of California’s vision recognizes and codifies a number of interdependent components. While this vision recognizes the need for standard technologies to integrate institutional data and to deliver key information, and new technolo-
gies to contain costs, provide for e-business, and to enhance the security of the network, the vision also recognizes the need to
◆ simplify complex institutional processes;
◆ establish the institution as a competitive employer; and
◆ embed performance metrics into the way the institution conducts its business.
Central to this vision is the ability to integrate knowledge, transactions, and training via intuitive navigation to optimize staff productivity and success.

Figure 5-3 illustrates the new business architecture envisioned by the University of California.11

Technologies Supporting the New Business Architecture

Not surprisingly, the new business architecture, which rests on a foundation of simplified processes and personalization, depends to a great extent on portal technology, Web enabling of institutional processes, Web content management, and workflow. In the specific case of the University of California, or of the University of Washington’s similar vision of an information-based service environment, this vision depends more on a variety of strategies to simplify and integrate institutional data than on the existence of integrated ERP systems per se. Achievement of this vision also depends on progress in the development of single sign-on capabilities, network security, and identity services within and between enterprises.

The Adaptive Enterprise

As stated earlier, colleges and universities are quintessentially adaptive organizations, persisting in generally recognizable form for more than a millennium. However, the idea of organizing the institution’s information and technology to enhance organizational adaptability is relatively new. William Fulmer described success in today’s competitive context as follows: “Companies that are successful on a rugged landscape not only try to simplify the process and adapt it to fit the landscape but are constantly evolving the system.”12

Key elements of adaptive organizations are the
◆ ability to identify and recognize opportunities and threats;
◆ agility to react to opportunities and threats;
◆ ability to learn; and
◆ ability to reconfigure services and business processes quickly.

While the faculty of colleges and universities have adapted effectively to new op-
opportunities (evolving disciplines, sponsored research, e-learning), the administrative apparatus of most institutions is slower to change. Subscribers to the vision of the adaptive organization argue that information technologies are creating an environment in which the rate of environmental change is accelerating. As a result, the need for the college and university administrative apparatus to adapt more quickly and more often to changing opportunities and threats is clear.

Technologies Supporting the Adaptive Enterprise

ERP systems are an essential element of adaptability insofar as the implementation of these systems presupposes the hard work of rationalizing both the institution’s data and the business rules that render the institution’s business practices transparent. Well-integrated data and well-defined and accessible business rules make business changes possible.

Much attention about the future also focuses on the description and directory standards that comprise Web services. The great promise of Web services is to make it possible for software from different operating systems, programming languages, and environments to communicate with each other and to be combined to achieve more complex operations.13 Simply stated, this vision of interoperability describes architectures that fit together like building blocks.

The ability to adapt—from a technical standpoint—also will depend on the organization’s ability to develop information that is both easily accessible and self-evident. This strategy is an essential element of the new business architecture described above. Data warehouses, decision support tools, simplified policy structures, and specialized knowledge bases are elements of an essential learning infrastructure for both service providers and service consumers.

Finally, higher education will likely invest in a variety of tools designed to foster and facilitate online collaboration as part of this overall strategy of fostering the institution’s ability to learn and, therefore, to adapt.

The Accountable and Continuously Improving Academy

It has long been observed that many public institutions—including colleges and universities—have been recharacterized in the minds of both citizens and those who govern them. The core of this recharacterization is a shift from the idea of a postsecondary education as a public good, even a public right, to one in which colleges and universities must demonstrate value for money like other sectors of the economy. This powerful trend appears nearly everywhere and in a variety of forms:

◆ quality rankings of all kinds in the popular press;
◆ a state-by-state report card for higher education;14
◆ increasing public scrutiny of the cost of education;15
◆ potential movement toward principle-based accounting standards by the Financial Accounting Standards Board (FASB);16
◆ profound changes in accreditation processes, including the shift toward accountability for performance of stated goals and incorporation of continuous improvement techniques from the Malcolm Baldrige assessment protocol;
◆ emergence of new performance management, performance dashboards, balanced scorecards, and management simulations; and
◆ increasing focus on student learning outcomes.

While this topic is too complex to treat comprehensively here, it is worthwhile to signal two important possible shifts: (1) from
an administrative culture of anecdote to a culture of evidence (management by fact); and (2) from a focus on the study and management of economic inputs to a focus on mission-related outcomes (for example, value for money or return on investment).

**Management by Fact**

Colleges and universities have been described as "amiable, anarchic, self-correcting collectives of scholars with a small contingent of dignified caretakers at the unavoidable business edge." The rugged landscape in which modern colleges and universities operate and the increasing scrutiny and demands for accountability make it impossible for today's leaders to serve as dignified caretakers.

Three reasons dominate higher education's historic propensity toward decision making by anecdote: (1) stakeholder politics; (2) lack of a professional administrative cadre; and (3) lack of timely and reliable information in formats that can be used to support decisions. Information technologies are unlikely to affect how stakeholder politics factor into institutional decisions. At the same time, colleges and universities have evolved strong professional cadres in the administration, even though—at the top—professional acumen is still acquired on the job more often than not. The third driver of higher education's historical penchant for decision by discourse has the potential to undergo radical reform in the decade ahead.

One of the chief benefits reported with the renewal of higher education's enterprise systems has been the major progress achieved in rationalizing the institution's data. Standardizing and normalizing the institution's data now make it possible for institutions to enter data once and to use that data many times. Combined with strong editing abilities and process controls, this capability addresses the issue of data's reliability to a considerable extent. The move from cumbersome batch processes to near real-time processes to a great extent addresses the issues surrounding the timeliness of information. Reducing these barriers is the precondition for creating environments that can and do meet decision makers' needs for information on their terms.

Progress in data management coupled with the deployment of new tools and techniques for using data, analyzing it, modeling it, and describing it is likely to be a dominant element of the institutional landscape in this decade. Combined with leadership development activities that emphasize both the tools and techniques and the benefits of shifting managerial behaviors could contribute to a significant shift in how leaders discharge their roles. New leaders, of course, will be strongly motivated by trustees, legislators, donors, accreditors, and others who will simply expect them to have mastery of key institutional information.

One of the leading examples of this may be a harbinger—the admissions function. Wayne Sigler, director of admissions at the University of Minnesota, described an information-intensive environment: "We are not as process oriented [as other campus activities]. At the end of the year, we have to show results." These results must be precise. "Coming in under target is expensive and almost unacceptable," he stated. "Coming in too high creates space and housing problems." Enhanced data warehousing and predictive modeling make it possible for admissions processes to be more precise. These capabilities will also enable institution-wide programs for tracking and monitoring at-risk students to enhance student retention and to optimize the institution's use of classroom space, parking capacity, and other key drivers of cost.

Taken to the next level, good information in concert with good tools can be placed directly in the hands of key stake-
holders. The University of British Columbia has taken the idea of self-service to new levels and is now using such resources to enable prospective students to be self-admitted to the university.

**Outcomes Orientation**

Expressed in many ways, return on investment or value on investment is clearly going to be a more central issue for senior management, trustees, parents, and legislatures in the next stage of ERP development. Administrators at all institutional levels will be expected to characterize the performance of their actions in terms of efficiencies gained, enhanced effectiveness, demonstrable gains in student and other stakeholder satisfaction, and/or reduced institutional risk. This pressure toward accountability for outcomes will apply to investments in information technologies as well.

Too often, senior management expects to gain value from an ERP system implementation as soon as it is installed. What this study’s data show is that most systems do not provide a return on investment until they have been running for some time and only when the business leadership can make improvements in the business processes affected by the newly installed systems.

Ken Orgill, CIO at West Virginia University, captured the problem. “The university executives were chagrined at the lack of savings, but we did not limit their expectations initially,” he said. “The system did free people up. For example, I have four or five data-entry staff who we retrained and moved to other areas. We gained productivity, and on top of that, we gained functionality over the previous product. We could do more with the system, and by the same token we couldn’t cut FTEs [full-time equivalents].”

Bill Graves, vice chairman of the board for Collegis, described the search for technology’s value in educational terms: “The challenge inherent in the inexorable trend toward self-service is to redesign the form and substance of high-touch human interaction throughout the educational process from the classroom to the administrative office. That challenge is key to creating . . . societal and private educational benefits derived from technology-enabled increases in the effectiveness and efficiency of expert human intervention in the educational process.”

In order to get a return on investment or to derive this value, the business owners of the ERP application must be able to use the capacities of the technology to

◆ reduce, eliminate, or transfer costs through a lowering of headcount and/or a reduction in transaction costs—outsource, eliminate duplication, and/or reduce the need for facilities;

◆ increase revenue through planning and better management tools that can help deliver a higher yield, gain access to new markets and products/services, or achieve higher productivity; and

◆ avoid new costs for existing or new services and functions, often through a transfer of effort (work shifting to better utilize fractional FTEs).

California State University (CSU), for example, devised a framework, “The Integrated Technology Strategy: Measures of Success,” in 1999 in response to questions from the legislature on how that university system planned to measure progress on its ERP implementation. For the next 10 years, CSU is committed to report back to the legislature on the ERP and other IT initiatives.

Again, a major advantage of the new ERP tools is an increased capacity to do reporting. Combined with a data warehouse that brings together information previously stored all over the institution, the reporting capability makes it possible to provide management with business analytics or perfor-
mance information needed to make decisions or take action. At the University of Minnesota, the strategy was to build a portal with reporting features for decision makers that would

◆ provide measures that relate to critical issues, such as graduation rates and retention, and which are proactive in the sense that they signal and can help prevent future problems;
◆ communicate to line officers levels of present and historical institutional performance; and
◆ include a capacity to attach comments and send an e-mail about performance.

In the future, critical planning and management information of this nature is likely to flow continuously into role-based performance dashboards so that provosts, deans, department heads, vice presidents, and trustees can get a continuous view of institutional performance against those indicators and measures that best reflect their viewer’s scope of responsibility.

As institutions gain distance from the productivity drain associated with implementing new enterprise systems, real savings are being realized. CSU’s West noted, “The nature of technology networks has changed the way processes like registration and purchasing occur.” Concrete examples abound and will likely grow in the coming years. The rationalization and standardization of procedures and policies is contributing—at some institutions—to improved efficiencies, for example, reducing the number of grading systems or simplifying and automating record holds.

The real dilemma for many institutions, particularly research universities, is to capture these savings centrally. According to MIT’s Curry, “Since we are not in hierarchical organizations, meaning we [central functions] don’t control personnel decisions and business processes at local levels, and since we cannot require that field offices reorganize, it is hard to capture savings. It’s the hardest thing we do. When we did business process maps, and looked at the monsters that filled the wall, pulled out the redundant steps, and priced the original processes ‘per widget purchased,’ we learned that we needed pieces of parts of people. We needed to regroup the field, and we couldn’t do it. So we couldn’t realize the savings, unless you viewed savings as that piece of a person that was freed up to do more productive work. When we took internal transactions, like keypunch, and moved data entry to the field, we found that net savings weren’t great either once you factored in the new cost of added system administrators and license agreements.”

Technologies Supporting the Accountable and Continuously Improving Academy

An infrastructure that supports a culture of management by fact and outcomes orientation is one in which information is accurate, timely, easy to access, and situated in meaningful contexts. Creating institutional alignment and agreement around such contexts is more complex than the issues related to technologies. Whether the emerging contexts are driven by FASB or by Government Accounting Standards Board (GASB) reporting requirements, or by accrediting agencies, Baldrige protocols, balanced scorecards, or management dashboards, institutions will benefit from enterprise systems, information portals, data warehousing techniques and technologies, and decision support tools. As mentioned, those responsible for managing college and university resources are likely to expect information from a variety of enterprise, local, and extramural sources. Such information will need to be synchronized and displayed in easy-to-reference ways that permit future leaders to understand how their
portion of the enterprise is performing at any given moment and how that performance is aligned with broader institutional performance objectives.

**An Evolving Technology Architecture**

Those survey respondents implementing new packaged ERP solutions in the past seven years are clear that ERP is one element of an evolving technical architecture to support the described notions of flexibility, adaptability, accountability, boundarylessness, and integration. Other related elements of this population’s near-term action agenda are broad in scope and immediate in time frame. Foremost, this group of ERP adopters is working to finish the job—that is, to install those ERP modules not yet installed at the time of the survey’s deployment. Interestingly, few appear to be undertaking the so-called “front office” reengineering associated with customer relationship management (CRM) technologies, and a large majority (60 percent) are committed to implementing “same breed” software as they extend the reach of new enterprise systems. Only 11 percent of those who have implemented new ERP systems recently plan to substitute vendors for new ERP implementations planned within a year. Figure 5-4 shows the percentage of ERP implementers who are completing, extending, or implementing these technologies within a year.

Together, the technology activities taking place suggest strongly that campus technology leaders are setting the stage for the kinds of changes in process and operations that their institutions may choose. This idealized architecture20 defines an important role for this wave of enterprise administrative systems and sets the stage for the integration of those systems with enterprise academic systems, local systems (like the campus bookstore), and eventually with evolving personal systems, like e-portfolios.

In this vision of the future, enterprise sys-
tems that have historically been limited to administrative applications such as student, HR, and financial applications are supplemented by, and integrated with, academic systems such as learning management systems, library systems, course management systems, and others. To connect people to these institutional resources, new technologies are being developed and deployed, including (1) portals—to personalize information and services; (2) identity services such as directories and middleware—to further support personalization and to secure institutional and personal assets; (3) networks, including local area networks (LANs), wide area networks (WANs), and wireless networks; (4) messaging and data mapping technologies to support enterprise integration; and (5) tools such as data warehouses, report servers, and online analytical processing (OLAP) to make real-time information accessible, intelligible, and meaningful to communicate to stakeholders. This complex of information technologies is being organized today to support an environment in which institutional services and information can be invoked in a personal and continuous fashion through a variety of devices, including workstations, handheld computers, cell phones, telephone call centers, voice response systems, and so on. This complex and highly interconnected environment can be described by the concepts in Figure 5-5.

**Figure 5-5. Future View of Processing Transactions***

<table>
<thead>
<tr>
<th>Students</th>
<th>Faculty</th>
<th>Staff</th>
<th>Alumni</th>
<th>Prospects</th>
<th>Community</th>
<th>Suppliers</th>
<th>Affiliates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Presentation Layer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Personalized • Anytime, Anywhere Access • Role-Based Presentation • Web Browser • Telephone/Call Center • Handhelds • Wireless Devices • Smart Cards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Security</th>
<th>Portal</th>
<th>Network</th>
<th>Reporting</th>
<th>EAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Single Sign-On • Enterprise Directory • Role Based • VPN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Role Based • Personalization • Cross-Platform • Cross-Application</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• LAN • WAN • Internet • Wireless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Analytics/OLAP • Ad Hoc Query • Report Server • 'Canned' Report</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Data Mapping • Messaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic</th>
<th>Administrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Advising • Course Management • Library • Research</td>
<td></td>
</tr>
<tr>
<td>• Admissions • Financials • Financial Aid • Fundraising • Grants Management</td>
<td></td>
</tr>
<tr>
<td>• HR • Procurement • Registration • Student Records</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operational Data Store(s) • Data Warehouse • Institutional Content • User Data • User Preferences</td>
</tr>
</tbody>
</table>

* In this figure, VPN stands for virtual private network and EAI for enterprise application integration.
The Leadership Challenge

The qualitative and quantitative data from this study suggest that many of higher education’s information technologists have largely succeeded in implementing new enterprise systems, despite the inherent complexity of this task and, in some cases, the immaturity of the technologies implemented. This success is largely tactical and expressed chiefly in terms of the technical goals of replacing aging systems and updating technical architectures. Based on the status of other activities being undertaken by survey respondents, many technologists view ERP as only one large and important piece of an overall and evolving technology architecture that will support e-business and e-education in the future.

The data also strongly suggests that higher education’s ability to realize much of the promise of these investments (in terms of adaptability, accountability, the erosion of boundaries, and so forth) depends on issues related to institutional culture and, in particular, to change management. In the future, as in the past, information technology can be and will be an enabler of important changes both in the delivery of higher education’s core activities of teaching, research, and service and in the delivery of educational and business services. As in the past, it will be higher education’s business owners—the deans, department heads, and executive officers, working in concert with the academic leadership—who determine how these new capabilities become institutionalized. As so often the case, the interplay between technological challenge and cultural response will likely determine both the vector and the rate of change. Visionary and imaginative leadership will exploit the inherent advantages of higher education’s new information technology architecture and, in the decade ahead, will begin to realize Graves’s vision of the “societal and private educational benefits derived from technology-enabled increases in the effectiveness and efficiency of expert human intervention in the educational process.”

Endnotes

1. While the unit cost of a vended enhancement—for example, software to handle compliance with the Student and Exchange Visitor Information System (SEVIS)—is lower than if an institution had to bear this cost alone, total cost of ownership in vended systems includes the cost of innovations and capabilities that may not be needed and that presumably would not have been borne by institutions that maintain their own administrative systems. The total cost of owning vended software may be higher or lower than that of owning homegrown software, depending to a great extent on what portion of vended capabilities the institution needs and uses.

2. There are many different visions of the integrated and collaborative enterprise. See, for example, Inside PeopleTalk, 12 (3), July-Sept. 2001. The entire issue is devoted to PeopleSoft’s vision of the collaborative enterprise.

3. In 1992, General Electric’s Jack Welch described what he called “The Boundaryless Organization.” Welch argued that creating organizations without bureaucracies depends on “how open you are about information, how open you are to ideas from other companies.” See <http://www.best-in-class.com/research/bestpracticespotlights/welch1.htm>.


6. For a good summary discussion of Web services in higher education, see Carl Jacobson, “Web Services: Stitching Together the Institutional


11. Ibid., p. 7.


18. At the University of Minnesota, Schedule 25, a classroom-scheduling program, automated what had earlier been a three-person 3 x 5 card system. While this system reduced space-planning workloads and generated real efficiency savings, it also afforded the scheduler the option of optimizing space utilization. By introducing explicit decision parameters (for example, all classrooms had to be used a minimum of 32 hours per week with a 65-percent occupancy rate), the number of classrooms needed was reduced by 25 percent, reducing that institution’s needs for additional classroom space. The changeover from quarters to semesters nullified the space savings.


20. This characterization was developed by Cap Gemini Ernst & Young and draws concepts from a number of IT architectural “renderings.” See, for example, Edward Lightfoot and Weldon Ihrig, “The Next-Generation Infrastructure,” *EDUCAUSE Review*, Nov./Dec. 2002, p. 54. See also the SCT white paper “Transforming the Institution’s Technology Assets into e-Education Infrastructures,” 2002, p. 5.