ECAR
EDUCAUSE Center for Applied Research

The Promise and Performance of Enterprise Systems for Higher Education

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The Promise and Performance of Enterprise Systems for Higher Education

EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology.

The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

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Foreword

The EDUCAUSE Center for Applied Research (ECAR) was launched on January 1, 2002, to create a body of research and analysis on important issues at the intersection of higher education and information technology. ECAR is fulfilling its mission through a program of symposia and through the publication of (1) biweekly research bulletins oriented to senior campus functional executives; (2) detailed studies designed to identify trends, directions, and practices in an analytically robust fashion; and (3) case studies designed to showcase campus activities and to highlight effective practices, lessons learned, and other insights from the practical experience of campus leaders. Since ECAR's inception, two symposia have been held and more than 40 research publications have been issued.

Enterprise Systems in Higher Education

Each year, EDUCAUSE surveys its members to ascertain major concerns among higher education's information technology (IT) priorities.[1] Across all Carnegie classifications, and colleges and universities of all sizes, survey respondents identified administrative information systems and ERP as the issue foremost on their minds. This is not a surprise. Enterprise system implementation is one of the single largest investments higher education institutions ever make.

Financial, human resources, student, and other information systems provide the foundation on which the business of the higher education enterprise sits. Higher education's business practices and processes, and the information that guides decision making in large areas of the academy, interact with and derive from these information systems. In turn, these systems and processes interact with college and university administrative culture in ways that determine how

- institutional resources are allocated,
- faculty and staff interact with an institution's core business activities,
- student needs for information and services are addressed, and
- decision makers interact with institutional information to formulate policies and decisions and to communicate within the institution.

These systems are by definition critical to the institution's mission.

Information technology in the academy traces its origins to the development of accounting systems that ran on very large mainframe computers. These systems were characterized by batch processing of trans-

actions and seemingly interminable reconciliations of all kinds. As the costs of data processing declined, administrative information systems proliferated through much of higher education's business enterprise, with each stove-piped administrative operation eventually getting its time at the system development feeding station. What resulted could be described as a patchwork quilt of stand-alone information systems integrated, when necessary, by periodic batch processes. The annual closing of the institution's books was, for many organizations, a defining element of the staff experience.

Nevertheless, for decades higher education's administrative information systems enabled institutions to pay bills, schedule classes, administer financial aid, pay employees, transfer funds, reconcile account balances, and perform all the myriad activities that make up the modern college or university. Given the remarkable enrollment growth during this period and the extraordinary growth in external regulation and reporting requirements, higher education's original information systems—like the old science buildings that have served institutions well for decades—have been nothing short of remarkable.

Between 1950 and 1980, a few niche vendors served the unique higher education administrative information systems market. As a result, many of higher education's so-called legacy administrative information systems are built on code supplied by firms no longer in the market. Much of the legacy entails either significant software customization and modification of vendor-supplied code, or information systems custom-developed from scratch. Many institutions became adept at developing administrative information systems, and some of these institutions are committed to maintaining and enhancing these systems.

As information technologies shifted from flat files or hierarchical database structures to relational databases, and from host-based systems to client-server and Web-based architectures, commercial software suppliers seized new opportunities to develop administrative information systems that could leverage the new architectures. The enterprise logic of manufacturing systems was added to this competitive and technical mix, resulting in the emergence of so-called ERP systems in the early 1980s.

As Christopher Koch admonishes us, "Enterprise resource planning software, or ERP, doesn't live up to its acronym."[2] Koch goes on to advise that the enterprise part of the term is ERP's true ambition. "What ERP attempts to do is to integrate all departments and functions across an enterprise onto a single computer system that can serve all those different departments' particular needs."[3]

Technology solutions that would counteract decades of stove-piped systems development attracted the attention of many in higher education. By 1995, this attention would become intensely focused, as the specter of the year 2000 (the Y2K bug) loomed large. Many colleges and universities in the United States, Canada, Australia, and elsewhere decided to invest in renewing their administrative information systems rather than in making these systems compliant with Y2K requirements.

Perhaps because of the scale, ambition, or even the audacity of this endeavor, higher education's experience with the renewal and management of its enterprise systems attracted substantial attention in the press. Much of this attention focused on painful and problematic implementations. This reporting in turn made ERP a topic of discussion among institutional leaders and in executive cabinet meetings throughout

higher education. For better or for worse, information technology—through the experience of ERP—has come under the purview of the business officer, the president, and the board of trustees.

As much as any topic intersecting information technology and higher education, this recent renewal of enterprise systems in higher education has suffered from a maelstrom of tall tales, changing numbers, faulty assumptions, omissions, and misstatements. For this reason, it is a topic worthy of research and dispassionate analysis.

Important Contributions

The Promise and Performance of Enterprise Systems for Higher Education is the fourth ECAR research study of 2002. This study is the result of eight months of collaborative research conducted under the direction of Robert B. Kvavik, an internationally known political scientist and research university executive. As associate vice president and executive officer of the University of Minnesota, Kvavik, among other contributions, provided overall executive leadership of that institution's implementation of new student and human resources enterprise systems. Joining Kvavik and me as primary contributors were ECAR Fellows Paula King and, later, Judy Caruso of the University of Wisconsin–Madison. These individuals made major contributions to this study and to the related case studies. They are acknowledged leaders in planning, developing, and maintaining enterprise technology applications.

At the outset, colleagues at Cap Gemini Ernst & Young joined the ECAR team for this research initiative. John Voloudakis was an integral member of the research team, and Karin Beecher led the collection and analysis of qualitative interview data. Andrew Vaz provided executive sponsorship for this project and applied wisdom and specialized Cap Gemini Ernst & Young resources in the form of regular expert input from internationally known subject-matter experts within the firm. This firm's depth of talent and knowledge of enterprise systems is impressive.

Judy Pirani of Sheep Pond Associates was also a key member of the team and played both a pivotal role in the qualitative research and a leadership role in the development of the associated case studies. Ed Lightfoot of the University of Washington, one of higher education's outstanding administrative IT practitioners, conducted research on institutions whose enterprise strategies included the extension of some or all of the campus legacy applications. This strategy let some institutions stake out leading positions in arenas such as Web-based services, data warehousing, and decision support.

Lori-Anne Williams of the University of Minnesota provided, prepared, assessed, and organized the technical and professional literature on ERP. Dr. Darwin Hendel of the University of Minnesota provided expert advice on the statistical analysis of the data. Rob LaFavor of EDUCAUSE provided an invaluable service by preparing and distributing the online survey and forwarding the data to the Minnesota Survey Research Center (MSRC) for conversion to Statistical Package for the Social Sciences (SPSS). Rossana Armson and Anne Caron of the MSRC prepared the survey data for analysis with SPSS.

The Promise and Performance of Enterprise Systems for Higher Education is perhaps the most comprehensive study of these important systems in existence. Thanks to EDUCAUSE members; to Rich Ekman, Russell (Rusty) Garth, and Edward Barboni of the Council of Independent Colleges; and to George Boggs and Margaret Rivera of the American Association of Community Colleges. Nearly 500 colleges and universities participated in a major survey in May 2002. More than 100 individuals participated in

focus sessions, telephone interviews, and campus visits. These contributors are recognized in the study. We cannot thank them enough.

A group of particularly gifted educational leaders gave significant time to reflect on higher education's collective experience in this area and on the future of enterprise systems in higher education. This group includes Jim Bruce, vice president for information systems and professor at MIT; John Curry, executive vice president of MIT; Paul Gandel, vice provost for information services and dean of libraries of the University of Rhode Island; Chris Handley, executive director of systems at Stanford University; Weldon Ihrig, executive vice president of the University of Washington; Dave Lambert, vice president and CIO of Georgetown University; Ed MacKay, vice president for planning and budget at the University of New Hampshire System; Marilyn McMillan, associate provost and CIO at New York University; Polley McClure, vice president and CIO at Cornell University; Jenny Rickard, dean of admissions and financial aid at Bryn Mawr College; Fred Rogers, vice president of university relations for Student Advantage; Dan Updegrove, vice president and CIO of the University of Texas at Austin; and Richard West, executive vice president and CFO of the California State University.

This study should be read in conjunction with a number of case studies on the topic of enterprise systems in higher education produced by ECAR. Higher education is fortunate to enjoy a professional IT community possessed of a great generosity of spirit and commitment to the common good. ECAR benefited enormously from this generosity during visits to numerous campuses while producing case studies that illustrate insights, techniques, and practices to be shared and imitated—and pitfalls and mistakes to be avoided. This sharing of successes and failures is almost without parallel in higher education and represents an important source of experience for the reader.

We are indebted to many people, but we would like in particular to thank our hosts David Ernst, assistant vice chancellor of the California State University Office of the Chancellor; Mojdeh Mehdizadeh, vice chancellor of the Contra Costa Community College District; Norma Holland, associate vice president of Indiana University; Ruth Constantine, vice president of Smith College; Steve Relyea, vice chancellor of the University of California, San Diego; Robert Kvavik, associate vice president and executive officer of the University of Minnesota; Weldon Ihrig, executive vice president of the University of Washington; Dan Updegrove, vice president of the University of Texas at Austin; Ed Meachen, associate vice president of the University of Wisconsin System; Randall Thursby, vice chancellor of the Board of Regents of the University System of Georgia; and Vic Albino, executive director of the Washington State Community and Technical Colleges Center for Information Services. These individuals and their campus colleagues were extraordinarily generous with their time.

ECAR is a new venture. Its success as a research center and as a business enterprise depends in large measure on its reception by EDUCAUSE members and on their participation. As always, EDUCAUSE members have shown great confidence in us and have demonstrated their support by subscribing to ECAR despite a tough economic climate for higher education in 2002. These members understand that particularly in tough times, investments in good research and analysis can save money in the long run.

ECAR has been especially fortunate to enjoy the support of an unparalleled group of sponsors. While Cap Gemini Ernst & Young, Datatel, Hewlett-Packard, PeopleSoft,

and SCT provided significant financial resources in 2002 to enable ECAR's research, they are more than financial sponsors. These companies truly believe that impartial applied research on critical issues in higher education makes for a more informed marketplace of both sellers and buyers. They are committed to understanding their customers and to helping them make the most effective decisions related to their technologies and products. Most impressively, these sponsors understand deeply and respect the importance of intellectual independence in the marketplace of ideas.

Finally, as we have toiled in this field, other ECAR fellows have been managing other elements of the ECAR program. Robert Albrecht, Mary Beth Baker, and Diana Oblinger are remarkable colleagues, and higher education is lucky to have them in its midst. The staff of EDUCAUSE under the leadership of Brian Hawkins never fails to amaze. EDUCAUSE is an organization that truly takes pride in excellence and strives for greatness in its performance. It is an honor to work with this group.

Richard N. Katz

Endnotes

1. Paul Kobulnicky et al., "Third Annual EDUCAUSE Survey Identifies Current IT Issues," *EDUCAUSE Quarterly*, No. 2, 2002, pp. 8-21.
2. Christopher Koch, "The ABC's of ERP," http://www.cio.com/research/erp/edit/erpbasics.html#erp_abc.
3. Ibid.

1

Executive Summary

At the end of the twentieth century and into the twenty-first, higher education has invested, by a conservative estimate, $5 billion in administrative and enterprise resource planning (ERP) systems. ERP—three letters that respresent the tremendous time, energy, and money consumed by hundreds of institutions over the past decade. What is ERP, why has a large percentage of the higher education industry embraced it, and what are the facts surrounding actual implementations? ECAR and its subscribers, wanting to understand the real story of ERP in higher education, launched this study to provide a comprehensive analysis of several key questions:

- What is ERP and why did/should universities invest in it?
- How did institutions implement their ERP systems?
- Do institutions feel their ERP efforts were successful and worthwhile? What lessons were learned?
- After implementation, what's next? What does the future hold for ERP, higher education, and vendors?

To address these questions fully, ECAR employed a multifaceted research methodology to collect both quantitative and qualitative data from nearly 500 higher education institutions—members of EDUCAUSE, the Council of Independent Colleges, and the American Association of Community Colleges. The approach consisted of an exhaustive literature review, a Web-based survey, a series of qualitative interviews (some developed into case studies), a discussion "summit," consultation with administrative systems leaders, and vendor and consulting firm interviews. To facilitate data collection and analysis, ECAR had to define what it meant by ERP and on what time frame the study would focus. For the purposes of this study, ECAR adopted Gartner Inc.'s description of an ERP system as having the following attributes:

- The system is multiple in scope, tracking a range of activities including human resources (HR) systems, student information systems, and financial systems.
- It is integrated; when data is added in one area, information in all related areas and functions also changes.
- An ERP system is modular in structure.
- The system provides industry-specific solutions that enhance standard systems by providing best practices for key business processes. We interpret this to include business process redesign.

In addition to having these attributes, institutions were also identified as ERP institutions for the study if they had installed at

least one purchased ERP system—financial, HR, and/or student system—since July 1, 1995. Of the 480 institutions that responded to the Web-based survey, 54 percent met ECAR's criteria. Eighty-four percent of the respondents were CIOs, directors of administrative computing, or other IT professionals, and 78 percent of these respondents indicated that they had played a significant role on the project, functioning as an executive sponsor, a project leader, a management team member, or a functional/technical specialist.

The Business Case and Respondent Overview

The single most important reason for embarking on systems replacement was largely a tactical one: "to replace aging legacy systems" (selected by 42 percent). Other respondents selected factors of a more strategic nature: "to improve service to customers" (17 percent) and "to transform the way the institution operates" (13 percent). Interestingly, the reasons for undertaking an ERP initiative were consistent across large and small, public and private institutions.

Between July 1995 and June 2002, 54 percent of the survey respondents implemented one or more ERP systems; 46 percent continued with existing systems or strategically modified them. In total, the sample installed 663 ERP modules: 238 financial, 202 HR, and 223 student. SCT installed the most modules in the study's sample group (30 percent), followed by PeopleSoft (25 percent) and Datatel (19 percent). SCT installed the most student systems (37 percent), PeopleSoft the most HR systems (29 percent), and SCT the most financial systems (27 percent).

Public and private institutions were equally likely to purchase ERP systems; however, larger schools were more likely to purchase an ERP system. In terms of Carnegie class (see pp. 22–23), baccalaureate colleges (BA) and doctoral/research universities were more likely to have implemented ERP systems than associate's colleges (AA) and master's colleges and universities (MA). Thirty-three percent of the institutions that implemented an ERP module since July 1, 1995, installed all three modules, 37 percent installed two of three, and 31 percent installed only one. Sixty-two percent purchased all of their modules from a single vendor, and 37 percent purchased from two vendors. If a second vendor was chosen, most often it was for student systems.

It's important to recognize that nearly half of the institutions in the survey are using non-ERP, or administrative, systems solutions that were implemented before July 1995. In addition, two-thirds of the ERP institutions in the study continue to use existing systems for one or two business areas. It's also important to note that among the institutions that haven't implemented an ERP module since July 1995, many are planning to implement an ERP solution, as shown in Table 1-1.

This broad overview of the survey respondents and the distribution of the various ERP modules leads to the essential, overarching question: Did the schools achieve what they intended with their ERP implementations? The answer from 51 percent was yes; 46 percent reported partial achievement, and only 3 percent said no. However, the cost was greater than the institutions originally planned, and the promised efficiencies have not translated into cost savings. Furthermore, 54 percent of the respondents believed their institution's productivity experienced a short-term (within the first six months) decline immediately after the implementation, although 70 percent now perceive productivity to have improved, following the initial break-in period.

When asked whether the institution would take the same approach again, 66

Table 1-1. Percentage of Insitutions Planning to Implement Additional ERP Modules

Time Frame	Planning to Implement ERP Module
Within the next year	10% are implementing or will implement
One to three years	25% expect to implement
Three to five years	10% may implement
Not under consideration	55%

percent of respondents said they would use a similar approach if they were to do another ERP project. Fewer than half (46 percent) of the non-ERP institutions would take the same approach.

How Did Institutions Implement?

Perhaps the most frequently asked question regarding ERP implementations is, "Was the project completed on time and on budget?" For the majority of our survey respondents, the answer was yes. More than two-thirds of the institutions surveyed reported finishing their implementations on or under their original budget. Most reported that they met their original schedule or were early: 75 percent for financials, 70 percent for HR, and 66 percent for student modules. These results are an enormously positive reflection on ERPs in higher education.

Nevertheless, there are a few notable exceptions to these trends. Size is an important indicator of whether an implementation remains on time and on budget: The larger the school in the study, the less likely it was to finish on time, regardless of vendor, public or private status, or Carnegie class.

The year an institution embarked on its ERP initiative also made a difference. As part of the analysis, the dates of the respondents' implementations were divided into four time-of-implementation periods. The 1998–2000 period was found to be the most difficult time to implement an ERP (especially for doctoral institutions) because the implementations were more likely to take longer, to be over budget, and to involve more customization of the base code. Customization had a greater impact on respondents' ability to complete their implementations on time and on budget than any other variable in the study.

The natural follow-up question to whether an implementation was on time and on budget is, "What was the budget?" Approximately 54 percent of the 258 ERP institutions in the study provided cost information and reported ERP expenditures that totaled $1.6 billion. On average, a finance module cost $2.9 million, a human resources module $2.3 million, and a student module $3.1 million. The most common funding mechanism among the survey respondents was central allocations (25 percent), and the near-unanimous choice for most underestimated budget item was training. Institutions also reported that their ERP systems are more expensive to support, with the most significant cost increases occurring in packaged software, databases, and training. Value is perhaps a more important metric. However, higher education, like the private sector, has not systematically measured the value derived from ERP implementations, nor has it benchmarked its ERP systems against any kind of performance metric.

A complete and successful ERP implementation requires many decisions during

the life of the project, and these ultimately determine the project's success or failure. Several major decisions revolve around leadership, reengineering, customization, and use of consultants.

Leadership

Who typically leads these ERP efforts? According to the survey respondents, the primary advocates are the CIO (31 percent), the CFO (29 percent), and the president or chancellor (17 percent). The CFO typically sponsors both the finance and the HR system efforts, but sponsorship of the student system is more varied: chief academic officer (21 percent), chief student affairs officer (17 percent), CIO (17 percent), CFO (17 percent), president (9 percent), and other (19 percent).

Full-time project managers were allocated to the project at 55 percent of the institutions. Overwhelmingly, doctoral/research universities used full-time project managers, whereas the majority of project managers at BA institutions were part-time. Full-time versus part-time managers were more evenly divided at AA and MA institutions. Project managers were internal employees 75 percent of the time, external 10 percent of the time, and joint (both internal and external) 15 percent of the time. Fifty-four percent of the managers had no previous experience in ERP project implementation, and only 25 percent had any experience with the vendor chosen. Thirty percent of the institutions changed project managers over the course of the implementation.

Along with the efforts of primary advocates, individual system sponsors, and project managers, 82 percent of the survey respondents used an oversight committee. Interestingly enough, the same percentage of respondents (82 percent) reported little or no involvement by the Board of Trustees in any aspect of their ERP implementations.

Reengineering

Sixty percent of the survey respondents performed some reengineering as part of their ERP implementation, 13 percent reengineered in advance of the implementation, and 22 percent did no reengineering at all.[1] One hundred and two institutions indicated they would change how they performed business process redesign if they had the opportunity to do it again.

Customization

Customization was a primary reason for projects to go over time and over budget. Eighty-seven percent of the survey respondents agreed or strongly agreed that their institution's ERP strategy was to implement with as little customization as possible. In practice, the results were more varied: 48 percent modified up to 10 percent of the code, 30 percent had no modifications, 18 percent modified more than 11 percent of the code, and 4 percent modified more than 25 percent. The results do not suggest that "plain vanilla" is necessarily best. In fact, the analysis demonstrates that customization has a major impact on business owners' and customers' satisfaction. Although this may seem intuitive, customization's prominence as the most statistically significant variable in the analysis is worth noting.

Consultants

Two-thirds of the survey respondents used consultants during their ERP implementations. Surprisingly, 90 percent agreed or strongly agreed that consultants helped them achieve their implementation objectives. Public and MA institutions were more inclined to use consultants than other institution types responding, but these trends are

modest statistically. Generally, the level of consulting assistance was higher for student systems than for finance or HR.

Institutions hired consultants primarily to support training, provide ongoing project support, and help with system selection. They derived benefits from consultants on the basis of their particular skills, which were used to fill gaps in existing staff skill sets. The benefits reportedly gained from consultants included product expertise (21 percent), technical expertise (20 percent), experience (methodologies/insights) from prior projects (16 percent), and the ability to help meet the project timeline (13 percent). An interesting correlation emerged when comparing data on institutions' perceptions of how they managed their consultants and whether their money on consultants was well spent: The better they felt about the way they managed their consultants, the more likely they were to feel that the money was well spent.

Lessons Learned

A key advantage to surveying hundreds of institutions after their ERP implementation is hindsight. No longer consumed by the day-to-day implementation effort, people have the time, distance, and perspective to reflect on what went well and what could have been done better, and this can provide valuable insights for the rest of the higher education community. Many of these insights, or lessons learned, will sound all too familiar, but repeating them here merely emphasizes the importance of incorporating them into our collective thinking about ERP implementation.

- *Leadership.* Strong executive leadership—not merely sponsorship by active executive involvement—is imperative to implementation success. Getting buy-in from all layers of management is also advised.
- *Communication.* A communication plan ties the many parts of the ERP vision and plan together, making the goals and implementation requirements clearly understood and securing support for them throughout the institution. It's been said that it is almost impossible to over-communicate.
- *Central ownership of data.* Shared data-center operations and central ownership of data is critical to success and also reduces costs.
- *Training.* The study finds that, generally, training costs are underestimated, delivery timing is bad, and training needs to focus on using the system to both support transactions and leverage the ERP system to change existing business practices. This is one area where institutions thought they could have done better.
- *External assistance.* Consultants were often cited as key to successful implementations, but the costs were a surprise. The advice from study participants is to select consultants carefully, be clear about their scope of responsibility, and actively manage the relationship to get the maximum benefit for the implementation.
- *Customizations and modifications to the vendor software.* One of the most significant findings of this study is the impact customizations had on the sample's ability to finish on time and on budget. The greater the volume of customizations, the more likely the ERP implementation was to be over budget and off schedule.
- *Reporting.* The ERP products often cannot generate the reports the institutions need. Many institutions have created data warehouses to solve their reporting and data query needs.
- *Obtaining value from the ERP implementation.* The four basic ways to obtain value from ERP implementations are

through efficiency, effectiveness, customer satisfaction, and reduced business risk. For example, providing online self-service and linking and automating related transactions have resulted in more efficient relationships between the universities and their students. These services have been provided on a scale that simply would not have been possible using personal service in expensive physical facilities.

- *Learning and knowledge.* Learn from other projects. Participants in the study emphasize that knowledge gained from previous projects helps institutions move forward more effectively with their implementations.

Even though many of the surveyed institutions adopted a number of these effective practices, some still had challenging implementations. External forces such as quality of software or consulting were found to be less influential than internal forces. When asked, these institutions revealed that the major obstacles to completion were mostly internal to the institution. They include data issues, cultural resistance to change, and lack of understanding of software capabilities. The realization that the greatest implementation challenges are the result of internal institutional issues—not external forces—contradicts a popular message prevalent in the industry for the past few years. It's interesting to discover that the institutions themselves—their cultures, their people, and their historical decisions—are the primary hurdle to clear for a successful implementation, not the technology, the consultants, or the vendors.

Endnote

1. There was no significant variation by Carnegie class, school size, vendor used, or ERP system purchased.

2
Introduction

Software for enterprise resource planning, or ERP, doesn't live up to its name. Forget about planning—it doesn't do much of that—and forget about resource, a throwaway term. But remember the enterprise part. This is ERP's true ambition. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs.

—Christopher Koch

Each year, EDUCAUSE surveys its members to ascertain dominant concerns among higher education's information technology (IT) priorities.[1] Across all Carnegie classifications, and all sizes of colleges and universities, survey respondents identified administrative information systems and ERP as the issue foremost on their minds.

Financial, human resources, student, and other information systems provide the foundation on which the business of the higher education enterprise sits. Higher education's business practices and processes, and the information that guides decision making in large areas of the academy, interact with and derive from these information systems. In turn, these systems and processes interact with college and university administrative culture in ways that determine how

- institutional resources are allocated,
- faculty and staff interact with an institution's core business activities,
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- decision makers interact with institutional information to formulate policies and decisions and to communicate within the institution.

These systems are by definition critical to the institution's mission.

At the end of the twentieth century and into the twenty-first, higher education has invested an estimated $5 billion in administrative and ERP systems.[2] The largest percentage of those dollars was spent in a concentrated period between 1995 and 2000. By any accounting method, ERP investments are among the largest single concentrated investments in dollars and human resources ever made by higher education in any area.

Perhaps because of the scale, ambition, or even the audacity of this endeavor, higher education's experience with the renewal and management of its enterprise systems has attracted substantial attention in the press. Much of this attention has focused on painful and problematic implementations. As much as any topic intersecting information technology and higher education, this re-

cent renewal of enterprise systems in higher education has suffered from a maelstrom of tall tales, changing numbers, faulty assumptions, omissions, and misstatements. This reporting in turn made ERP a topic of discussion among institutional leaders and in executive cabinet meetings throughout higher education. For better or for worse, information technology—through the experience of ERP—has come under the purview of the business officer, the president, and the board of trustees. For this reason, it is a topic worthy of research and dispassionate analysis.

Objectives

This study addresses four sets of questions:

- What is ERP and why should universities invest in it? In other words, what is the business case? What was promised institutions that installed ERP systems? Conversely, if institutions elected not to implement a packaged ERP solution, why not? What alternate approaches did they take and with what results? Are these alternate strategies intended to be short-term or long-term solutions?
- What is the current status of ERP implementation nationally? The study provides aggregate data that show the magnitude of investments: where, how, and who. How did institutions implement their ERP systems? Included here are software selection, project planning, management and budgeting, leadership and organizational structures, communications, and integration with other technologies (for example, e-commerce applications and content management systems). The study queried the impact of implementing ERP software with extensive user modifications versus minimal user modifications. Also of interest were the many changes institutions must make to support the new technology from a process, policy, people, and organizational perspective.
- What were the benefits and costs? Do institutions feel their ERP efforts were successful? What lessons were learned?
- And finally, what comes next? What directions do the study's respondents and the vendor community see ERP taking?

This study is not intended as a history of ERP and administrative systems implementation, although it includes data that provide an interesting perspective on what happened during the past two decades. Rather, it is intended as a guide for senior administrators, be they presidents, provosts, CFOs, or CIOs, on the promise and performance of enterprise systems, with emphasis placed on decision support information—that is, when and whether to do it, and how to do it successfully.

What Is ERP?

According to Christopher Koch,[3] the key word in enterprise resource planning is "enterprise." ERP "attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs."

The term has its origins in manufacturing, where attempts to automate and integrate business processes, including manufacturing material and shipping requirements, and to coordinate them with product demand resulted in reduced inventory and increased revenue and customer satisfaction.

Gartner Inc. carried the concept over to higher education in the 1990s and described ERP systems as

- multiple in scope, tracking a range of activities that include human resources (HR) systems, student information systems, and financial systems;
- integrated, meaning when data is added

in one area, information in all areas and related functions also changes;
- modular in structure; and
- consisting of industry-specific solutions that enhance standard systems by providing best practices for key business processes, and interpreted to include business process redesign.

This study used the Gartner attributes, and institutions were identified as ERP institutions if they installed at least one vendor-supplied financial, HR, and/or student system after July 1, 1995. In the study's concluding chapter on future trends, the ERP definition and vision broaden to include other technical applications and new organizational structures to maintain and develop ERP on campus.

Methodology

The study used a multifaceted research methodology to gather both quantitative and qualitative data from nearly 500 higher education institutions. The authors believe this is the single most comprehensive gathering of information on ERP in higher education ever. The data provide a view of one segment of higher education's collective experience with ERP implementation as well as in-depth institution-specific perspectives.

Six data collection and analytical initiatives were undertaken.

(1) A literature review, which helped to define the major elements of the study and create a working set of hypotheses.

(2) Consultation with administrative information systems leaders to identify and validate the most interesting research questions and hypotheses, which would then frame the construction of a quantitative survey instrument. In particular, the EDUCAUSE Advisory Group on Administrative Information Systems and Services (AGAISS) was used for this purpose. On the basis of these discussions and the literature review, a research framework was finalized in March 2002, allowing work to begin on developing the online survey.

(3) A quantitative Web-based survey designed by the research team from ECAR and Cap Gemini Ernst & Young. EDUCAUSE e-mailed invitations with the Web address of the survey and access code information to 2,980 institutions belonging to EDUCAUSE (1,473), the Council of Independent Colleges (219), and the American Association of Community Colleges (1,288). Senior college and university administrators, the majority of who were CIOs and IT leaders in various capacities, from 457 institutions in the United States and 23 institutions in Canada responded to the survey. The respondents are for the most part EDUCAUSE members. Their responses provide a detailed understanding of how higher education approached ERP system implementations. The survey appears on the ECAR Web site. Appendix 2 contains the names of institutions that responded to the survey.

(4) Case studies, which provide detailed information on specific implementation issues of interest to the industry, including both triumphs and cautionary tales. Intensive telephone interviews were undertaken with more than 40 IT and functional executives and managers at 23 institutions, selected on the basis of peer nomination. Institutions that participated in this research phase had either implemented ERP systems within the past seven years or were currently in the late planning or actual implementation stages of these projects. All subject institutions are members of EDUCAUSE. The study selected institutions that included each Carnegie class and every ERP vendor.

Also carried out were in-depth case studies involving 6 institutions, selected on the basis of peer nomination, that have undertaken enterprise system implementations of significant scope and/or success and from

whom others may learn effective practices. Additional research—most of which involved on-site visits—covered four institutions that have chosen to defer or eschew packaged ERP solutions in favor of a focus on alternative enterprise strategies. Significantly, the quantitative data from the online survey tell a gentler story about ERP implementation than do the qualitative data from the case studies.

(5) A discussion "summit" involving 25 participants from 18 comprehensive or research-intensive institutions and from the ECAR and Cap Gemini Ernst & Young team. Invited participants were senior executives known for having sponsored and led major enterprise system implementations at some of the most complex institutions in the world. Participants were asked to validate, refute, clarify, and extend preliminary descriptive statistics from the online survey. Participants were also asked to summarize key implementation lessons, describe their institutions' visions and goals for enterprise systems, and discuss the possible future of enterprise systems in higher education. This panel of experts was brought together in Cambridge, Mass., at Cap Gemini Ernst & Young's Accelerated Solutions Environment.

(6) Vendor and consulting firm interviews, which provided an alternative perspective on higher education's performance in implementing ERP systems. These interviewees addressed trends in the ERP market and provided information on future directions for both vendors and their customers.

The Web-Based Survey

Figure 2-1 shows the distribution of the responding institutions by their new Carnegie class, EDUCAUSE membership, and the universe of higher education institutions (Carnegie class total).

The sample mirrors the EDUCAUSE membership much more closely than it does the national population of institutions by Carnegie class.[4] With the survey's endorsement by the Council of Independent

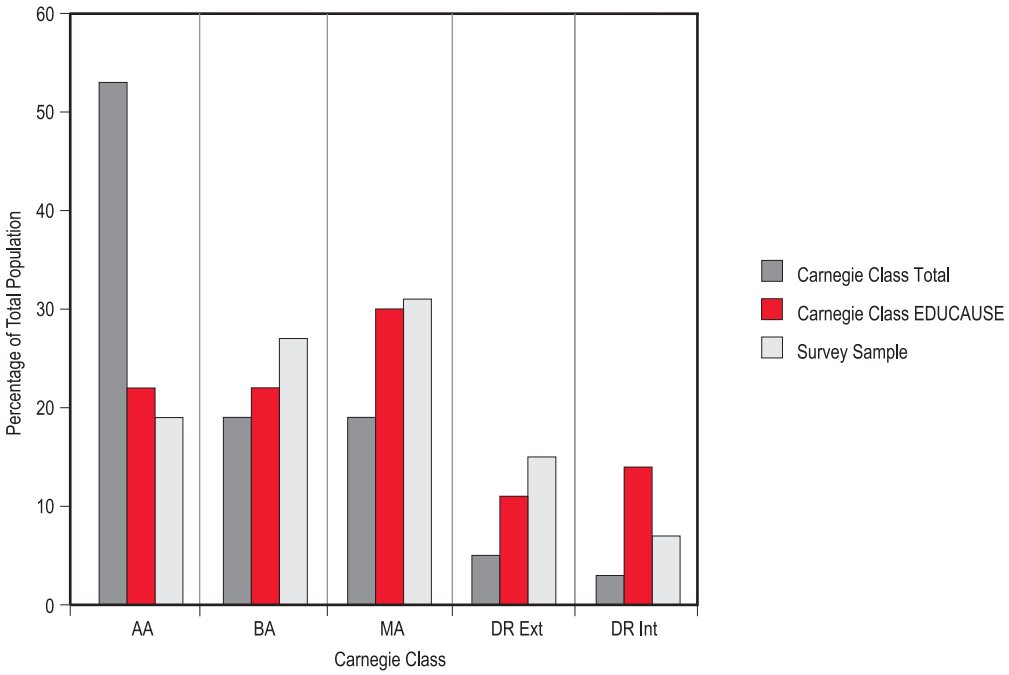


Figure 2-1. Population of Institutions, EDUCAUSE Membership, and Survey Sample, by Carnegie Class

Colleges (CIC) and the American Association of Community Colleges (AACC), the study was able to obtain more representation from smaller liberal arts and community colleges than have earlier ECAR surveys. Note, however, that the study's sample relied on volunteers to complete the survey from the entire population of three national organizations, so the sample isn't random; this limits the statistical conclusions that are possible. Nevertheless, the 33-percent response rate from EDUCAUSE member institutions gives us confidence that the study's sample portrays a good picture of the EDUCAUSE membership.

The survey was completed largely by CIOs and other IT staff, so it reflects their experiences, observations, and opinions on ERP implementations (see Figure 2-2). Had the study surveyed chief academic officers, presidents, and CFOs, for example, we expect that differences of opinion would have been found. We emphasize that this study is largely a CIO view of ERP implementation, moderated by observations from other institutional leaders obtained through complementary in-depth qualitative surveys and the study's advisors.

The respondents had a great deal of experience with the implementations: 78 percent indicated that they played a significant role on the project as an executive sponsor, project leader, management team member, or functional/technical specialist. Respondents were also asked whether they had been in their current position during their institution's ERP implementation. Seventy-one percent had been in their position either before planning began or after the planning began but before implementation (Figure 2-3). Only 14 percent were hired after the implementation, which may be at-

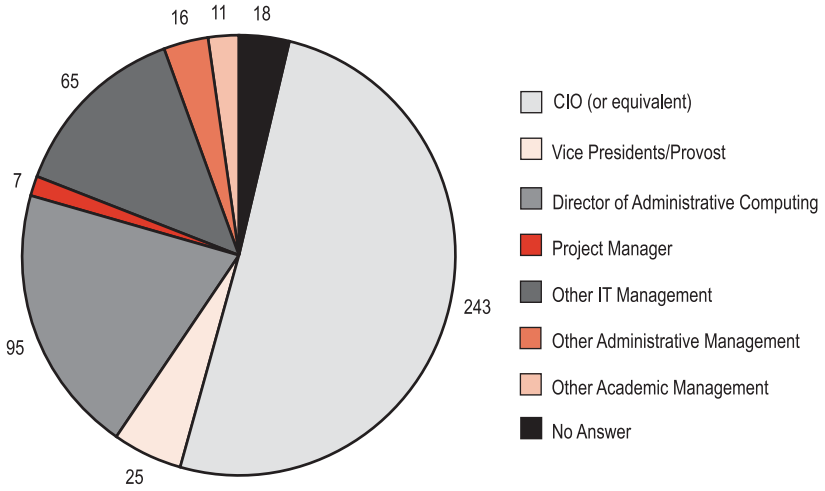


Figure 2-2. Survey Respondents by Administrative Position

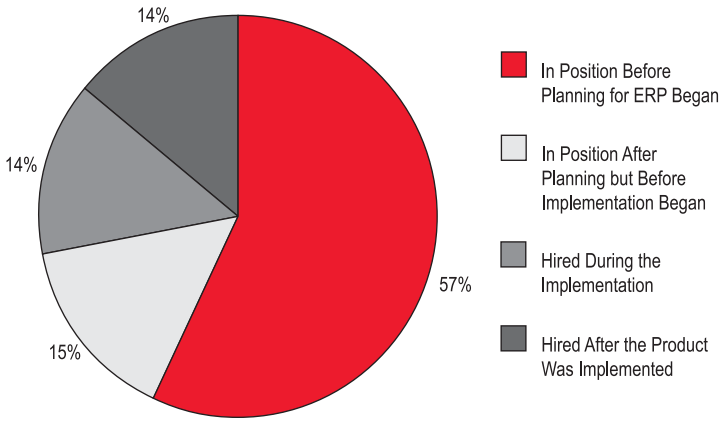


Figure 2-3. Survey Respondents by Length of Involvement with ERP Implementation

tributable to normal turnover in such a large sample. Half had served as the executive or project leader and the rest as part of a management or technical team.

Also important to note is that the various findings presented in this study may represent the average experience of these CIOs or their range of experience. As a consequence, some readers will find the information contrary to their own experience at a single or small group of institutions. Using a baseball analogy, the study would report that average hitting for the league as a whole was .250 and the average pitching earned run average (ERA) was 3.0. But these numbers might not at all reflect the hitting and pitching percentages of the league's top and bottom teams. It *would* offer an opportunity to see how those two teams performed against this sample's average. That's what the study offers the institutions that participated in the study's survey.

We recognize that local experiences will differ—sometimes significantly—from the sample's average. When possible, the study segmented the data to both identify and explain variations from a norm. Moreover, to balance the findings of the quantitative survey, the study has prudently used commentary from colleagues who responded to the study's in-depth surveys. For example, the years 1998–2000 in particular show an implementation pattern for the doctoral institutions in the study's sample that was far more troublesome than that of the sample as a whole viewed over 20 years and that of smaller institutions in the same time period.

Historical Perspective on ERP

Between 1950 and 1980, a relatively small number of niche vendors served higher education's unique administrative information systems market. They supplied many of higher education's so-called legacy systems, built on code that is no longer commercially supported or marketed. As a result, much of the legacy entails significant software customization and modification of vendor-supplied code by colleges and universities, or information systems that have been custom developed from scratch. Many institutions became adept at developing administrative information systems, and some of these institutions are committed to maintaining and enhancing them.

As information technologies shifted from flat files or hierarchical database structures to relational databases, and from host-based systems to client-server and Web-based architectures, commercial software suppliers seized new opportunities to develop administrative information systems that could leverage the new architectures. In the early 1980s, the enterprise logic of manufacturing systems was added to this competitive and technical mix to produce the so-called ERP systems.

Enterprise System Selection

The first administrative system installation by the study's sample of institutions occurred in 1980. By 2002, 54 percent, or 258 institutions, had implemented one or more enterprise systems; 46 percent, or 222, continued with existing systems or strategically modified them.

The study grouped the sample by a modified Carnegie classification of institutions of higher education (www.carnegiefoundation.org/classifications). The Carnegie taxonomy describes the institutional diversity in U.S. higher education. Most higher education projects rely on the classification to ensure a representative selection of participating individuals and institutions. To obtain larger numbers for statistical and descriptive purposes, the study collapsed the categories as follows:

- Doctoral/research universities (extensive, or Dr. Ext.) are institutions that typically offer a wide range of baccalaureate programs along with graduate education through the doctorate. They award 50 or more doctoral degrees per year in at least 15 disciplines.
- A second category of doctoral/research universities (intensive, or Dr. Int.) also offer a wide range of baccalaureate programs and graduate education through the doctorate. They award at least 10 doctoral degrees per year in three or more disciplines, or at least 20 doctoral degrees per year overall.
- Master's colleges and universities (MA) typically offer a wide range of baccalaureate programs as well as graduate education through the master's degree. The study grouped both master's colleges and universities I and master's II together.
- Baccalaureate colleges (BA) are primarily undergraduate colleges with major emphasis on baccalaureate programs. The study combined the three baccalaureate college groups into a single BA group.
- Associate's colleges (AA) are institutions that offer associate's degrees and certificate programs but, with few exceptions, award no baccalaureate degrees.

Other Carnegie-classified institutions were excluded from analyses that used Carnegie class as a variable because of their small numbers in the sample. Similarly, ERP vendors that sold only a few systems to the study's sample institutions were excluded.

By percentage, BA and doctoral institutions were more likely to have implemented enterprise systems than AA and MA institutions. A total of 663 enterprise modules had been installed by the sample group: 238 financial, 202 HR, and 223 student. Half were installed prior to 1998. Sixty-eight percent of all enterprise implementations in the study's sample occurred over the period 1995–2002.

Viewing implementation dates by Carnegie class (Figure 2-4), the study finds that BA and MA institutions made more purchases early in the analysis period. The purchasing trend is similar for all groups except in the last period, which shows more of a tapering off among AA and Dr. Ext. in-

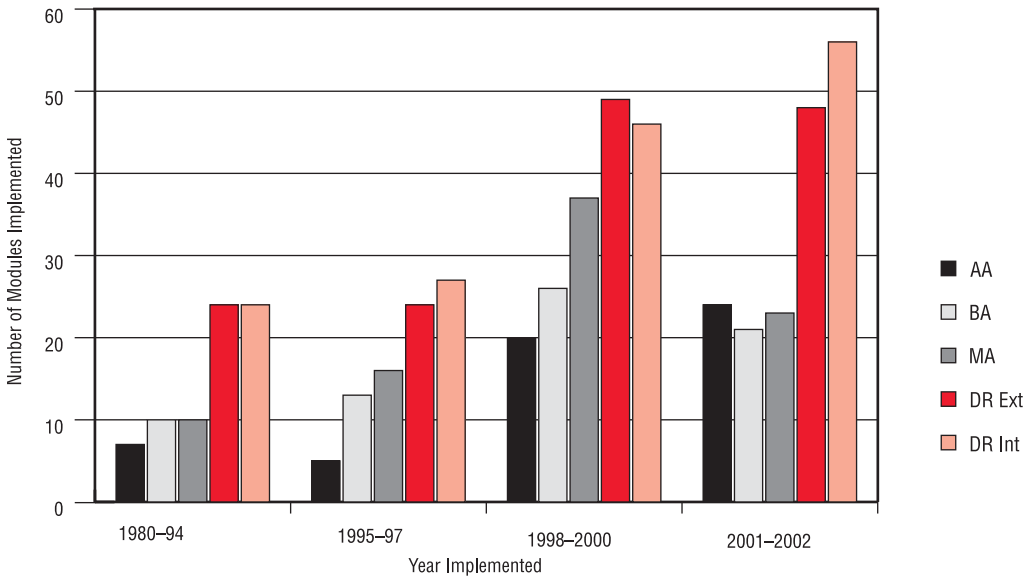


Figure 2-4. Carnegie Class Implementation, by Period (*n* = 510)

stitutions. This slowdown may reflect budget problems for public institutions and some degree of market saturation for the Dr. Ext. category. Note also the rapid rise of PeopleSoft in the later periods (Figure 2-5).

SCT installed the most modules in the study's sample group (30 percent), followed by PeopleSoft (25 percent) and Datatel (19 percent). SCT installed the most student systems (82, or 37 percent), PeopleSoft the most HR systems (58, or 29 percent), and SCT the most financial systems (65, or 27 percent). Figure 2-6 shows the overall distribution of ERP systems by vendor.

Private institutions and institutions with fewer than the mean full-time equivalent (FTE) number of students (6,134) in the study's sample were most likely to have cho-

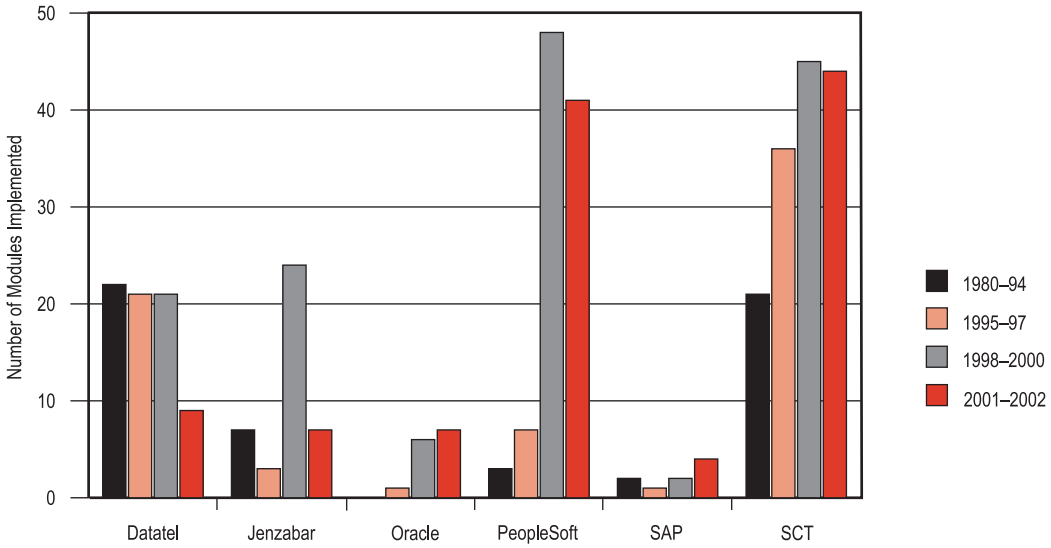


Figure 2-5. Vendor Implementation, by Period (*n* = 382)

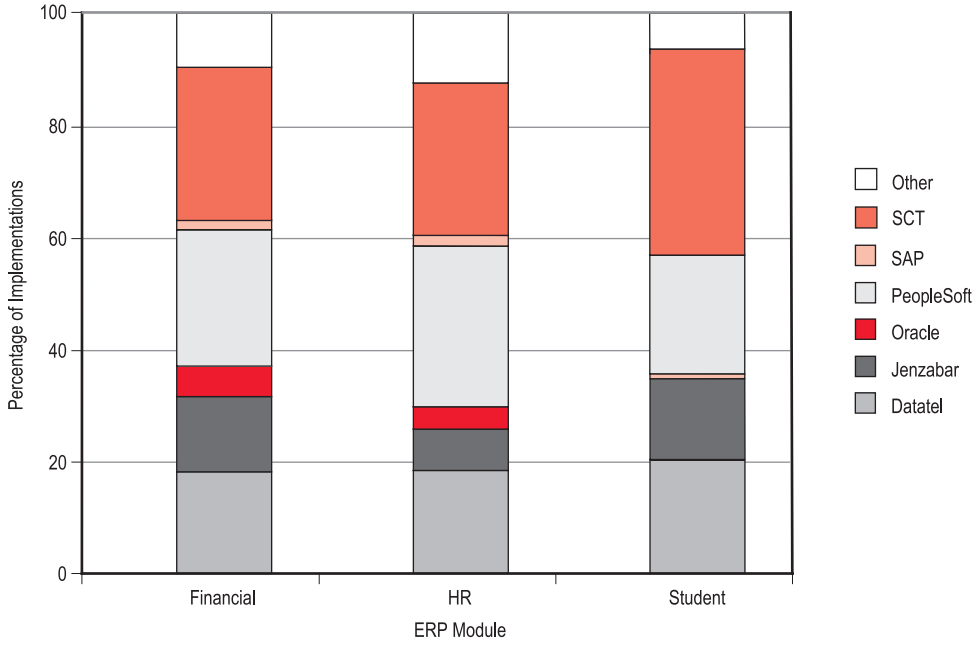


Figure 2-6. Enterprise Systems Installed, by Vendor (*n* = 663 Implementations)

sen Datatel and Jenzabar. Public institutions, regardless of their size in number of students, more often chose PeopleSoft. SCT was selected more evenly by public and private institutions but more often by smaller institutions. In Canada, with the exception of student systems, where SCT sold the most to the study's sample, Datatel, PeopleSoft, and SCT each shared about a third of the market for financial and HR. But the numbers for Canada are small, and these percentages should be interpreted as representing only the sample. About 10 percent of the institutions changed vendors during the course of an implementation. Reasons given included a vendor's going out of business or not delivering promised software on time, and a system office mandating a different vendor.

From our data, we conclude that no single ERP vendor dominates the higher education market for enterprise systems. Four or five major vendors are competing, depending on the module. It appears that vendors have been quick to recognize differences among segments of higher education and to pursue competitive leadership within these market niches. Figure 2-7 shows vendor selection, public versus private institutions; Figures 2-8 through 2-10

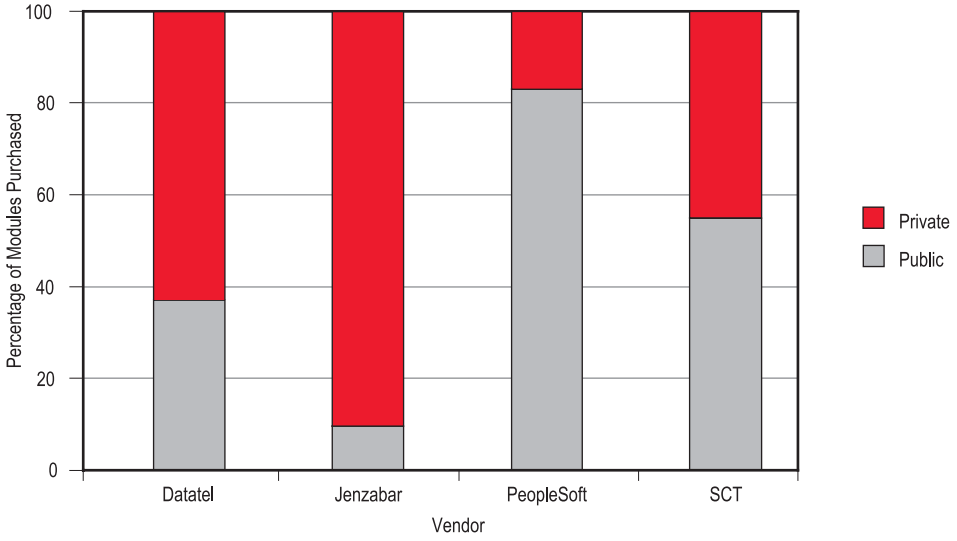


Figure 2-7. Vendor Selection, Public versus Private Institutions

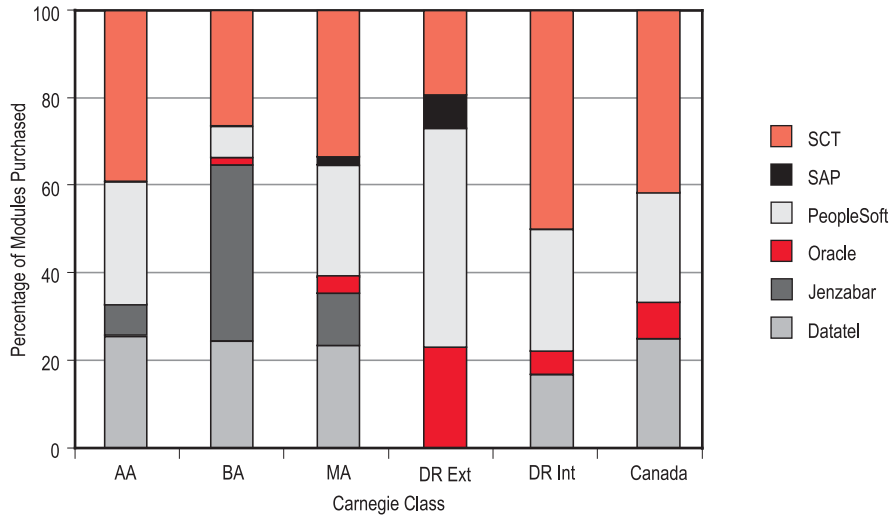


Figure 2-8. Vendors Chosen for the Financial Module, by Carnegie Class

Figure 2-9. Vendors Chosen for the HR Module, by Carnegie Class

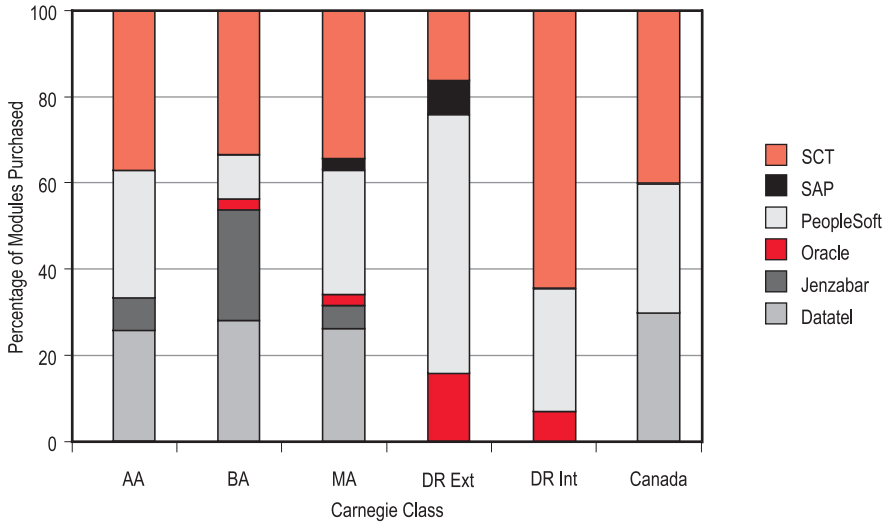
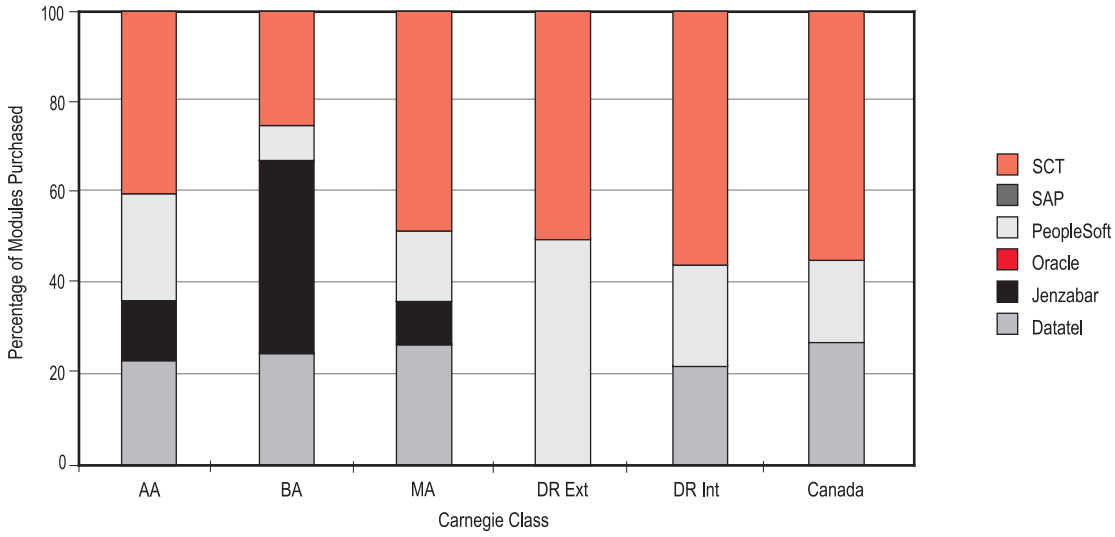


Figure 2-10. Vendors Chosen for the Student Module, by Carnegie Class



show the vendors chosen for the various modules, by Carnegie class.

Public and private institutions were equally likely to purchase ERP systems. The larger the school, the more likely it was to implement an ERP system. Small institutions were evenly divided in whether they did or did not implement an ERP system.

Table 2-1 shows the number and percentage of institutions that purchased one, two, or three systems.[5]

Thirty-three percent of the institutions installed all three modules, 36 percent installed two of three, and 31 percent installed only one module. Sixty-two percent purchased all of their modules from a single vendor, 37 percent purchased from two vendors, and one percent purchased from three vendors. Most often, the second vendor was chosen for student systems, probably because several of the ERP vendors did not offer student systems as part of their suite until recently. When asked whether future ERP modules would be purchased from the same vendor (best of suite) or another vendor (best of breed), 80 percent indicated that they would purchase best of suite. Two institutions purchased their three ERP modules from three separate vendors. Notably, two-thirds of the sample continue to use legacy systems for one or two business areas, which may indicate a future demand for ERP system purchases.

Institutions that had not yet installed all three modules but were planning to install more explained why they had not yet done so. Their answers appear in Table 2-2

Table 2-1. Number and Percentage of Institutions that Purchased Specific Modules

Modules Purchased	Number of Institutions	Percentage of Institutions
Financial only	17	6
HR only	4	1
Student only	68	24
Financial and HR	71	25
Financial and student	28	10
HR and student	5	2
All three	96	33

Table 2-2. Reasons for Not Yet Installing All Planned Modules

Reason	Respondents	Percentage
Phased implementation plan	36	56
Waiting for product to mature in later release	11	17
Other projects need to be finished first	8	13
Seeking additional funding	7	11
Need top management approval	2	3

Respondents were asked to select all reasons that applied.

Although the number responding is small, it appears that most institutions have a deliberate and phased implementation plan; and, to a lesser degree, they're waiting for the product to mature in a later release. The longer implementation may also reflect some vendors' practice of bundling multiple systems in cases where the purchasing institution may only be looking for one system.

Why did institutions choose a particular vendor? When asked to select all reasons that apply, respondents provided the information in Table 2-3.

The top five reasons selected were the software's best fit and functionality for the institution, the architecture's best fit with the institution's strategy/goals, the vendor's reputation, the vendor's ability to provide a complete solution, and price, in that order. Surprising, perhaps, is the low weight given to outside advice. This suggests that institutions used a fairly rigorous request for proposal (RFP) process that specifies functionality and system requirements, including the need for a complete solution. These factors combined represent 46 percent of the responses.

Chris Handley, executive director of systems at Stanford University, shared his insight on vendor selection. "I came to Stanford two-and-a-half years ago after they had picked best of breed rather than best of suite. My previous ERP system experiences led me to believe that 'best of suite' is the easiest thing to implement. There are not enough differences between the products to really make best of breed a wise strategy because of what I term 'version upgrade gridlock.' For example, which system do you upgrade? When you upgrade one, you create problems with the other. So you have to fix the other. Then you upgrade the other and you have to fix the first one. It's a never-ending cycle." He added, "I look for what the mission-critical applications are, and for universities that is teaching and research. I would pick the system that

Table 2-3. Reasons for Selecting a Particular Vendor

Reason	Frequency	Percentage
Features/functionality best fit requirements	193	20
Architecture's best fit with IT strategy/goals	127	13
Vendor's reputation	126	13
Vendor's ability to provide a complete solution	124	13
Price	110	12
Vendor product/vision	99	10
Advice from peers	67	7
Previous experience with vendor	41	4
Part of larger purchasing group that selected product	38	4
Advice from consultant/industry analyst	28	3

best supports those applications and go with that entire suite."

The California State University (CSU) System shares the Stanford perspective. A software evaluation study performed by Gartner encouraged CSU to search for a software suite rather than a best-of-breed solution for their enterprise-wide administrative system needs. In choosing the suite approach, CSU understood that while every software module might not be the best match for individual needs and requirements, this choice could alleviate concern about the level of additional effort and cost needed to interface disparate systems in this multicampus system.

With the procurement process underway in 1998, new CSU Chancellor Charles Reed, who had previously operated in environments that used centralized suite software, challenged decentralized thinking. Following a chancellors' and presidents' retreat in mid-1998, the chancellor's office mandated a suite approach. All campuses would migrate to this software and run it in a baseline/centralized manner rather than each campus implementing it locally.

The vendor community communicated a similar understanding of the factors behind institutional purchasing decisions, although there were some differences. Vendors most frequently felt that they were chosen because of the alignment of their company's vision, products, people, and culture with those of the institutions they serve. Several vendors referred to this as a partnership between themselves and their customers.

This point was well articulated by Russell Griffith, president and CEO of Datatel, who said, "We need to be more than a vendor. We need to understand our customers' businesses and be an advisor to them." It was further reinforced by Karen Willett, director of product marketing for PeopleSoft Learning Solutions. She said, "The vendors that institutions want to work with, and that they choose to work with, typically are the ones that they plan on having a long-term partnership with." Bob Maginn, chairman and CEO of Jenzabar, agreed: "The need for a partnership view is essential. When you bring in a system like this, it's like a marriage. When you go in, you have to figure out how to make it work, and then you need to keep working at it to make it successful."

Other factors that multiple vendors felt were important included the company's reputation, its product reliability, the technology architecture, their people, and the ease of implementing their products. The list of selection-influencing factors that the vendors discussed included

- ease of implementation;
- cost, including the combined cost of software and implementation;
- product vision;
- technology/technical innovation;
- alignment between vendor and customer, or partnerships with customers;
- people, including employees' skills and experience;
- reliability of code and products;
- having a top-quality product; and
- company's reputation and commitment to the industry.

In contrast to the reasons that the survey respondents cited as important to their purchasing decisions, none of the vendors specifically pointed to functionality as a key to their customers' purchasing decisions. In fact, several vendors openly disagreed about functionality's being a key factor in the ultimate choice of a system. For example, Judy Chappelear, PeopleSoft's director of marketing development for higher education, said, "Notice I didn't mention functionality. It tends to be fourth or fifth in the line of criteria when it really comes down to the final decision making, although we spend most of our time in the sales process dealing with the functionality of the software." Russell Griffith of

Datatel said, "The product is a minimum requirement to play."

This interesting discrepancy between vendor and institutional perspectives may be explained in several ways. One likely explanation is that survey respondents were asked to select all that apply when providing the data appearing in Table 2-3. Therefore, although functionality was a factor in the decision-making process at a large number of institutions, it may not have been, as Chappelear states, the most important factor.

Another possible explanation could arise from the composition of the respondent pool, which consisted primarily of CIOs and IT professionals. Although the factors in Table 2-3 are perceived as important to them, it may be that because ERP purchasing decisions are often complex, other senior decision makers—CFOs, presidents, and various senior executives—may have had different priorities. Then, too, vendors' perceptions of their customers' decision-making processes and motivators may not be correct.

It could also be possible that the factors influencing software purchase have changed over time. Functionality may have been more important earlier on as the packages were evolving; however, as the vendors learned from one another and updated their functionality accordingly, this factor could have become less important.

For the most part, institutions were satisfied with their vendor relationships. The study's analysis shows that satisfaction with the outcome of the implementation is not correlated with the vendor chosen, nor does the addition of Carnegie class make any difference. Fully 87 percent agreed or strongly agreed that the vendor was responsive to their needs during the sales process. However, just 65 percent agreed or strongly agreed that the vendor provided strong support after the purchase of the software.

For their part, vendors expressed some dissatisfaction with the way higher education as an industry purchases software and services. They feel that although the industry expresses an interest in partnering with their vendors, the vendors often have to bid for work through RFP processes, which disallow interaction between the vendors and the institution to jointly develop solutions. According to SAP, "The checklists of functionality and team approach seem to limit the willingness of people to think differently about their potential solution." Oracle said, "It almost seems like there is an inability to ask for what is desired, but rather only for what is known, during the purchasing process. Today the selection and evaluation process is done by committee and consensus and is focused on features and functions, not on where the institution strategically wants to go."

Several of the vendors hoped that in the future they would have the opportunity to work more closely and collaboratively with prospective customers during the purchasing cycle. As PeopleSoft's Judy Chappelear explains, "I would like to see some more innovative and creative ways for the customers to evaluate software and software vendors."

This, then, is the overview of what the study's institutions purchased, whom they purchased from, and when the implementations occurred. The next chapter addresses why institutions purchased ERP solutions.

Endnotes

1. Paul Kobulnicky et al., "Third Annual EDUCAUSE Survey Identifies Current IT Issues," *EDUCAUSE Quarterly*, No. 2, 2002, pp. 8-21.
2. Our survey respondents report ERP expenditures of approximately $1.6 billion. From this figure, we conservatively estimate $5 billion for the industry as a whole.
3. Koch, op. cit.
4. The study notes that the Carnegie classification of institutions of higher education recognizes 1,669 AA institutions, whereas the AACC membership currently includes 1,171. The study's sample includes 5 percent of the Carnegie classification institutions, 7 percent of the AACC membership, and 26 percent of the AA EDUCAUSE membership. The AACC numbers are based on the definition of colleges eligible for membership in the AACC constitution—colleges that award the associate degree and are regionally accredited. The Carnegie count includes career colleges and colleges accredited by the Accrediting Council for Independent Colleges and Schools.
5. The 585 total modules purchased in Table 2-1 exceed totals listed elsewhere because Table 2-1 includes some ERP purchases made prior to 1995.

3

The Promise of ERP Systems

I am giddy; expectation whirls me round.
Th' imaginary relish is so sweet
That it enchants my sense.

—Shakespeare, *Troilus and Cressida*

This chapter investigates the rationale for implementing an ERP system by addressing the following questions:

- Why did higher education institutions purchase ERP systems?
- What did they expect to achieve?
- What was the ultimate goal/vision for implementing ERP at the institution?
- How did ERP fit in with the institution's long-term technical and strategic vision?

Objectives and Drivers

In the literature on ERP, the most commonly stated objectives for implementing an ERP system include providing better information for planning and management of higher education institutions, along with better service to faculty, students, and staff; lowering business risk; and, potentially, increasing revenues and reducing costs through greater efficiency.

Noteworthy, too, ERP systems hold the promise of removing the silo approach to information management—with every department owning and maintaining its own databases—and introducing instead a cross-departmental system, especially at large doctoral institutions. For instance, an ERP system can combine student databases such as registration and financial aid with human resource systems, thereby eliminating the need for duplicate records for a current student who is both on financial aid and employed by the university. Other systems, including alumni, donor, and sponsored projects databases, can eventually be added through modular software purchases.

ERP also helped institutions resolve Year 2000 (Y2K) problems that made legacy administrative systems difficult, if not impossible, to fix in a cost-effective or timely way. In the mid- to late-1990s, many universities adopted ERP systems because they found themselves unequipped to handle the coming Y2K changeover—their legacy systems couldn't handle the change to the year 2000. As educational institutions considered their options, weighing vendor-supplied ERP systems against having to remediate their cumbersome legacy systems, ERP became a key choice for institutions looking not only to solve an immediate problem but also to address enterprise-wide systems issues at the same time.

The University of Wisconsin–Oshkosh is fairly typical. According to CIO John Berens, "We needed to replace our legacy systems built by in-house programming staff in the '60s and '70s. It was customized to fit our campus's business practices and policies. By the mid-1990s, it was very hard to change the system and hard for administrators to get all the data from the system for planning purposes [and for] enrollment. Any policy or business process change required a large number of programming hours because it was a very integrated system. By the mid-1990s, it was very clear that its technology and structure were not keeping pace. A potentially major Y2K situation loomed. Our student system was not Y2K compliant, and we projected it would take18 months for a dedicated staff to bring the system to Y2K compliance. And if we invested in this effort, we knew the system would survive January 1, 2000, but we would still have a limited system."

Chancellor Chuck Spence of the Contra Costa Community College District (CCCCD) provided another perspective on the importance of Y2K. "I was grateful for the Y2K issue. I rode that horse, as so many people did." Convinced during 1997–1998 that the CCCCD needed to begin a major change effort, he concluded that they would do HR, student, and financial systems at once. "It was clear from Y2K that we had to change the entire system. This was a good decision."

Even as the Y2K issue was surfacing, less noticed but equally compelling was a recognition that student demands in particular but also faculty and staff demands seemed to be increasing, with rising expectations for "high quality and quick service in the current environment."[1] According to Sue Van Voorhis, registrar for the University of Minnesota, "We used to have home-grown mainframe systems with over 60 interfaces. It was very silo oriented. This is how we served our customers. For example, we used to send students to five different offices in order to graduate. About five years ago there was a big push toward enhanced customer service."

Increasingly, institutions face rising customer expectations and demand for greater customer access to and control of administrative processes and transactions. The private sector provides sophisticated online services that are extremely customer oriented, so it's not surprising that expectations for similar services would arise in the higher education sector. Other factors include a demand for simplicity and transparency in an increasingly complex environment, the elimination of procedural controls, and the simplification of processes. Noteworthy also is the new IT labor force, characterized by high expectations and an unwillingness to be on the trailing edge of technology.

Mello[2] listed four key trends for those planning to implement ERP in the post-Y2K era: improving integration and flexibility, embracing e-business, reaching out to new users (bringing more of a company's employees on board as ERP users), and adapting to the Internet. In this environment, ERP seems like a natural solution, bringing disparate segments of university services into alignment through cross-functional software that eliminates the need for duplicate data entry and brings automation to areas such as registration, financial aid, and billing.

Reasons for Implementing ERP

The survey respondents only partially confirmed these presurvey observations, as demonstrated by the mean score for each factor in Table 3-1. They were asked to weigh, on a scale of 1–4, the importance of commonly stated factors for implementing an ERP package, with 1 being most important.

Table 3-1. Factors in the Decision to Implement ERP

Factor	Mean
Replace aging legacy systems	1.39
Modernize the campus IT environment	1.57
Provide better management tools	1.62
Increase customer satisfaction	1.66
Improve efficiency	1.76
Solve the Y2K problem	2.75

Most important was the perceived need to replace aging legacy systems, and, surprisingly, least important was the Y2K problem. Mark Sheehan, executive director for information services and chief information officer, and Craig Deaton, associate director, administrative systems at Montana State University, commented: "Our legacy system was maxed out and was too expensive to upgrade. The biggest reason [was] to migrate to a relational database structure from our administrative system's flat-style data structure. Y2K was a looming concern, but it was a loud echo in the background."

While the Y2K issue carried less weight overall, opinions among the study's respondents varied more over this factor than over the others in Table 3-1.[3]

What these data suggest is that ERP system implementations were driven significantly by an IT business need, particularly prior to the year 2000. Executive Vice President John Curry of the Massachusetts Institute of Technology maintains that institutions spent 30 years underinvesting in their legacy systems, effectively eating away a capital good that sorely needed replacing. CCCCD Chancellor Chuck Spence shared this observation: "We needed a new part on our mainframe. The only replacement part was in a junkyard in Norway. We used the same software for 25 years, [and] the only person who knew that code was nearing retirement age."

Respondents were given an opportunity to note other important motivating factors. Only three concerns emerged that are different from those in Table 3-1, but they are not surprising: an outside mandate in the sense that the state or system required adoption of new software, a concern for greater accountability (which is part of the "better management tools" factor), and meeting the needs of small institutions within university systems.

John Curry pointed to the change in sheer size of institutions over the last 30 years and to a concomitant need for ever more timely information. "Federal reporting requirements have been huge in that regard. The financial and risk environment, particularly with respect to federal environment and regulators, has changed."

At Middle Tennessee State University, Sherian Huddleston, interim assistant vice provost for enrollment services, notes, "The impetus for change was that the Board of Regents wanted common reporting across all the schools (6 universities, 14 community colleges, and 26 technical schools), and they wanted to be able to go retrieve data themselves."

The University System of Georgia is reengineering its SCT Banner student information system implementation of the mid-1990s in part because of a need to provide

more comprehensive data reporting than was realized in their initial, more decentralized implementation. The University of Wisconsin, the University System of Georgia, and the California State University System found that ERP implementations gave smaller institutions access to systems and resources they wouldn't have been able to acquire on their own.

Did early adopters or different Carnegie classification groupings of institutions weigh the motivating factors differently? For the most part, the study found uniformity of opinion across all groupings, including public and private institutions and institutions of all sizes. However, there appeared to be no uniformity of opinion about vendor selection. At first glance, the respondents did not perceive any single vendor as better able to address the factors listed in Table 3-1. Again, this may testify to sound vendor selection processes within higher education, or it may indicate a strong degree of functional similarity among the vendor-supplied ERP packages.

The study also asked respondents to choose the single most important reason for implementing an ERP system. The responses appear in Table 3-2.

Table 3-2. The Single Most Important Reason Given for Implementing ERP

Reason	Number Responding	Percentage
Replace aging legacy systems	105	42
Improve service to customers	42	17
Transform how institution operates	33	13
Year 2000 problem	23	9
Modernize campus IT environment	14	5
Provide better management tools	9	4
Keep institution competitive	9	4
Increase efficiency	7	3
Accountability/regulatory compliance	5	3

The data in Table 3-2 strongly reinforce the study's earlier finding that replacing legacy systems was the primary reason respondents decided to move to a packaged ERP system. Improving their services and transforming operations were secondary reasons.

From the Tactical to the Strategic

The data lead us to speculate that the enterprise concept and its implications were initially secondary considerations for higher education institutions. ERP was viewed primarily as a replacement for legacy systems (or modules) to improve transaction processing and administrative efficiency. In this way, ERP would reduce institutional costs and improve service.

The study hypothesizes that the enterprise concept is something university leadership has evolved toward, first with a service vision of one-stop Web-enabled services (especially in the student area), and later with an eye toward the reporting capacity in the data warehouse.

When asked whether the institution's future vision and the ERP vision were aligned, the mean of the general population of respondents agreed that they were, although doctoral institutions expressed a significantly lower level of agreement (see Figure 3-1). However, there was a high degree of variance in the responses to this question, indicating that there was no general trend toward alignment among universities and colleges. The mean response was 3.06 on a scale of 1–4, with 1 being strong disagreement and 4 being strong agreement.[4] The mean response for doctoral institutions was 2.70.

The consequence is that the real payoff with an enterprise investment, discernible more as effectiveness than as improved efficiency, requires hard work and a commitment to change. This will be higher education's major struggle over the first decade of the twenty-first century—creating seamless, customer-oriented organizations. With full adaptation to an ERP logic, institutions will move away from a suboptimal environment in which information is captive and protected, services are mapped to organizations, and departmental data solutions predominate—as do hierarchical and specialized administrative structures. In the envisioned environment, information is ubiquitous and shared, and services are integrated and seamless, while enterprise data warehouse solutions and horizontal administrative structures and processes predominate.

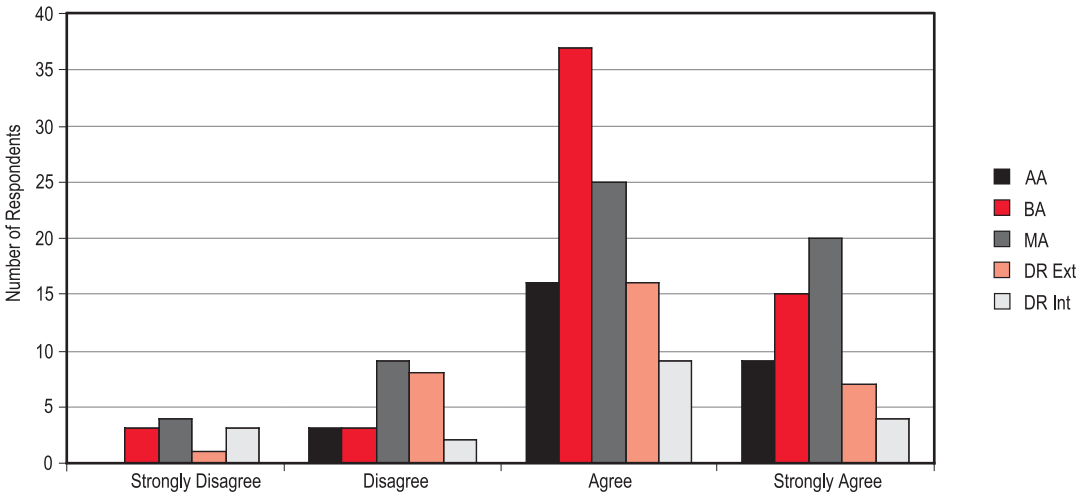


Figure 3-1. Agreement on Alignment between ERP Vision and Institution Vision, by Carnegie Class

Not for Everyone

Not all institutions jumped on the ERP bandwagon, and it may be that the impetus for implementing ERP systems is weakening, as shown in Figure 3-2. Non-ERP solutions are in use at nearly half the institutions in the study's sample, and two-thirds of the study's ERP institutions also continue to use legacy systems as well as newly purchased software. Note that non-ERP solutions were in greater evidence at the AA institutions in the study's sample, while the ERP solution was more prominent at the sample's BA and doctoral institutions. Non-ERP refers to systems developed in-house or based on packages purchased years ago and modified to meet the organization's needs.

Existing administrative applications are often considered outdated and obsolete. Programmers may refer to them as "spaghetti code." But buried in this spaghetti code are many unique changes that reflect years of decisions about how to do business in a particular market, regulatory environment, or university culture. These decisions have been translated into the programming logic that is now embedded in these older systems. Renewing and extending these older systems can be an effective and affordable way to preserve these business practices while making the administrative applications more responsive to user needs. At the same time, maintaining these systems can make it easier to preserve old ways of doing things, effectively legitimizing the status quo.

Don't assume newer is necessarily better, advised Project Manager Ellen Harmon of the Washington State Community and Technical Colleges Center for Information Services. Harmon considers her existing legacy system to be just another, older ERP. "We actually have an ERP that has been developed over the last 18 to 20 years for specific clients, and because of that, this ERP is very focused on what these particular clients need." The case is the same at many other universities. "Their legacy systems have been developed to meet specific needs and are tailored for their environment," said Harmon. "An ERP vendor might say your system is old, and therefore is bad, and we will sell you this new system. But it is a legacy system, too."

The problem with some legacy systems lies in their cumbersome user interfaces and inadequate tools, which make it difficult to

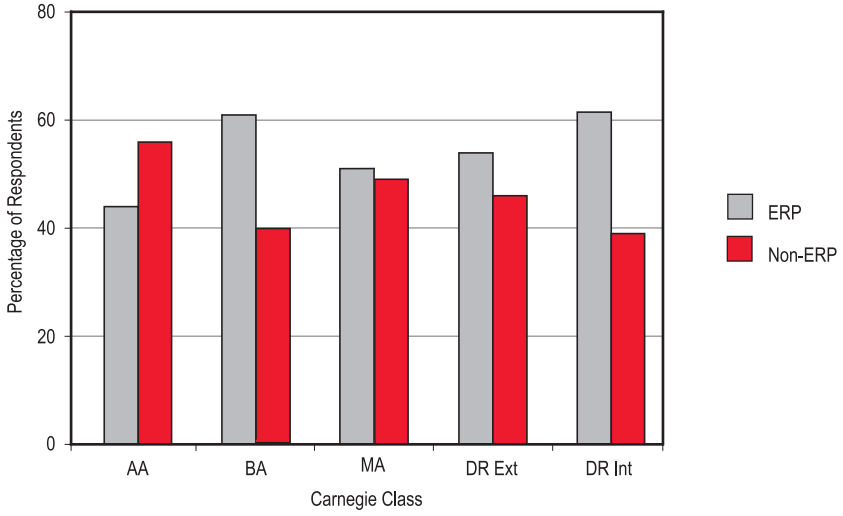


Figure 3-2. ERP and Non-ERP Respondents, by Carnegie Class

interact with these systems and to access and analyze critical planning and management information. For the non-ERP adherents, there is no need to replace the entire system to address these issues.[5]

The findings of ECAR research conducted by Ed Lightfoot (University of Washington) on the University of California at San Diego, Indiana University, the University of Texas–Austin, the University of Washington, and the Washington State Community and Technical Colleges help us to conclude that institutions that pursue a non-ERP alternative usually adopt three general approaches. They

- create interactive Web interfaces that provide quick and easy access to information and transaction services;
- develop data warehousing techniques that provide user-friendly ways to retrieve information and produce timely, accurate, and meaningful data analysis and reports; and
- renew the underlying system technologies as required to meet the changing needs of a particular environment, upgrading databases and languages as well as the underlying systems and hardware.

These three approaches address the most serious deficiencies typically found in legacy systems. Lightfoot's findings are supported by data in this study (Tables 3-3 and 3-4). Respondents were asked to select all that apply.

Table 3-3. Ways in which non-ERP Institutions Extend Functionality Using Their Legacy Systems

Approach	Frequency
Web-based interfaces	153
Build or purchase new components	122
Data warehousing	99
Redesign processes	66
Enterprise application integration tools	27

Table 3-4. Ways in which non-ERP Institutions Extend the Life of Their Systems' Technical Environment

Approach	Frequency
Rehost systems to more modern applications	78
Restructure system for better maintainability	75
Staff development	66
Convert to more vendor-supplied database products	48

Respondents were also asked why they continue to use their non-ERP systems. When offered a list of commonly accepted factors and asked to select all that apply, they responded as shown in Figure 3-3.

For the most part, the factors are pragmatic and may also reflect the absence of a compelling IT business case, especially in light of available resources and other institutional priorities. They stay with their current systems because they work (25 percent), other institutional priorities take precedence (18 percent), and, to a lesser degree, institutions are not ready, and the experience of others makes them cautious. When asked for the single most important reason for not selecting an ERP product, respondents' answers mirrored the findings in Figure 3-3. The existing system works (32 percent), other priorities (15 percent), and not ready (16 percent).

Nevertheless, one-third of the institutions that haven't implemented vendor-supplied ERP software for student, finance, or human resources since July 1, 1995, have conducted a formal review of an ERP solution. A good number are either implementing or considering implementing a system in the near future. Table 3-5 shows levels of current interest. The data are similar for all ERP modules. Approximately 10 percent are either currently implementing or will implement an ERP module within the year, and 25 percent expect to implement in the next one to three years. Ten percent are at least three to five years out. Fifty-five percent are either not contemplating an ERP implementation at this time or do not know.

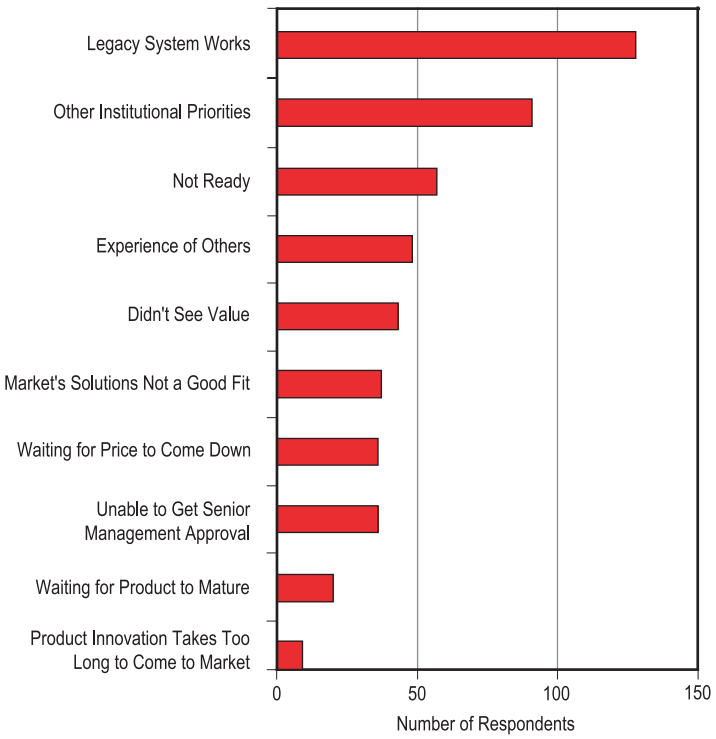


Figure 3-3. Non-ERP Institutions' Reasons for Not Having Purchased ERP

Table 3-5. Non-ERP Institutions' Planning

Plans	Financial	HR	Student
Currently implementing	5	5	5
Will implement within 1 year	6	5	4
Will implement in 1-3 years	25	24	23
May implement in 3-5 years	9	12	13
Not under consideration	51	52	51
Not answered	4	2	4

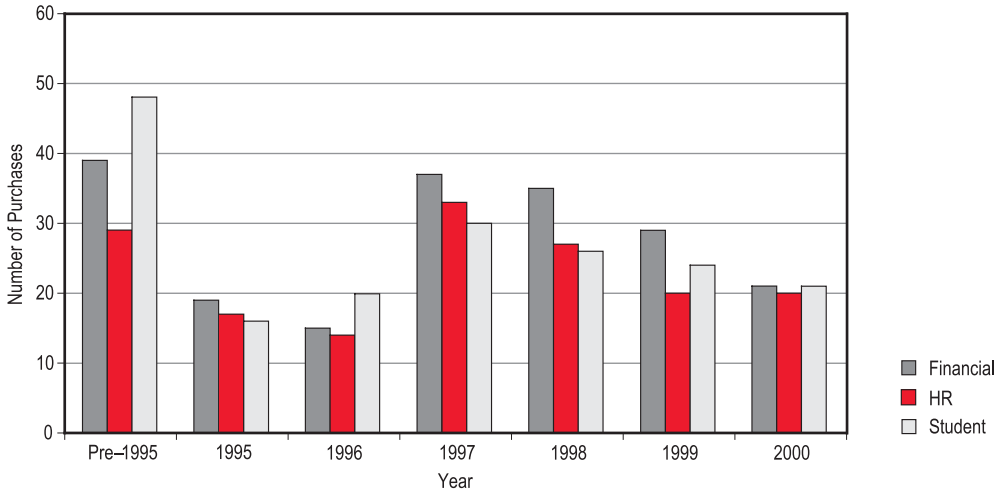


Figure 3-4. ERP Purchases by Year

There is some indication that implementations have been slowing over the last decade. Since 1997 and 1998, the number of purchases has been declining (see Figure 3-4), especially among doctoral institutions. Several ERP vendors also validated this finding, having noticed their sales leveling off after a pre-Y2K spike and a post-Y2K decline. However, several of the vendors who serve mostly smaller institutions in higher education indicated that they are experiencing strong sales in 2002.

This pattern mirrors findings in industry, where Stein noted that as early as 1998 the push toward ERP was slowing.[6] Forrester, a research group, claimed that the new push was toward more lithe, adaptable modules rather than the large, comprehensive systems.[7] Businesses began to view ERP as a tool for revenue growth and flexibility, rather than as a means to cost reductions and streamlined systems.[8] Some observers claimed that ERP systems had become "a liability for many because they perpetuate some of the legendary material requirements planning problems such as complex bills of materials, inefficient workflows, and unnecessary data collection."[9] Forrester research claimed that ERP systems failed to improve the bottom line.[10]

The next chapter addresses these outcome questions.

Endnotes

1. V. A. Mabert, A. Soni, and M. A. Venkataramanan, "Enterprise Resource Planning: Common Myths Versus Evolving Reality," *Business Horizons*, Vol. 44, No. 3, May 2001, p. 69.
2. A. Mello, "Four Trends Shaping ERP," *Enterprise,* Feb. 7, 2002. Retrieved 2/28/02 from <http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2844338,00.html>.
3. To determine the spread of answers given, or the variation as opposed to central tendency (mean), the study calculated the standard deviation and the coefficient of variance. For all the objectives listed in Table 3-1, except Y2K, the standard deviation is 0.65 and the coefficient of variance is 0.4. For Y2K, however, the standard deviation is 1.2 and the coefficient of variance is 1.4, which is to say that the study's respondents differ much more on their assessment of the importance of Y2K.
4. Variation in response to this question is demonstrated by a relatively high standard deviation of 0.91.
5. To examine the risks and benefits of a non-ERP approach and to provide a better understanding of why institutions are choosing this path, Ed Lightfoot of the University of Washington studied four universities and one community college system's computing consortium. Although each university has followed a different non-ERP strategy that reflects its unique culture, habits, structure, and history, they nevertheless share common approaches. A brief look at each university highlights some of these special contexts and shows how this factor has influenced their approach to administrative systems.
6. T. Stein, "ERP: Tackling Complexity," *InformationWeek,* No. 679, Apr. 27, 1999, p.18.
7. A. Parker, "ERP Future Lies In Modules, Not Monoliths," *Computer Weekly*, Jun. 10, 1999, p. 52.
8. R. Freedman, "ERP Beyond Y2K (The Outlook for Enterprise Resource Planning Systems)," *PC Magazine*, Jun. 22, 1999, p. 219.
9. M. Bradford, T. Mayfield, and C. Toney, "Does ERP Fit in a LEAN World?" *Strategic Finance.* Vol. 82, No. 11, May 2001, p. 28.
10. J. Menezes, "ERP Fails to Improve Bottom Line, Says Forrester," *Computing Canada*, Vol. 25, No. 45, Nov. 26, 1999, p. 4.

4

The Performance of ERP Systems

Don't be afraid to take a big jump. You can't cross a chasm in two steps.

—David Lloyd George

The key factor is to remember that any ERP system is a means to an end. It has to help the organization manage complex business processes so it can increase productivity and run more efficiently.

—J. Pallato

Pallato's advice guides this chapter. ERP software and technology are tools whose deployment probably represents 10–20 percent of an ERP implementation effort. ERP systems are a means to an end, and often an impetus to changing the way higher education does its business. Almost invariably this means changing the campus culture. We see ERP as 80–90 percent about people, and about campus and institutional culture—values, organizations, rules, and responsibilities. It's also about how colleges and universities do their work, approach their business strategies and processes, and regard their orientation toward customers and colleagues. The study continually finds contradictions and informative juxtapositions of an ERP implementation's technical aspects with its people or cultural aspects.

This chapter addresses the following questions:

- How well did a major segment of higher education implement ERP systems? Did they complete their implementations on time?
- What are the critical success factors for an ERP implementation and what are the major obstacles? Are they external to the institution or internal—for example, do problems stem from software and hardware or from policies, traditions, and staffing?
- Do institutions feel their ERP efforts were successful and how do they know? What benefits accrued to successful ERP implementers? How satisfied were the faculty, staff, and students?
- What does an ERP implementation cost and how was it funded?
- What were the most important changes that resulted from an ERP implementation?
- What key lessons can higher education learn from ERP implementations included in this study?

After the initial wave of ERP implementation, the literature began to give warnings, helpful hints, and complete guidelines for all facets of ERP. Included was advice on deciding whether ERP fits the organization,

selecting a vendor, choosing modules versus comprehensive packages, planning, implementation, training, and benchmarking.[1-5]

This study addresses these issues squarely, and a key objective of this chapter is to provide a summary of effective practices on the basis of the study's 500-plus contributors' shared experiences. We begin with a national and comprehensive overview of the implementation experience.

Time to Completion

Popular opinion is that ERP implementations take longer to complete than planned—often much longer. This is not what the study's respondents report (see Figure 4-1). Seventy-six percent of the institutions indicated that they completed their financial system on time or early; the figures are 70 percent for human resource and 67 percent for student modules. However, the larger the institution, the less likely it was to finish on time, regardless of vendor. Larger institutions have more complex processes and are more likely to engage in customization. Later, this chapter will show that customization has a major impact on time to completion and cost.

Fewer than 5 percent of the respondents indicated that they went over schedule by more than 50 percent, which we feel is a remarkable overall performance.

Sixty percent of the sample's modules were operational within one to two years after planning and purchase of the software, 20 percent within three years, and 20 percent in four or more years. About 5 percent were operational within a year. The figures are the same for financial, HR, and student systems. Financial systems go in faster, followed by HR and then student modules. Planning and purchasing for 80 percent of the study's sample is completed within a year.

A number of institutions applauded the speed and ease of their implementation. "Our vendor's methodology is solid and guided us through the process as painlessly as possible." "We brought up a large ERP system in six months for a large statewide system. Two of the major modules went live with barely a ripple." "Project timelines are the most aggressive our vendor has ever encountered. Such aggressiveness appears to have hurdled traditional obstacles such as resistance to change and preponderance of customizations instead of business process reengineering."

Anecdotal observations suggest that institutions with a burning platform outperform those without. Institutions with a Y2K

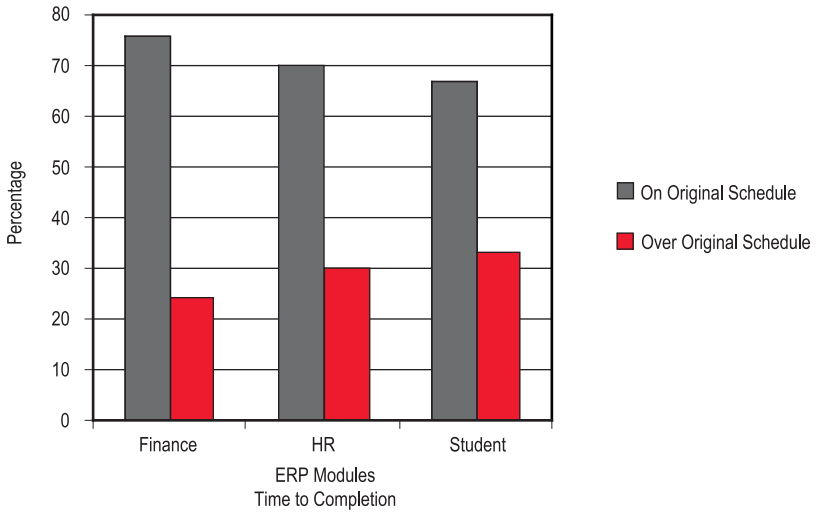


Figure 4-1. Performance against Original Schedule

problem and a failing legacy system were under enormous pressure to succeed and to do so quickly.

This certainly was the case at the University of Minnesota, where student administrative services would not work beyond the year 2000. The institution had to cope with Y2K, a legacy system, and a concomitant legislative mandate to shift from quarters to semesters. No work was done on the legacy system, as all bets were made on completion of the vendor's student system. The administration had left the door open to success or defeat, but not retreat. The stress was enormous for all involved. Minnesota succeeded, but apparently no more rapidly than other institutions in the study's survey sample. The study's data acknowledge cases like Minnesota's but also indicate that institutions that commit to an ERP implementation succeed with or without a burning platform. CIOs increasingly are able to accurately determine time frames for implementation.

Institutions that went over the planned implementation time gave the following reasons, in order of magnitude: organizational issues (especially with the student system), data issues, resource constraints, and an unrealistic time frame to begin with. Less often mentioned but nevertheless real and important were technical problems, scope creep, failure of the vendor to deliver key functions, and training.

An example from Smith College's situation illustrates why one institution's project timeline expanded. "The initial timeline developed for the implementation called for it to be completed in about three years," according to Kim Butz, Smith College's former director of administrative technology. "However, about halfway through Smith's implementation, SCT introduced its Web modules, and Smith elected to expand the scope of the implementation to include these components. Overall, the entire implementation was completed in four-and-a-half years."

All respondents were asked to identify the three biggest obstacles they had to overcome to successfully complete their implementations. Their responses appear in Tables 4-1 to 4-3.

When these tables are combined to rank the obstacles in order of significance, a remarkably similar pattern for all three ERP modules emerges (see Table 4-4).

Clearly, the perceived obstacles to success are internal to the institution. Resistance to change and lack of internal expertise, whether reflected in a lack of understanding of the software's capabilities or a lack of alignment between software and business practices, are both rated among the top barriers. One respondent noted, "We clearly underestimated the personnel resources required for implementation," and another commented on "conflicts over priorities between the project team and production staff in both IT and the functional areas." Still another said, "Our admissions office resisted the change, and as a result the module was two years over schedule." Data issues and customization were more likely to plague the student systems, but that's not surprising.

Data issues, many attributable to sins of the past when all units maintained their own systems, must now be aligned and transferred into a new integrated system. Robert B. Kvavik of the University of Minnesota has joked about a Minnesota state legislator asking the university's lobbyist, "Stan, how many people work at the U?" And the answer was "about half," which was probably as good an answer as he could give because so much personnel data sat on multiple databases that could not be combined and reported. Perry Hanson, CIO of Brandeis

Table 4-1. Obstacles for Financial Systems

Obstacle	Frequency	Percentage
Resistance to change	75	12
Lack of internal expertise	63	10
Alignment between software and business practices	63	10
Lack of understanding of software capabilities	60	9
Data issues	57	9
Quality of software	43	7
Customization	42	6
Conflicts with other priorities	39	6
Technical issues	31	5
Scope creep	30	5
Lack of consensus among business owners	29	4
Inadequate training	28	4
Lack of financial resources	24	4
Project schedule	20	3
Issues with external consultants	17	3
Inadequate communication strategy	15	2
Lack of consensus among senior management	11	1

Table 4-2. Obstacles for HR Systems

Obstacle	Frequency	Percentage
Lack of internal expertise	58	12
Resistance to change	54	11
Lack of understanding of software capabilities	52	10
Data issues	51	10
Alignment between software and business practices	36	7
Customization	30	6
Conflicts with other priorities	28	6
Scope creep	27	5
Lack of consensus among business owners	25	5
Quality of software	24	5
Technical issues	22	4
Lack of financial resources	22	4
Inadequate training	18	4
Project schedule	15	3
Issues with external consultants	15	3
Lack of consensus among senior management	12	2
Inadequate communication strategy	9	1

Table 4-3. Obstacles for Student Systems

Obstacle	Frequency	Percentage
Resistance to change	88	14
Data issues	83	14
Customization	55	9
Lack of understanding of software capabilities	54	8
Lack of internal expertise	51	8
Alignment between software and business practices	47	7
Conflicts with other priorities	36	6
Quality of software	34	6
Lack of consensus among business owners	31	5
Technical issues	27	5
Scope creep	24	4
Lack of financial resources	21	4
Inadequate training	19	3
Project schedule	14	2
Lack of consensus among senior management	13	2
Inadequate communication strategy	12	2
Issues with external consultants	8	1

Table 4-4. Obstacles for Each ERP System, by Order of Significance

Obstacle	Financial	HR	Student
Resistance to change	1	2	1
Data issues	5	4	2
Customization	7	6	3
Lack of understanding of software capabilities	4	3	4
Lack of internal expertise	2	1	5
Alignment between software and business practices	3	5	6
Conflicts with other priorities	8	7	7
Quality of software	6	10	8
Lack of consensus among business owners	11	9	9
Technical issues	9	11	10
Scope creep	10	8	11
Lack of financial resources	13	12	12
Inadequate training	12	13	13
Project schedule	14	14	14
Lack of consensus among senior management	17	16	15
Inadequate communication strategy	16	17	16
Issues with external consultants	15	15	17

University, noted that with the completion of their ERP system, "We can actually count who works here, and our payrolls are accurate."

Obstacles noted in the interviews include problems with institutional culture, tradition, and practices. Compensation and benefits at many institutions do not motivate behavior, and there is a lack of clarity about who owns the data.

Implementation Difficulties

The study's respondents were asked to rate the difficulty of implementing ERP systems in comparison with other large technology projects (Figure 4-2). On a scale of 1–5, with 5 being very difficult and 3 being about the same, the mean response for the overall difficulty of the initial implementation was 3.52 for financial, 3.53 for HR, and 3.80 for student modules. Technical difficulty was rated as less of an issue, although it was still judged to be greater than on other IT projects: 3.41 for financial, 3.41 for HR, and 3.55 for student. Rated more difficult was managing process and organizational change, with reported means of 3.69 for financial, 3.69 for HR, and 3.90 for student. So overall, ERP systems are viewed as more difficult to implement than other major IT initiatives. For a few institutions, they proved to be extremely difficult.

Anne Strine, assistant vice chancellor, Information Technology, of Pima Community College, said, "I think it fit in with my expectations, but I think very few in the college had experienced a project with such an impact and such a short implementation time frame. I don't think anyone would say it was harder, but in a way it was, because people didn't know what to expect. After we got into the project, I tried to keep people aware that it was going to be a tough project, so that it was part of their expectation and they didn't panic when it got hard."

John Berens, CIO of the University of Wisconsin at Oshkosh, paints a different picture. "I must have been the most naïve CIO that went into this. It was absolutely more difficult than planned. I knew it would be very large and very long in terms of time and resources. I guess I didn't appreciate the degree to which student systems touched every aspect of the campus. Literally it touched throughout the campus—the students, all the employees, and then every office that depended on the core student system."

Echoing Berens's observations were Mark Sheehan and Craig Deaton of Montana State University. "It was more difficult than planned. The compressed timeline sounds good on paper, but until you live through the war, you really don't know its impacts on personnel and the organization. The

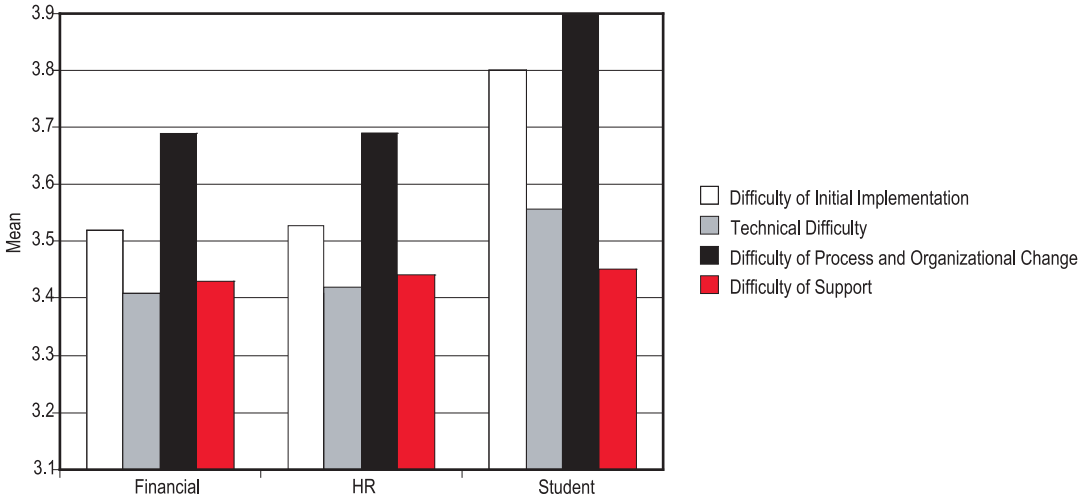


Figure 4-2. Implementation Difficulty Compared with Other Large IT Projects

implementation was more complex. The new system was more complex than the legacy system. And I am sure some of our estimates and projections were based on the legacy experience, but it was an entirely different ball game . . . the entire paradigm shift that the whole organization experienced was difficult. The functional users had to take more ownership of their systems. The staff absorbed more complex levels of technology. The legacy system was basically a mainframe. We moved to client-server and Web services. And there was the technical shift to new operating systems and more robust Web services. Then there is the cultural shift for the organization—the four campuses having to work together. Before, the campuses met every four months to discuss issues, but it wasn't the same as working together under the same umbrella."

The study's panel of experts also emphasized the level and the nature of the new systems' difficulty. Polley Ann McClure, vice president and CIO at Cornell University, noted, "There are serious long-term implications for institutions from these projects. Many had never managed a big institutional project like this, where different departments had to work together in a systematic, somewhat hierarchical process to be successful."

These comments complement the findings of the quantitative data in important ways. They provide a sense not only of what the new level of difficulty was, but of its complexity as well. Clearly, trade-offs were made to accommodate the schedule, and these have a negative impact on customer satisfaction.

The study analyzed the importance of institution size, Carnegie class, vendor chosen, and whether the institution was public or private, viewing all these factors as possibly affecting the difficulty of an ERP implementation. The main finding was that the larger the institution's student body, the more difficult the project—regardless of vendor chosen, public or private status, or Carnegie class.[6]

Especially noteworthy is the date of implementation. The study grouped the implementations into four time-of-implementation periods: 1980–1994, 1995–1997, 1998–2000, and 2001 and later. Implementations during 1998–2000 in particular emerged as difficult, especially for doctoral institutions. The implementations were more likely to go over time and budget, and more customization of the base code was undertaken. Productivity drops were more significant, and it took longer to return to an earlier level of productivity. The student implementations were the most difficult.

In retrospect, the study's respondents who represented this period were most likely to change their approach should they do it again. The difficulties encountered during this time period were probably due, at least in part, to problems with particular software and institutions' trying to complete their implementations in time for the Y2K deadline. Cutting corners in areas like training and reengineering, or reducing functionality to ensure on-time project completion could account for the longer-term productivity drops.

Reengineering and Business Process Redesign

Ideally, reengineering and business process redesign are a continual activity in the new ERP environment. From a practical standpoint, it's wise to reengineer and align institutional policies, procedures, and business rules (such as charts of accounts, vacation and sick-time policies, and grading systems) in advance of an ERP system implementation because it means that less work is needed to customize code, thereby reducing costs. Note, however, that undertaking

full reengineering—including modification of workflows, information transfers, and business processes—before selecting and understanding the nuances of an ERP package can necessitate more customizations to make the software work with the new processes.

The University of Minnesota significantly modified nearly 100 student policies (not processes) prior to implementation, including standardizing honors criteria and reducing nine grading systems to three. But this appears to be an exception. Only 13 percent of the respondents reengineered processes in advance of the ERP implementation; 60 percent did reengineering as part of the ERP implementation process, and 22 percent did no reengineering. AA, BA, and MA institutions reengineered later in the implementation than did doctoral institutions, usually after the implementation was complete. Financial systems were reengineered later than HR and student systems. Overall, there was no statistical significance by Carnegie class, institution size, vendor used, or ERP system purchased.

Charles White, vice president, Information Resources and Administrative Affairs, Trinity University, supports the quantitative findings. "We did not engage [in] the process that the vendor recommended—a year-long audit of our business practices—because we felt there was not enough time to complete the audit and implement the system before our Y2K deadline." As a consequence, "To this day, we continue to run into business practices that require change. Some staff members feel that we should change the system to reflect the process, rather than changing our business practice. They talk about the tail wagging the dog, but I make the argument fairly strongly from the IT side of the house that they should change their business practices rather than customize the system. And they generally change their business practices."

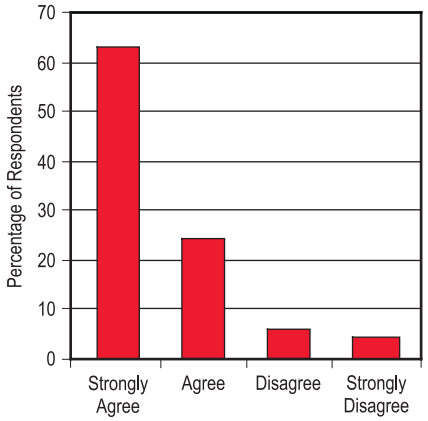
Judith Caruso of the University of Wisconsin–Madison comments, "We changed business processes, but [we did it] during the implementation process as we figured out how to implement a particular module. For example, the ERP system changed the work relationship between the registrar and the bursar. We had to redesign those business areas. Staff moved from one office to another; their lines of work changed."

Customization

Customization has been a major issue for senior administrators because of a fear that their organizations would "pave the cow paths," that is, not make the expected changes to business processes, thereby failing to produce efficiencies and to change the way service is provided. Of course, the more modifications made to code, the costlier and more time-consuming the implementation and subsequent upgrades. It's not surprising then to find that 87 percent of the study's respondents agreed or strongly agreed that their institution's strategy was to implement software with as few customizations as possible (see Figure 4-3).

The concern is warranted. One of the study's most significant findings is the singular and overwhelming impact customization had on the sample's ability to finish on time and on budget. This reveals a dilemma, because customization improves satisfaction

Figure 4-3. Limiting Customization Was a Strategic Goal



levels with the ERP implementation outcomes for staff, management, and students.[7]

That customization is a problem is not surprising by itself. What is surprising is that many factors that higher education intuitively believes would put a project at risk—such as budget, quality of financial and project management, and project manager's experience—were not statistically significant. We speculate that CIOs recognized these problems (as demonstrated in Tables 4-1 through 4-4) and successfully addressed or circumvented them. In retrospect, the survey did not ask the CIOs to address obstacles they ranked higher than customization—for example, levels of resistance to change, staff experience, and data-integrity problems. These may well have had a significant impact on time to completion and would have fit nicely into the regression models the study developed.

In practice, 30 percent of the respondents indicated that they had made no modifications to their systems, 48 percent had modified up to 10 percent of the code, and 23 percent had modified more than 11 percent of the code. (See Figure 4-4.) Only nine institutions, or 4 percent, had modified more than 25 percent of the code. This is less customization than the study had expected.

Institutions were asked on a four-point scale ranging from strongly disagree = 1 to strongly agree = 4 whether they had a structured and formal process for making customizations, whether they followed their process for making customizations, and whether the institution's strategy was to implement with as few customizations as possible. The means were calculated for each question. Figure 4-5 shows that doctoral institutions were initially planning to do more customization than other Carnegie class institutions. For that reason they appear to have established more rigorous structures for monitoring and approving customizations.

Institutions were asked on a five-point scale ranging from from none, minor (1–10 percent of code), some (11–25 percent of code), significant (26–50 percent of the code), and extreme (more than 50 percent of code), with none = 1 and extreme = 5, whether they had made customizations to their modules. The means were calculated, as shown in Figures 4-6 and 4-7.

Figure 4-6 shows how institutions in the various Carnegie classes customized their products. Regardless of Carnegie class, the student systems were the most customized. Doctoral institutions—especially Dr. Ext. institutions—did significantly

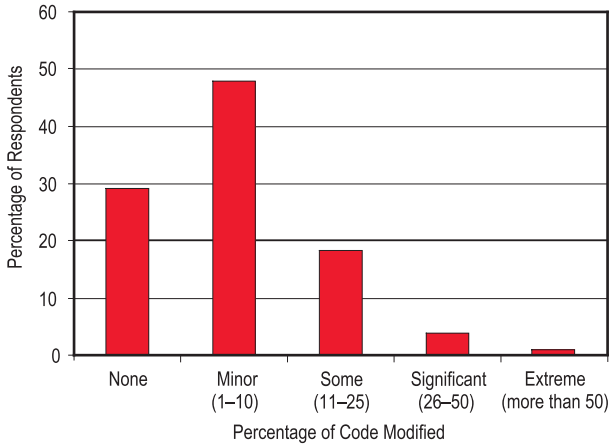


Figure 4-4. Degree of Customization

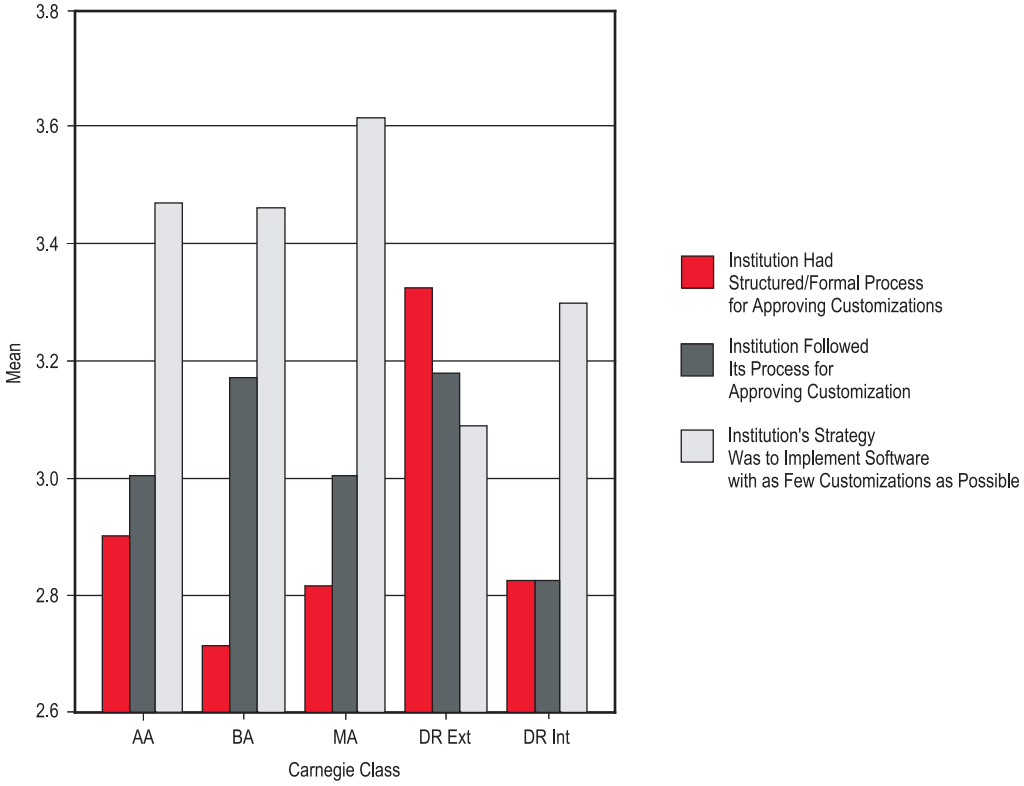


Figure 4-5. Customization Strategy and Processes, by Carnegie Class

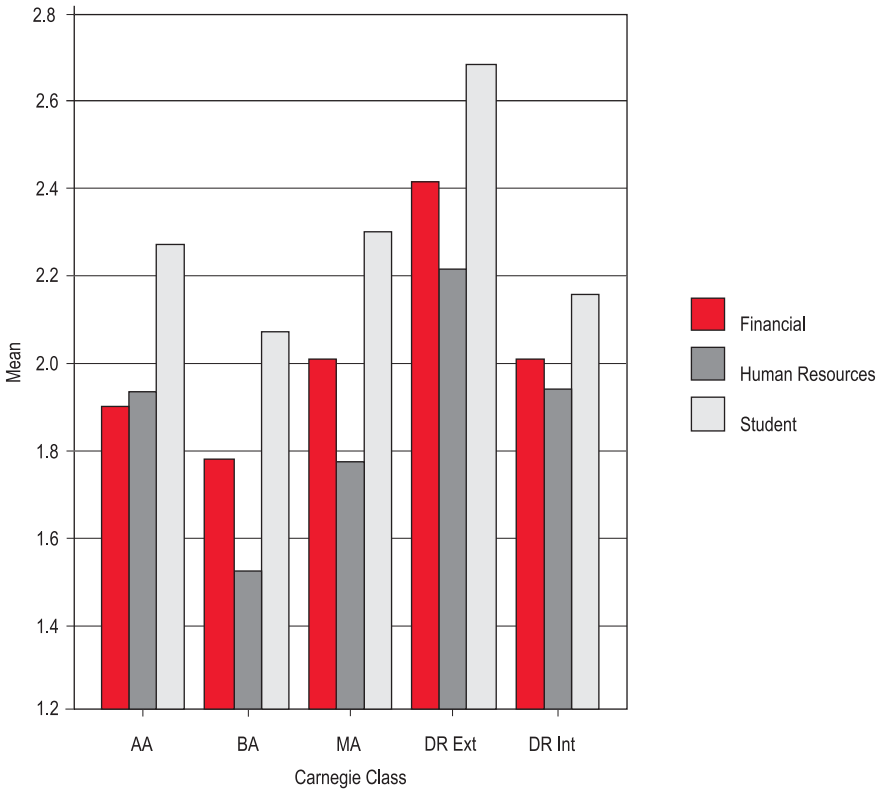


Figure 4-6. Actual Customizations, by Module and Carnegie Class

more customization than all other groups for all modules.

Another interesting finding is that private institutions did far less customization of their HR systems, as shown in Figure 4-7.

Charles White of Trinity University captured the general commitment to little or no customization. "One of the first of our many commandments was that until we implemented the system fully, we would not change it. Everything was as it came. I said no customization because we had a problem with customization in our legacy system. We customized things, but we never documented them, due to lack of time. And I argued, 'How can you customize when you don't have the system implemented fully, when you don't really know its capabilities and functions?' And customization creates a real problem during new releases, upgrades, and patches. You have to redo the customizations every single time."

Stanford University took a less absolute but nevertheless disciplined, tough approach to customization, and it appears to be fairly representative. According to Chris Handley, "We agreed to make customizations to the package only when they were absolutely essential to the business, and then when the customization would serve the whole campus. If an institution or department requested a customization specific to its area, or the school/department didn't like the way the package works, [that] area bears the cost. And we didn't put any contingencies in the budget, so we tried to keep the discipline. There is an amount of money that is roughly equivalent to 10 percent of the overall budget that belongs to the provost. If we need a customization, we have to go to the provost and we have to make a business case as to why we need it. That kept the amount of the customizations down. This is the first time that I used provost approval, and I wished I had done like that everywhere else!"

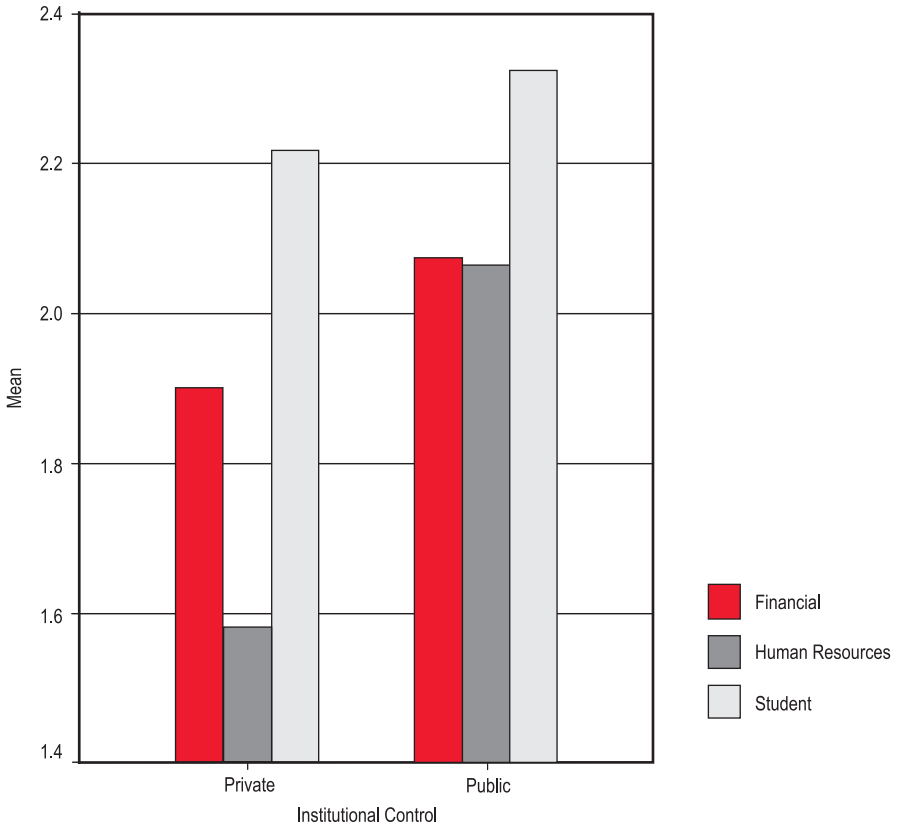


Figure 4-7. Customization, Private versus Public Institutions

Smith College took a slightly different approach on implementing without customizations, according to Kimberly Butz, Smith's former director of administrative technology. "What we decided up front was that each department would have to use the system for one year—through their full business cycle—before we would consider any modifications. And it ended up that after implementing all five base modules and all the Web modules, that there are only about 10 form or program modifications campus-wide." As a result, Smith's ongoing system maintenance was made significantly easier. "When it comes time for upgrades, we implement them so much earlier than other Banner schools because of our vanilla approach to implementation," explained Ruth Constantine, Smith College's vice president for finance and administration.

Reasons given for modifying code included improving reporting, filling gaps in functionality, integrating the product with other systems, improving the look and usability of screens, and getting the product to conform to existing processes. Gaps in functionality, conformance to existing practices (especially for HR and student modules), and improved reporting were the factors most often cited, and more often by doctoral institutions. For example, one institution indicated that it gives no grades but instead evaluates portfolios, and another has courses that are worth one-third of a unit, so major modifications were needed. The large doctoral institutions in particular had problems with gaps in functionality or difficulties accommodating different practices in multicampus systems. In some instances, state-mandated requirements necessitated significant customization.

It is not at all clear from the study's findings that "plain vanilla" is best. A number of institutions reported major business problems because the no-customization approach had been too rigid. Some institutions found creative ways to provide enhanced functionality beyond that offered by their ERP package without customizing the system's base code. For example, one BA institution created new forms for some areas of its system rather than modifying those that were provided with the system. They also used "bolt-ons," or third-party applications, that interfaced with their ERP system, rather than trying to utilize subpar functionality in some areas of the ERP package or creating new functionality in the package. They used external data analysis tools to track and manipulate data in ways the core system could not. By taking this approach, they could meet their users' business needs more fully, while the core system was largely unmodified, making it easy to upgrade and maintain.

What the data show is that customizations were made, usually for pragmatic reasons, in conformity with a formal process often involving senior management. Institutions where customization was undertaken also indicated a higher level of staff and student satisfaction. A price was paid, however, in terms of completion time and cost. But this may well be a reasonable trade-off.

Consultants

Consulting firms and independent consultants played a major role in the implementation of ERP systems. Large, general-purpose consulting firms, specialized firms, and vendors' implementation consultants were all used. For purposes of the survey, we categorized these consultants as

- a large, general-purpose consulting firm;
- a national or international firm that provides a broad range of services to clients in a number of industries;
- a specialized consulting firm;
- a firm that provides a focused range of services, such as higher education consulting, ERP consulting, or project management;
- independent consultants;

- individual contractors filling key roles such as technical specialist or project manager on an implementation;
- vendor consultants; and
- a consulting practice owned by an ERP software vendor.

Two-thirds of the study's respondents used consultants for at least one aspect of their implementation. The reasons they gave for hiring consultants are summarized in Table 4-5. Respondents were asked to check all the reasons that apply.

Primary factors cited include knowledge transfer, augmenting staff, training, and project design. Institutions that did not use consultants gave the primary reason as the strength of internal human resources or the intent to develop in-house expertise, followed by cost and absence of funds in the budget for this service.

Public institutions were more inclined to use consultants, especially MA institutions. Private baccalaureate colleges were the least likely to use consultants, perhaps because of relatively more straightforward implementations and support from the vendor. However, these are just trends, and their level of significance is modest.

The study asked the respondents from institutions that hired consultants to estimate the level of consultant effort. They indicated this by providing the percentage of a given activity's project team that consisted of external resources employed for key aspects of the ERP implementation. These percentages, or levels of effort, were categorized as 0 percent, 1–25 percent, 26–50 percent, 51–75 percent, 76–90 percent, and 91–100 percent. Tables 4-6 through 4-8 show the findings.

The study found that support for training scored highest in terms of percentage of consultant time used, with an average effort in the range of 51–75 percent, represented in the table by a mean of 3.76. Technical implementation support scored lowest. Note that the standard deviations throughout the tables are quite high. One standard deviation above and below the mean represents 68 percent of the variation from the mean, or average, and two standard deviations account for 95 percent of the variance. What this signifies is that institutions used consultants very differently in terms of overall effort, and by specialty areas such as training, system selection, and so on.

There are some differences among the various ERP modules, most notably with the student system. The overall level of consulting activity is higher for the stu-

Table 4-5. Reasons for Choosing Consultants

Reason	Frequency	Percentage
Provide knowledge transfer	127	21
Augment internal staff	126	21
Provide training	103	17
Project design and advice	102	17
Strategic partner planning through implementation	70	11
Manage implementation	48	8
Turn around at-risk implementation	18	3
Outsource bulk of implementation activities	11	2

Table 4-6. Consultant Activity for Financial Systems

Type of Support	Mean	Standard Deviation
Training	3.76	1.67
Upgrades	3.46	1.94
Project management	3.45	1.62
Ongoing	3.44	1.91
System selection	3.38	2.02
System design	3.38	1.65
Project planning	3.25	1.56
Technical implementation	3.10	1.41
Process redesign	2.95	1.61

Table 4-7. Consultant Activity for HR Systems

Type of Support	Mean	Standard Deviation
Training	3.71	1.77
Ongoing	3.53	2.00
Project management	3.46	1.72
System selection	3.42	2.08
Project planning	3.42	1.59
Upgrades	3.33	1.96
System design	3.31	1.60
Technical implementation	3.13	1.51
Process redesign	3.05	1.69

Table 4-8. Consultant Activity for Student Systems

Type of Support	Mean	Standard Deviation
System selection	3.86	2.10
Training	3.76	1.66
Ongoing	3.64	1.92
Upgrades	3.60	1.98
Project planning	3.46	1.59
System design	3.41	1.59
Technical implementation	3.39	1.54
Project management	3.38	1.71
Process redesign	2.97	1.68

dent systems than for HR and finance. Interestingly, consultant support for system selection was much higher and ranked number one for student systems, whereas it ranked fourth and fifth for HR and finance, respectively. (See Table 4-9.) Project management for student systems was ranked lower.[8]

Internal staff largely provided support for system selection. However, when consulting firms were used, large consulting firms were most often chosen, especially for the selection of financial systems. Consultants of all types—particularly the vendor firms—supported project planning. This pattern is also true for system design. Specialized con-

Table 4-9. Consultant Activity Ranked in Terms of Most Used, by Module

Type of Support	Financial	HR	Student
Training	1	1	2
Upgrades	2	6	4
Project management	3	3	8
Ongoing	4	2	3
System selection	5	4	1
System design	6	7	6
Project planning	7	5	5
Technical implementation	8	8	7
Process redesign	9	9	9

sultants were more often involved in support for project management and technical implementation. Large and specialized firms were used for process redesign, with specialized firms used more often for student systems and HR. Vendor firms dominated training efforts as well as ongoing support and system upgrades.

The perceived benefits of working with consultants appear in Table 4-10. Respondents were asked to select all that apply.

Not surprisingly, 41 percent of the responses relate to supplementing expertise that is missing in-house. When combined with insights from previous experience (also an expertise factor), this area accounts for 57 percent.

Gratifying for the consulting industry are findings showing that 90 percent of the respondents agreed or strongly agreed that the consultants helped the institution achieve implementation objectives. Two-thirds believed their money was well spent. There is a correlation between money being well spent and how well the consultants were managed: The higher a respondent's opinion about whether the institution managed its consultants well, the higher the opinion that the money had been well spent.

Half of the respondents were concerned that the cost for consulting was higher than estimated or that the price was not tied to achieving milestones. Other expressed concerns included, in descending order of frequency, experience overstated, failure to transfer knowledge, failure to understand the institutional culture, and poor fit of personnel. But these numbers are not high.

Importance of Leadership

According to Anne Strine of Pima Community College, "One of the most important things about our implementation was that our chancellor, who was not necessarily active in all the meetings, came whenever we needed him. He was the biggest cheerleader that we had. He was always there to push forward decisions or carry us over the rough spots. He was vocal and very visible about his opinion in regard to how big and important this project is to Pima. If he hadn't been as visible and as strong as a supporter, it would have been a miserable

Table 4-10. Benefits Gained from Consultants

Benefit	Frequency	Percentage
Product expertise unavailable internally	139	21
Technical expertise unavailable internally	132	20
Methodology/insights from previous experience	105	16
Meet project timeline	91	13
Not have to hire new FTEs	65	10
Project management experience unavailable internally	63	9
Derive additional value from an ERP system	51	7
Meet project budget	29	4

project. He got to the bottom of things . . . did not let things fester."

Many institutions have stressed the importance of active participation by the chancellor or provost as a contribution to project success. According to Richard West, California State University System's CFO, "You need executive involvement, not just sponsorship. It's important to have discipline in project management."

On-Campus ERP Promoters

Respondents were asked to identify the primary advocate for an ERP solution at their institution. Most often mentioned was the CIO (31 percent), followed by the CFO (29 percent), and the president or chancellor (17 percent). The chief academic officer was the primary advocate for an ERP solution at only 4 percent of the institutions. Table 4-11 shows the primary advocates, by Carnegie class.

The study looked at sponsorship of the specific ERP systems and found that the CFO, not surprisingly, sponsored a financial system at 75 percent of the institutions responding, followed by the CIO (7 percent) and the president/chancellor (5 percent). Perhaps surprising is the CFO's leadership for HR systems (45 percent) versus that of the chief HR officer (27 percent). There's a very different pattern for student systems, where the following officers served as executive sponsors:

- chief academic officer, 21%
- CIO, 17%
- CFO, 17%
- chief student affairs officer, 17%
- president, 9%
- other, 19%

The chief sponsor changed during 18 percent of the financial and student implementations, but during only 13 percent of the HR implementations.

One striking finding is the overwhelming opinion that senior business officers were supportive of an ERP solution. On a scale of 1–4, with 1 representing strong disagreement and 4 representing strong agreement, these officers achieved a mean score of 3.34 for their support. Department managers scored lower, with a mean of 2.96.

Full-time managers were allocated to the project at 55 percent of the institutions. Doctoral institutions overwhelmingly used full-

Table 4-11. Primary On-Campus ERP Advocates, by Carnegie Class

Chief ERP Advocate	AA (n = 31)	BA (n = 65)	MA (n = 61	Dr. Ext. (n = 34)	Dr. Int. (n = 20)
Board of Trustees	3%	2%	3%	3%	5%
President	19%	20%	23%	15%	5%
System/district office	3%	3%	7%	3%	10%
Chief academic officer	0%	3%	5%	3%	0%
Chief information officer	48%	35%	24%	17%	45%
Chief financial officer	17%	27%	30%	44%	25%
Chief HR officer	0%	2%	0%	3%	0%
Chief student affairs officer	0%	0%	2%	0%	0%
Other	10%	8%	16%	12%	10%

time project managers, whereas the majority of project managers at BA institutions were part time. Full-time and part-time managers were evenly divided at AA and MA institutions. The managers were internal employees in 75 percent of the cases, external in 10 percent of the cases, and joint (both internal and external) in 15 percent. Fifty-four percent of the managers had no previous experience implementing an ERP project, and only 25 percent had any experience with the vendor chosen. Thirty percent of the project managers changed over the course of their institution's implementation.

Oversight Committees

Eighty-two percent of the implementations had an oversight committee. Table 4-12 identifies the frequency of university representatives on oversight committees. The respondents were asked to select all that apply.

It is very clear that oversight committee staffing was the responsibility of the senior business and academic officers. It is also clear that the presidents delegated oversight responsibility to senior management. A little surprising is the small number of customers represented—faculty and students. Not surprising is the low number of consultants and vendor representatives. Eighty-two percent of the respondents noted little or no involvement by the Board of Trustees in any aspect of the ERP implementation.

Figure 4-8 contrasts the involvement of customers—deans, faculty, and students—with that of business officers, by Carnegie

Table 4-12. Composition of Oversight Committees, by Position

Position	Frequency	Percentage
Chief information officer	200	22
Chief business/financial officer	172	19
Chief academic officer	99	11
Chief HR officer	94	10
Chief student affairs officer	84	9
Faculty	61	7
Dean	56	6
Consultants	38	4
President/chancellor	35	4
Auditor	22	2
System/district office	20	2
Students	20	2
Vendor	16	2
Board of Trustees	3	0

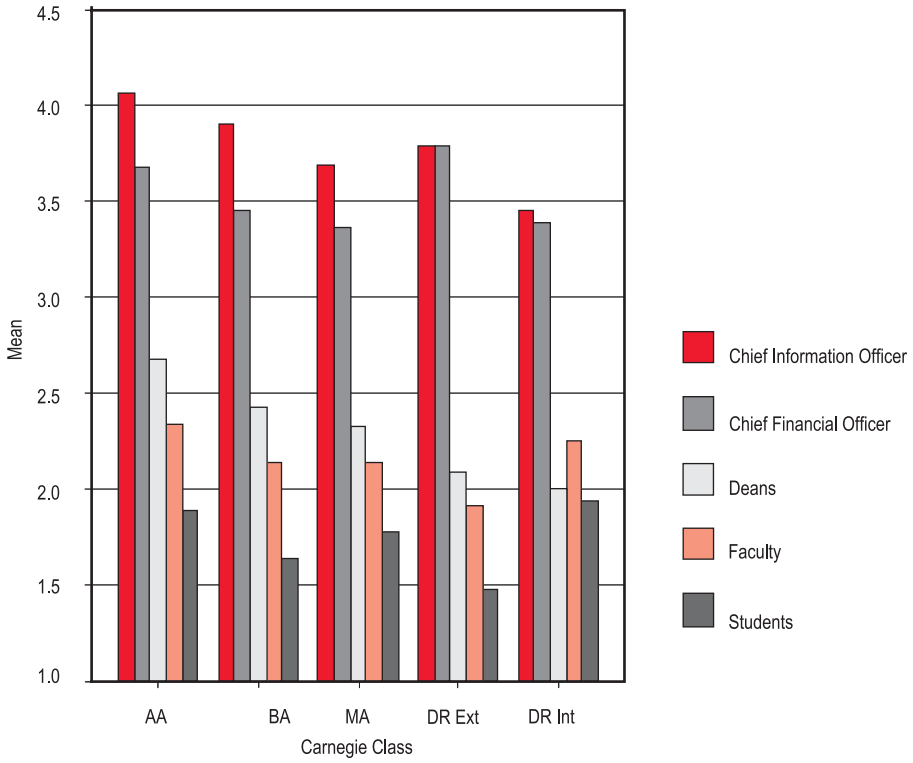


Figure 4-8. Stakeholder Involvement in ERP Projects, by Carnegie Class

class. Institutions were asked to rank levels of involvement on a scale of 1–5, with 1 being lowest and 5 highest. The means were calculated and are shown in Figure 4-8. The disparities are substantial across all Carnegie classes. As we move through the five classes, from AA to Dr. Ext., the involvement of deans, faculty, and students declines.

Only 2 percent of the committees included the university auditor. At the University of Minnesota, the auditor proved to be a particularly useful representative by continually introducing risk management methodologies and assessment into the implementation process and by providing assurance to the president and Board of Regents as the implementation progressed.

Implementation teams varied greatly by institution, according to the study's interview data. At Pima Community College, Anne Strine described an implementation team comprised of a group from each functional area and IT. "We met weekly throughout the implementation to communicate progress, changes, and additions. Everyone knew what was going on. You don't want senior administrators making decisions about a real operational issue that they haven't touched in years. So we tried to keep a balance—a college-wide policy orientation view of what was going on in addition to an operational perspective."

Wayne State University followed conventional project management wisdom. According to John Camp, assistant vice president and deputy CIO, and James Johnson, vice president for Computing and Information Technology and CIO, "We had a project sponsor and an oversight committee for each system, [and we] had project management teams [of users] organized by process. Project management came from IT. The EVP [executive vice president] for finance was the sponsor for the financial system, the chief of staff and EVP for finance were the spon-

sors for the HR system, and the associate provost was the sponsor for the student system. We also had a cabinet IT committee that had oversight for all the projects and owned the budget."

Structure and participation were much different at small institutions, such as Whitman College. According to CIO Keiko Pitter, "The financial aid office employs two people; the registrar employs three. So the committee structure is a waste of time because you see the same faces every time. We hired a half-time project manager from our vendor. I was the other half of the project manager position. One of the senior officers of the college comprised the steering committee. On top of that, the Board of Trustees assigned two people 'from industry' who belonged to their group—not trustees themselves—to monitor our progress. But I gave a report to these two gentlemen every three months. And for each module, there was an implementation team."

The ERP implementations at the California State University (CSU), Georgia, and Wisconsin systems have an oversight board and a central leadership office. Each system, however, has fulfilled its centralized mission in different ways. The nature of the ERP application implementations for these systems varies greatly in the amount of central control and individual institution autonomy allowed. For instance, in the case of student ERP implementations in the University of Wisconsin System, individual campuses are able to choose any student application they want, while at CSU, all campuses are required to migrate to the PeopleSoft student application. Only the University of Wisconsin System, for its financial and human resource applications, maintains a single database instance for the entire system. Both Georgia and CSU have a separate database instance per campus.

Level of Involvement

The respondents assessed the level of involvement with the project for a number of their institutional officers on a scale of 1–4, with 1 representing no involvement, 2 minimal involvement, 3 some involvement, and 4 active involvement. (See Table 4-13.)

As one survey respondent put it, the CIO and CFO clearly play a dominant role. One outcome was that confidence in the CIO and the IT office has been strengthened as a result of the project. Fully 80 percent of the respondents agreed or agreed strongly. An anonymous survey respondent noted: "We obtained a balance of power between IT and the end users, and much better communications and respect between the two." This compares with 62 percent in the non-ERP institutions.

Cost of Implementation

ERP systems are expensive in terms of both actual costs and intangible costs, raising some difficult questions. What is a reasonable cost for moving toward a more efficient business model? How long should an ERP system be in place before its worth can be demonstrated?

Institutions often underestimate their costs for ERP implementation. The systems require not only software packages but also changes in practice across the enterprise. This often results in costs not expected at the outset, such as outside consulting to find the most efficient implementation strategies, training for employees throughout the organization, and software customization in certain areas of the business.

Higher education institutions are generally unaccustomed to having to estimate the level of effort required to implement such complex projects, which can span several years and involve thousands of staff-hours of effort across multiple campus, school, and functional boundaries. Further

Table 4-13. Mean Level of Involvement of Various Participants

Position	Level of Involvement
Chief information officer	3.72
Chief business/financial officer	3.46
Vendor	3.29
Consultants	3.00
Chief HR officer	2.99
Chief student affairs officer	2.79
Chief academic officer	2.40
Dean	2.24
President/chancellor	2.09
Faculty	2.05
Auditor	2.03
System/district office	1.95
Students	1.56
Board of Trustees	1.51

complicating matters, some institutions reported that their software vendors, to make their bids appear more competitive, underestimated the level of effort required to implement their product.

Such estimating challenges often raise the cost of an ERP implementation well above projections.[9,10] At the same time, non-ERP approaches are not without cost either, but the study didn't gather such figures for these institutions.

Widely Ranging Costs

The survey asked respondents to include all costs that their institution associated with the ERP implementation project, including hardware, software, personnel, consulting services, and so on. Having reviewed the data, we concluded that it would be premature to report the numbers found, in the absence of a standardized costing template/methodology to assure real meaning and data comparability. However, we do note with caution some trends and benchmarks.

The costs in the study's survey ranged from $20,000 (which we think is a data-entry error) to $130 million.[11] On average, a finance module cost $2.9 million, HR module $2.3 million, and a student module $3.1 million. There is an enormous variation in cost by institution when viewed by the standard deviation, probably because the institutions sum up their expenses in very different ways. There are also enormous differences by Carnegie class. BA implementations are the least expensive, followed by AA and MA institutions, whose implementations usually cost double that of a BA implementation. Doctoral institution imple-

mentation costs vary greatly, running anywhere between 10 and 20 times the cost of AA, BA, and MA implementations. Student systems cost the most across all Carnegie classes and are often two to three times more expensive than finance and HR systems at AA, BA, and MA institutions.

Finding the Means to Pay

Table 4-14 shows the sources of funds used to pay for ERP implementations. By far the most common source, representing the majority of funds, was central allocations, followed by internal reallocations and discretionary funds. Several institutions indicated that they had received Title III and V funds.

Funding mechanisms varied significantly by state and by private versus public institution status. The University of Texas–San Antonio received no state funding. The university used a student IT fee that had no restrictions on its use. Oberlin College used the information technology office's replacement and renewal fund as seed money for the implementation and then used a capital funding mechanism (blessed by the trustees) for four to five years to fund the rest. In Rhode Island, the software was paid for by the state's Department of Administration because debt service by law has to be paid by the department and is not included in the budgets for the University of Rhode Island and the other state-funded schools. Also, maintenance was built into their contract for seven years. Princeton University received $70 million from the trustees in a single appropriation to be paid out over five years. Departments across the institution cut their budgets to achieve the 5-percent savings needed to pay for this allocation. At Stanford University, the funding came from end-of-year-surpluses.

Staying within the Budget

Respondents were asked whether their projects stayed within their original budget. The study's findings appear in Table 4-15.

More than two-thirds of the institutions indicated that they finished on or under their original budget. Five percent or fewer went over budget by 50 percent. While the number of responses is low, the factors most often cited for causing implementations to go over budget included (from most frequent to least frequent) underestimated project staffing, underestimated consulting fees, and an unrealistic budget to begin with. Other factors were noted in the open-ended

Table 4-14. Sources of Funds

Source	Recurring	Over 25%	Nonrecurring	Over 25%
Central allocation	178	126	130	83
Internal reallocation	71	30	51	17
Legislative allocation	21	9	22	13
User fees	11	2	2	2
Tax on unit budgets	10	6	7	3
Endowment	7	7	13	8
State bonds	-	-	11	8
Institutional bonds	-	-	18	15
Discretionary funds	-	-	54	30

Table 4-15. Percentage of Implementations Under, On, and Over Budget

Budget	Module Implemented		
	Financial	HR	Student
Under budget	7%	5%	5%
On budget	61%	69%	63%
Over budget by up to 50%	28%	24%	27%
Over budget by more than 50%	4%	2%	5%

questions. One institution noted that it bought the wrong product and lacked skills, which led to the heavy use of consultants who lacked higher education experience. Others noted complicated custom data conversion, scope creep, and customizations. One survey respondent commented that one strategy for staying on budget was to cut lots of corners, with the result that two to three years later, needed functionality continued to be missing.

The University of Minnesota managed its project in terms of five risk areas and weighted the importance of each one: schedule (50 percent), budget (10 percent), functionality (20 percent), personnel (15 percent), and infrastructure (5 percent). Each represented trade-offs. To finish on time or on budget often meant that functionality had to be sacrificed. But these were calculated decisions based on weights, opportunities, and circumstances.

Added Cost of New Systems

Institutions were asked to compare post-ERP and pre-ERP increases in ongoing support costs. The findings appear in Table 4-16.

Factors were rated on a scale of 1–7, where 1 represents an increase of more than 100 percent and 7 a decrease of more than 25 percent. The factors are ordered by the mean cost. A mean of 5 indicates that the costs are about the same. A mean below five indicates an increased cost. Not surprisingly, costs increased the most for packaged software, databases, and training, followed by staff and hardware. The smallest cost increase, as would be expected, was for internal applications and code. Interestingly, the mean change was not a decrease for any of the categories. However, some institutions reported no increase in costs in a number of areas.

Training is the near-unanimous choice of experienced ERP implementers as the most underestimated budget item. Training expenses are high because workers almost invariably have to learn a new set of processes, not just a new software interface. Reporting was another implementation task identified as a significant problem area. Many institutions must create literally hundreds of reports to be able to effectively use their ERP systems, and some of the institutions interviewed did not realize this until well into their implementations.

The study looked at expenditure patterns by Carnegie class, institution size, and public versus private status. For the most part there were few differences, but there were also some exceptions. AA institutions were least likely to have budget increases above 26 percent. Private institutions tended to have higher post-ERP staffing and infrastructure costs, which suggests that modernizing the IT infrastructure may have been a larger issue initially for them. Some cost increases are obvious. Larger institutions pay more for their software post-ERP,

Table 4-16. Cost Trends Post-ERP

Expense	Mean	Percentage Decreased or Stayed the Same	Percentage Increased up to 25%	Percentage Increased over 26%	Percentage Increased over 51%
Packaged software	3.25	25	26	15	34
Database	3.44	31	29	15	25
Training	3.72	27	41	14	17
Staff/personnel	3.84	35	33	14	18
Hardware and infrastructure	3.97	38	26	18	18
Desktop products and services	4.13	52	24	13	11
Help desk and user support	4.17	46	33	13	14
System operations and management	4.24	46	29	16	19
Consulting	4.28	57	23	6	14
Internal applications and code	4.95	66	23	7	4

largely because software and the associated annual maintenance are priced to the size of the institution.

Assessing the Implementation

How well did the participating institutions implement their ERP systems? Respondents were asked to evaluate the various aspects of their implementation on a scale of 1–4, with 1 being strongly disagree and 4 being strongly agree. The findings appear in Table 4-17.

What the study finds is a more positive assessment of financial management, project definition, and rollout, including provision of timely training. Communications and benchmarking were assessed significantly lower, as was the effectiveness of the training provided.

Measuring the success of ERP systems goes beyond simple measures of efficiency. In the rush toward ERP systems while under the threat of Y2K, many organizations did not set up benchmarks and metrics against which to measure the success of their implementation.[12] Richard West of California State University captures the situation in higher education: "This industry in general doesn't have measures in place. And it is difficult to put measures in place in an industry that doesn't measure."

Anne Strine outlines the more commonly used benchmarks and measures of success. "I think our implementation was a success. I would measure success by, one, did we stay on budget and on schedule? The answer in both cases is yes. Two, are we able to run the college on the system? Yes! Did we have any major blips in delivery of service? No,

Table 4-17. Implementation Assessment

Implementation Aspect	Mean
Excellent budgeting/financial management	3.00
Excellent software rollout strategy	2.99
Scope of project was well defined	2.96
Provided timely training for ERP system users	2.95
Excellent job managing/assessing data conversion	2.88
Excellent executive engagement	2.82
Excellent job identifying project outcomes	2.77
Project had an excellent written strategy	2.73
Exemplary job communicating goals/status/changes	2.66
Training provided users with understanding of system's capacities	2.57
Broad agreement on benchmarks for the project	2.53
Excellent job measuring and communicating project outcomes	2.52

we didn't. We didn't miss a payroll, we didn't screw up registration."

Perry Hanson feels his project was a success at Brandeis University. "It was a success partly because we did it quickly and partly because we came in under budget. And partly because we made fundamental changes to the way Brandeis does business, because so many of the business practices here were ill defined, or there was a lack of cooperation between departments. We used this as a vehicle to pull a lot of things together, and it worked. I think over the next two years you're going to see even more come together. People matured tremendously over the process."

At Montana State University, Mark Sheehan and Craig Deaton define success as "reaching the majority of our goals within the timeline with the resources provided. And with that definition, I would say that we were successful. We were able to migrate and to provide equivalent, if not enhanced, business services at the end of the implementation. We added new services, particularly in the Web arena, and we did so in the pockets of our budget constraints. Were there pockets of nonsuccess? Yes, we made rational choices as we ran out of time and money. We decided that certain areas were not priorities to the organization. We would return to them in subsequent years. We were not successful in some of the quality aspects—especially in data conversion. There is still some legacy data that we never converted into the new system. It rests in some flat files in our legacy system. We need to migrate the data at some point of time. And there are services at the end of the contract that we did not move forward with—document imaging, workflow."

These measures of success may be acceptable, but they are not sufficient. Institutions going forward need to build

more-robust performance measures that address investments of people and money (inputs), the quality and timeliness of various processes, and the outcomes, which should be measures of efficiency, effectiveness, and customer satisfaction. They should be able to link input levels and process performance to outputs in measurable ways. Lastly, metrics should be set in advance of project implementation, and pre-implementation benchmarks should be measured; then project success can be accurately judged.

These conclusions were backed by observations of the ERP vendors. Almost all of the vendors interviewed indicated that they were seeing their customers focus much more heavily on return on investment (ROI) as a criterion for software selection and as a performance measure in software implementations. This focus has emerged over the past year in the worsening economic climate, which has forced institutions to take a more business-oriented view of their operations because of costs and other pressures. However, the vendors also indicated that measuring success is difficult for many higher education institutions because they often do not clearly articulate their goals before beginning an implementation. Moreover, unlike their corporate counterparts, they do not have a culture of measuring their performance on a regular basis.

To help their customers work through these issues, many of the vendors, including Oracle, SAP, and SCT, have developed services that address performance measurement. Ron Police, senior vice president for Oracle Higher Education, explained, "We have a formal reference program being put in place to measure the customer's goals and metrics going in, and to identify what value the system drives."

Achievement of Goals

In the opinion of survey respondents, ERP projects were a success. One hundred twenty-four, or 51 percent, of respondents answered yes, they achieved what was intended. One hundred twelve, or 46 percent, reported partial achievement, and only six, or 3 percent, answered no. One institution answering no elaborated: "We still have not received the primary benefits and really have not achieved the additional functionality that was anticipated. We are Y2K compliant but basically do what the old system did." However, this is an exception in the survey.

Respondents were asked to assess the performance of their implementation against a number of common project outcomes. Their responses, shown in Table 4-18, are based on a scale of 1–4, where 1 represents strongly disagree and 4 represents strongly agree.

Respondents uniformly, across all sizes and types of institutions, see benefits from the ERP implementations. There is a clear perception of professional development resulting from the implementation as well as improved service levels and accountability owing to better and more easily accessible information. In short, the promise of ERP systems was significantly fulfilled. But it came at a higher cost than expected. The promised efficiencies did not translate into cost savings. Non-ERP institutions were more inclined than ERP institutions to believe that they had reduced business risk (mean of 3.27). There was no difference in improved business performance between ERP and non-ERP institutions.

Timing of Benefits

The study asked respondents to estimate how long it took to get the desired outcomes after they went live with the new systems. Their answers appear in Table 4-19.

Table 4-18. Assessment of Outcomes

Outcome	Mean
ERP participants gained from experience professionally	3.30
Added new services for students, faculty, and staff	3.29
Improved services to students, faculty, and staff	3.25
Easier to take advantage of new technologies	3.22
Management information is more accurate and accessible	3.12
Enhanced regulatory compliance	3.11
Improved institutional processes	3.04
Increased institutional accountability	3.03
Enhanced institution's business performance	3.02
Reduced business risk	2.97
Enhanced support of academic mission	2.92
Enhanced primary users' knowledge and skills	2.91
Increased stakeholders' confidence in institution	2.79
Less costly to integrate than previous system	2.56
Less costly to upgrade than previous system	2.16
Removed some services that students, faculty, and staff valued	2.15
Less costly to operate and maintain that previous system	2.01

Table 4-19. Time Needed to Obtain Desired Outcomes

Length of Time	Frequency	Percentage
Immediately	48	21
Within 3 months	34	15
3-6 months	39	18
6 months to 1 year	55	24
More than 1 year	49	22

Institutional productivity dropped immediately after the implementation (during the first six months) for 54 percent of the respondents. In contrast, 70 percent believe that productivity has improved today (see Figure 4-9). Institutions were asked to rank productivity immediately following implementation and productivity today on a scale of 1–5, with 1 representing dropped significantly and 5 representing increased significantly. The mean scores were calculated and are shown in Figure 4-9.

A number of institutions discussed a break-in period. The first year-and-a-half were difficult: productivity declined as people learned how to use the system and became accustomed to the integrated environment. After the adjustment, institutions liked the ERP systems because of greater access to data, better data quality, better services for students, and so on. Sue Van Voorhis of the University of Minnesota explained, "The first term we went live, we could not issue financial aid. We did not bill students until December. We had to stabilize the system. We implemented a six-month project and resolved the problems, plus we implemented our paperless financial aid process, which is a huge success. The Web has forced us to put expert professionals at the front counter and phones, since the Web has the responsibility for general support and processing. There are 23 expert caseworkers at the desks and phones. They all know registration, financial aid, and billing issues and make professional judgment decisions. These positions were created at the professional level. Several staff did not qualify or get hired for these positions. They get up to 500 walk-ins, 2,000 calls, and 300 e-mails per day at the beginning of the term."

The cause of this productivity drop varies, but several factors were identified in the study's research. End-user training, both its quality and its timing, can have a significant impact on how prepared employees are to use the new system. If training is provided

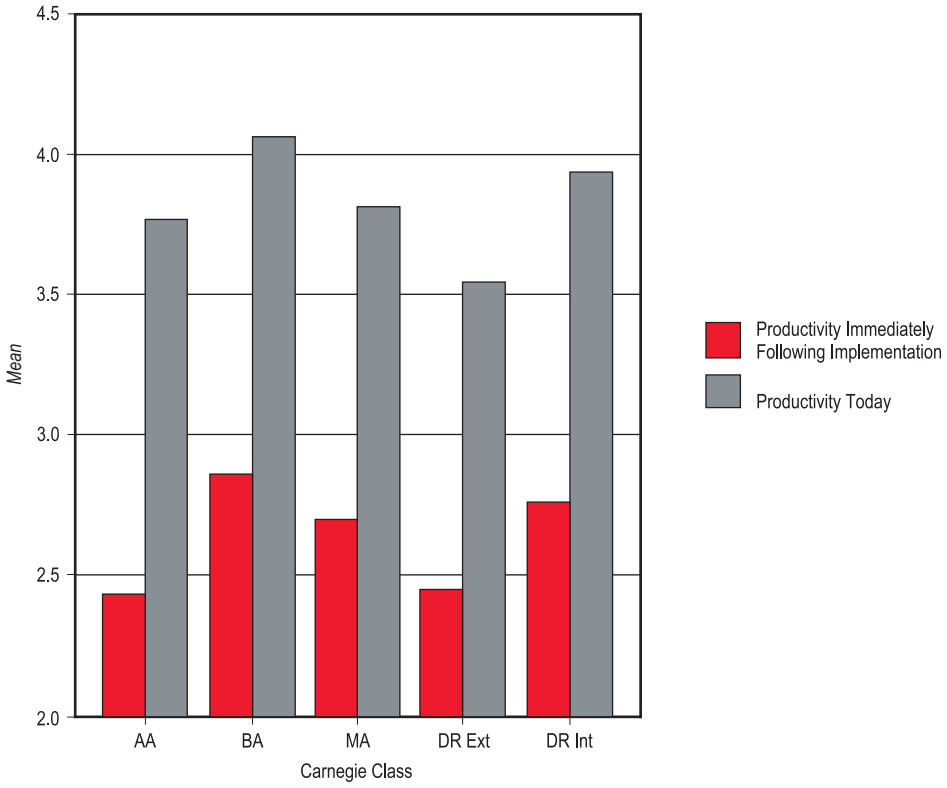


Figure 4-9. Changes in Productivity, by Carnegie Class

too soon, before users have access to the system, they will have difficulty making the transition when the software is available. Having personal "hand-holding" available for users who needed it was reported as an effective way for at least one institution to help its users through the initial cutover.

Another factor is the involvement of end users in both the design and testing phases of the project. This can help prevent the rollout of the new system without critical components' functioning correctly—for example, reporting. A factor often overlooked that can help mitigate the post-implementation trough is effective communications throughout the project's life cycle. If employees know what to expect from the ERP project, when to expect it, and what will change—and if they feel that they had input throughout the process—the natural tendency to resist change will be reduced. While there will always be some pain associated with any implementation, paying attention to these factors helped some of the institutions in the study make more effective use of their ERP systems more rapidly.

Too often, senior management expects to gain value from an ERP implementation as soon as it is installed. What the study's data show is that most systems do not provide an ROI until after they have been running for some time, and only when the business leadership can improve the business processes that the newly installed system(s) affect.

Ken Orgill at West Virginia University described the problem: "The university executives were chagrined at the lack of savings, but we did not limit their expectations initially. The system did free people up. For example, I have four or five data-entry staff that 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."

Deborah Elias-Smith, vice president for PowerCAMPUS at SCT, thinks ROI has become a stronger focus for higher education executives post-Y2K. "From 1997 to 2000, few took advantage of the transformational capabilities of the software. In the last two years, providing higher levels of service and improving productivity are becoming more compelling and commonplace business cases."

To obtain increased productivity, an ERP application's business owners must be willing and 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 by, for example, outsourcing, eliminating duplication, and reducing 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 higher productivity;
- avoid new costs for existing or new services and functions, often through a transfer of effort; and
- change the nature of work being performed by university employees, often by implementing self-service capabilities.

Some institutions have been aggressive and deliberative in obtaining additional value. The California State University System created a measures-of-success document, "The Integrated Technology Strategy: Measures of Success," in 1999 in response to questions from the California legislature on how CSU was going 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.

At other institutions, cultural barriers often prevent management from realizing the potential value from their ERP systems. For example, many of the institutions interviewed for the study indicated that they did not reduce headcount following their implementations, even though a significant amount of data-entry work was eliminated through the use of self-service tools included with their ERP packages. Because these institutions were reluctant to trim their workforce, their costs did not drop. However, some did indicate increased effectiveness because the employees were redeployed or retrained to perform more value-added tasks.

One major advantage of the new ERP tools is an increased capacity to create reports, and this promises to provide value to ERP implementers. Combined with a data warehouse that gathers information previously stored all over the institution, the system can provide management with high-quality analytics and real-time access to the information that it needs to make decisions or take action.

Anne Strine summarized the productivity problem at Pima Community College: "I also, absolutely, believe the conventional wisdom that it takes about three years to reap the benefits of an ERP system. And I think that it was true for our implementation. We didn't ever lose anything, but it was harder for a while. We didn't start to reap the benefits until two or three years down the road, but we can really see the benefits now in the data that we have available to us, in how we can get to it much more easily, how we can use it to make decisions in a different way, and how we are offering services to our students that we never could before."

Ruth Constantine, Smith College's vice president for finance and administration, explained the situation her institution encountered post-implementation: "The expectation [as the system went live] was it is going to meet all of our needs today. And then people begin to realize all the reports they have to write, and that they must adapt the way they do business to the way they can get information. It's hard, it's time consuming, it's frustrating, and on the day it goes live, it's not going to meet all your needs that day. It's going to begin to meet all of your needs over the course of the next year."

In summary, it's clear that many institutions lose functionality and momentum in the earliest stages of implementation, only to recover old functions and gain new ones as they gain mastery of new technologies and business processes. Specifically, there is a steep learning curve in using new systems and screens that do not always align with past practice. Other reasons for short-term losses in productivity include lack of experience, failure to change business practices and accept the new system, and more data entry and monitoring at the source.[13]

How did the study's constituents benefit from the ERP systems, and how would they characterize the outcomes? The respondents were asked to assess how they themselves benefited from the implementations and how management, students, staff, and faculty benefited. Eighty-seven percent perceived major benefits for management, 85 percent for staff, 78 percent for students, and 68 percent for faculty.

Figure 4-10 shows perceived differences by various institutional constituencies, as assessed by the respondents. The highest assessments of the ERP implementation benefits come from the respondents themselves and from their senior management and Board of Regents. Conversely, they feel that the faculty most often assessed the implementation as fair, poor, or very poor.

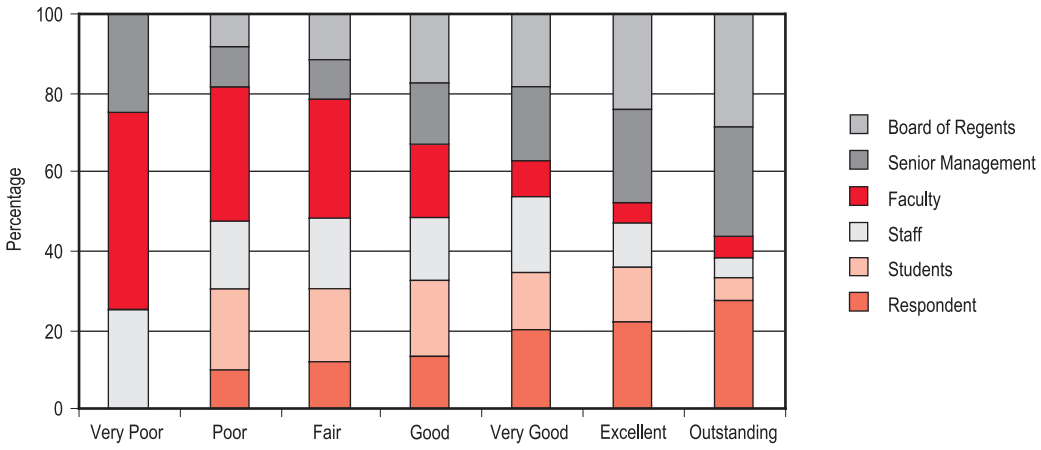


Figure 4-10. Benefits as Perceived by Various Constituencies

There were some differences by Carnegie class in assessing benefits for students and faculty. Respondents from doctoral institutions viewed students and faculty as seeing fewer benefits than respondents from the other Carnegie class institutions. AA and Dr. Int. institutions perceived the characterization of benefits by students and faculty as significantly higher. One other significant difference emerged when the cost of the implementation was considered. The lower the cost of the implementation, the higher the perceived characterization of benefits by students and faculty. Cost did not have a similar effect for the respondents, senior management, staff, or Board of Regents.

Mark Sheehan and Craig Deaton of Montana State University report a not-untypical faculty perception of benefits: "The academic community resents it. They were never properly introduced to the system and never participated in its development." But things change, as noted by Chris Handley of Stanford University. "At the end of the first full cycle, you start to hear people say, 'You know, I'm finally starting to see why they did this.' But in the first year, they hate your guts—there are no two ways about it. On the positive side, I do think some of the users will tell you that they have more information than they ever had before. But they will also tell you that since they have moved from a highly customized system, it [now] requires more steps to complete a task."

Members of the vendor community echo these comments. Judy Chappelear and Karen Willett from PeopleSoft explain, "You get different answers regarding success, depending on where the institution is with implementation. Implementations are always painful. There is no such thing as a painless one. Sometimes that pain lasts longer at some institutions than at others. But after the implementation, most of them are happy. The other factor is that you get a different answer, depending on whom you ask at the institution. So maybe if you're talking to a faculty person, you would get, 'Oh, PeopleSoft. I don't think that was any great shakes.' But if you talk to the registrar, you might get a glowing report. I think, depending on what voice you're listening to, you'll hear something a little bit different. But I think from the CIO's standpoint and the CFO's, and the other folks on the executive side, you'd get a high percentage of positive responses."

Willett also illustrated the effect communication has on the reported level of satisfaction. At institutions that made the

entire community aware of what was going on, what was coming, and what the benefits would be, expectations were better managed and people tended to be more satisfied with the project results.

There is a lesson here, and that is not to underestimate the differences in perspective between providers of information technology solutions and their users. Information technologists are accountable for delivering robust and reliable working systems on budget and on schedule. Users of information technologies, on the other hand, must continue to run their business and are appropriately concerned with high functionality. Users also want their systems to perform in ways that make sense in the local context. The trade-off between standardization, as embodied in decisions not to modify vendor code, and operational accountability for local departmental performance, college performance, and overall student satisfaction should not be underestimated.

Doing It Again

Would the respondents do it again, and if so, what would they change? Would they build or buy next time? Eighty-eight percent would buy, 7 percent would build, and 5 percent had no opinion.

Two-thirds of the respondents would use a similar approach if they were to do an ERP project again. However, only 46 percent of the non-ERP institutions would take the same approach. Table 4-20 shows what respondents would change.

The study finds again a concern for communications, process redesign, and training, which are human factors. Less concern is shown for the software and hardware purchased and the implementation of the technology.

Table 4-20. What Respondents Would Change in Their Next ERP Project

Change	Frequency
Communications	112
Process redesign	102
Training process	90
Project schedule	88
Project budget	71
Project governance	61
Internal team structure	58
Software customizations	52
Project manager	50
Project scope	48
External consultants	43
Software	41
Technology infrastructure	29

New Issues Created

ERP systems bring change to institutions that adopt them. Some changes are expected and some are not. Most often mentioned is a change in workload and the nature of work.

More Work, Different Work

Sixty-nine percent of the respondents perceive that central, departmental, and college workloads have increased significantly. Also, 66 percent believe that the nature of the work has 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 more local decision making, which is tied to expected service improvements.

The study observed that a good number of institutions had not planned thoroughly for the changes brought about by the transition to an enterprise-wide way of doing business. That is the bottom line for most organizations implementing ERP—a paradigm shift in the underlying principles of business practice. Changing from departments, silos, and bunkers to an information-sharing culture can challenge employees to begin thinking of the ultimate goals of the enterprise rather than the specific performance of their individual unit. In other words, with ERP, every area of an organization must focus on customers and efficiency.

Various comments provide insight into how the nature of work has changed.

"Offices can now do their own reporting against the institution's data, and more persons at more levels of the organization have direct access to relevant information for planning, budgets, and decisions."

"We are much more efficient. No manual entry of information. Work has shifted from keying data to assisting students and analyzing data. In general, the scope of staff's responsibilities has broadened."

"Department administrators must be more knowledgeable about the systems and associated business practices, and there is increased data monitoring and security awareness. More technology and automation require higher levels of skills among formerly clerical staff. End users now input more information."

"Central workload now focuses more on compliance, as much of the management-level work is done locally."

"True 7-by-24 IT support is no longer an option but a necessity."

New Interdependencies

Service silos with their bunker generals often typified pre-ERP institutions, but that has changed at many institutions. The logic of ERP is to move away from a silo-based, suboptimal environment in which information is captive and protected, services are mapped to organizations, and departmental data solutions predominate. In the new environment, information is ubiquitous and shared, services are integrated and seamless, and enterprise data warehouse solutions predominate, along with horizontal administrative structures and processes.

The ERP system's integrated capabilities enabled Smith College to make some significant service improvements in its customer-facing offices. Before ERP implementation, a student had to visit a specific office to complete a transaction with the college and often had to visit multiple offices for complex issues. But after the implementation, Smith was able to dramatically improve this process. "Our records are absolutely, completely in

sync, so it doesn't matter what office a student walks into, from a customer service point of view," explained Ruth Constantine. "If we have the information, we don't want to send her to somebody else. Now we know we can look at the absolute same screen and help that student, even if she came to the controller's counter instead of the student financial services counter."

One respondent noted, "It is more work to understand the integrated nature of the ERP and its effects on other offices. The integrated system requires offices to work closely together in ways they haven't before. It is typical to see four or five different groups to coordinate year-end closing, for example. We are much more sensitive to interoffice dependencies."

All offices have to coordinate their upgrade activities, and major stakeholders have to work together. Although this new paradigm takes institutions some time to get used to, one respondent noted that this integration had really benefited their institution because employees had to take an enterprise-wide view of their jobs, thereby getting a better understanding of how the business operates as a whole.

External Interdependencies and Standardization

Some respondents raised concerns about their institution's dependence on the performance and long-term viability of the vendor. The systems had been expensive to install and required a good deal of time and planning. An institution cannot afford to change vendors often or suddenly. Moving to an external vendor also required the institutions to adapt more of their operations to a national standard. We believe there is a long-term benefit here that has yet to be fully recognized, especially in terms of customer satisfaction.

Many believed that sharing the cost of development by purchasing a product from an external vendor would reduce development costs and improve the overall quality of the product, with a concomitant benefit to the way institutions do business and serve their customers. Implementation difficulties and the actual cost of the product undermined that belief for many. We believe the jury is still out, especially because of measurement inadequacies and an internal inability (and sometimes resistance) to take full advantage of the product's capabilities.

Nevertheless, there is cause for concern, as voiced by CIO Dave Lambert of Georgetown University. "The only thing we just have to remember is we're doing it to ourselves again here. I mean the ERP system architectures are now falling at least two generations behind architectures that underlie advanced research computing and advanced networking. Where we [in higher education] are doing grid [computing], we're doing end-to-end stuff. The administrative processes and supporting technologies transform generally much more slowly than technologies [that lean toward supporting] the heart of the academic enterprise."

John Curry believes that higher education, at least now on its administrative side, has tied its future to the investment strategies of the vendors.[14] "We are using external pressures from our vendors and our peer vendor user groups to do the right internal things—a powerful tool for sustaining technological currency. At the same time, if the vendors aren't taking advantage of the other technologies that we have much greater control over for our research business, we're going to see some kind of disconnect or frustration in the near future."

Lessons Learned

Niccolo Machiavelli and his lesser-known but equally inspirational predecessor Francesco Guiciardini earned their reputations by assembling the political practices

that served the best interests and promoted the survival of princes of the realm. Today's princes or princesses, be they presidents, provosts, CFOs, or CIOs, can gain enlightenment from the insights their many colleagues have offered in this study.

A key advantage to surveying hundreds of institutions post-ERP implementation is the benefit of hindsight. No longer consumed by the ERP effort, people have the time, distance, and perspective to reflect on what went well and what could have been done better, thereby providing valuable insights for the rest of the higher education community. Many of these insights, or lessons learned, will sound all too familiar, but their recurrence emphasizes the importance of permanently incorporating them into our collective thinking about project management. We recognize that cultures vary greatly among the institutions surveyed in this study and that no single practice described here will necessarily work everywhere.[15]

In listing effective practices, we exercise caution, following the good advice of Guiciardini: In *Storia d'Italia*, he commented, "He who imitates what is evil always goes beyond the example that is set; on the contrary, he who imitates what is good always falls short." Barry Fullerton of the University System of Georgia gives a more contemporary version of this advice: "The law of unintended consequences will be in play. It's not going to go the way you think. You can't anticipate all that's going to happen or all the money it's going to need. I'd give you the same advice as I would to someone going overseas. Take out half your clothes and double your money."

Leadership

Strong leadership is imperative to implementation success. Leaders need to profess an ERP vision that will both guide and inspire the campus community in an engaged and determined manner. Additionally, leaders must understand and respond to the needs of their project teams, including everything from basic project "blocking and tackling" to acknowledging and rewarding team efforts at key junctures in the project. Advice about strong leadership in ERP implementations is prevalent, but its familiarity makes it no less important. The following views on leadership come from people who have learned these lessons well.

John Curry: "Walk a mile in the shoes of those whose roles you would change. Embrace relentless incrementalism as the change approach of choice. Lead change from the business rather than the technology side of the house."[16]

Richard West, California State University System: "You need executive involvement, not just sponsorship. It's important to have discipline in project management."

Chris Handley, Stanford University: "Get buy in from the top and use that buy in to get penetration through the two or three layers in each school and department. Universities are pretty impervious to communication vertically. Just because the president does something, it doesn't mean the senior managers agree with it or will do it. You'll have the fight sooner or later—so have it sooner."

Dave Lambert, Georgetown University: "You are better off getting things done fast than you are to worry too much about whether it's going to be the right thing to do. Because where people are in terms of understanding what this next generation of software does is so far away from what it really does that they cannot participate in the process in any way, shape, or form. They can't make decisions. They can't participate in functional requirements until they've had a chance to see it. And the whole world changes after that."

Communication

A communications plan ties the many parts of the ERP vision and plan together, making the goals and implementation requirements clearly understood and supported throughout the institution. Communication is another element of project management that everyone thinks they fully understand, but few do it really well. It has been said that it's almost impossible to over-communicate, and within the context of ERP projects, no one has been accused of that yet. Robert B. Kvavik of the University of Minnesota recommends that institutions "build a communications budget that is four times what you think you are going to need. Then double it! You then have the right amount."

Other respondents offered some important thoughts regarding communication.

Jeff Noyes, University of Texas–San Antonio: "Make sure people who are supposed to tell others actually do so. There is unrest in the schools/colleges despite the sponsors' doing presentations to the deans three times."

Kimberly Butz, Smith College: "It really touches every area of the community, so you have to keep everyone informed, including the faculty and people who may not have ever used your legacy systems. But hopefully, if you do the implementation right, it's going to reach everybody in the organization, so it's really important that you communicate to all of them."

Ownership of Data

Shared data-center operations and central ownership of data are critical to success, and they reduce costs. The old silos led to redundant and duplicative systems for maintaining and using data. Data was entered often and used seldom. Data incompatibility and differences in fields resulted in continual recoding when data was needed for central institutional purposes.

Lucinda Lea, Middle Tennessee State University: "You need to get all the players at the table to decide who owns what data and who is authorized to make decisions/changes regarding that data."

Christopher Koch: "It is expensive to port university information from old systems to new ERP homes. Old data are often dirty. Even clean data may demand some overhaul to match process modifications necessitated by the ERP implementation.... Often, the data from the ERP system must be combined with data from external systems for analysis purposes. Users with heavy analysis needs should include the cost of a data warehouse in the ERP budget."[17]

Training

An enormous training effort is needed to prepare staff for the cultural transformation that ERP implementations require. It's important that everyone who needs training receives it. Generally, training costs are underestimated and delivery timing is bad. Training needs to focus on using the system to support transactions and on leveraging the technology to change existing business practices.

Carol A. Carrier, University of Minnesota: "Be very deliberate on how you organize and deliver training. We were successful with a central training model that had eight full-time trainers. At peak, the HR organization offered eight courses specifically related to the new systems. Time it well. If offered too early, the training is lost. We offered open labs where people could just come in and work for an hour with an instructor. Everything was evaluated thoroughly."

Chris Handley, Stanford University: "We decided that no employee could get a user ID for the system unless he/she completed training. We did not care who you were, and we enforced it. And even with all that, the first round of training that you do for any of these systems you are lucky if you

get to the 80-percent level, because you can't get really good training until you have all the business processes in place. The business processes normally get reinvented after the first year after it goes live, as people understand how to use it. So the training does not become 'good training' until about year two."

Consultants

Consultants were key to successful implementations, but the costs surprised everyone, especially prior to the year 2000, when the demand for functional experts in particular was enormous. Institutions lost some of their best people only to have to rehire them from consulting firms. When using consultants, select them carefully, be clear about their scope of responsibility, and actively manage the relationship to get maximum benefit.

Steve Cawley, University of Minnesota: "We used prequalified consulting firms. We hired a consultant to take over the legacy systems so that our AIS staff could devote themselves entirely to PeopleSoft. We managed our consultants very carefully and maximized our return on that investment."

Modifications to Vendor Software

One of the most significant findings of this study is the impact customization had on the sample's ability to finish on time and on budget. Many of the ERP implementations tried to limit customizations, and some were more successful than others. Successful efforts here will bear fruit with every new release.

Bill Bowes, University System of Georgia: "We established the principle of using the business processes of the financial and human resource software and were very careful about mods. We learned this from our student implementation. We didn't want to get into a situation where we had to do major mods for every new release."

Reporting

ERP products often do not contain the reports institutions need. Many institutions have created data warehouses to solve their reporting and data query needs.

Bruce Maas, University of Wisconsin–Milwaukee: "We rolled out the data warehousing concurrently with every module to solve reporting problems. We had earlier experience on our campus with a legacy data mart, which provided limited access to the most commonly needed list/label data. There was a commitment from our campus leaders at the very start of our project planning to improve upon existing legacy data warehousing capabilities with the new system in order to provide easy, timely access to data to our end-user community."

Obtaining Value

There are four basic ways to obtain value from ERP implementations: efficiency, effectiveness, customer satisfaction, and reduced business risk. More efficient relationships between universities and students have been provided by online, one-stop self-service and by linking and automating related transactions. These services have been provided on a scale that simply would not have been possible using personal service in expensive physical facilities. Major savings can be realized by digitizing the services institutions provide to an expanding customer base that makes heavy use of these services. Higher education can also provide the service more quickly, saving time and money and enhancing customer satisfaction.

A good example is the University of Minnesota's paperless financial aid process. The university built a Web-based front end to the PeopleSoft financial aid and student

financials and linked it with the Department of Education. Included are a promissory-note process and a signature feature that interact with the Department of Education's e-signature process. There is also an online award process that lets students accept, reject, or adjust loan amounts 24 x 7. The system supports 700 simultaneous users. It reduced the process from six weeks to four days, and it saved $80,000 annually by reducing the need for temporary help, overtime, and printing and mailing. Waiting lines disappeared; 500,000 pieces of paper were no longer needed. Payback on the $250,000 investment was three years. Eighty-seven percent of the students used the system in the inaugural year, and customer satisfaction soared, as did record accuracy and reconciliation of accounts.

The implementation of new enterprise systems can motivate institutions to rationalize their policies and procedures. Rational procedures and policies can contribute to improved efficiencies by, for example, reducing the number of grading systems or simplifying and automating record holds.

Learning and Knowledge

Learn from other projects. The ECAR systems study emphasizes that knowledge gained from previous projects helps institutions move forward more effectively with their implementations. A lot of information is already circulating on this topic in the industry, but below are a few salient points that emerged from the research.

Organization of Project Team(s)

- "We created experts in each administrative area, which helped us move from central ERP to distributed ERP responsibilities."
- Dave Koehler, Princeton University: "Make the project a functional project, not a technical one—[that is,] make the ownership of the project functional. Project management is a key skill. People in higher education don't typically have an affinity for this."
- Lucinda Lea, Middle Tennessee State University: "The working groups should be led by functional users. Be careful about who you put on the working groups. Personalities matter, especially in the leadership positions. Leaders need to know how to problem solve, how to work together, and how to build relationships."
- Mark Sheehan and Craig Deaton, Montana State University: "Involve the entire campus beyond the extent they want to be involved. Don't let people opt out of planning the system. We did give the academic community the opportunity to opt out, and they took it. I think their idea was, 'You guys handle it, and whatever you come up with will be fine with us.' That did not pan out."

Ongoing Support

- Richard West, California State System: "Don't wait on decisions about releases. Stay current on those. It's important to have a good understanding of technology life cycle. You've got to stay close to the vendor. You shouldn't go off the release cycle."
- "Ongoing support requires attention. ERP systems require ongoing resources for maintenance and patches and fixes in a way that legacy applications didn't."
- "Testing the links between ERP packages and other university software links that have to be built on a case-by-case basis is another often underestimated cost."[18]
- "Implementation teams can never stop."[19]

Smith College felt that by going through the implementation process, its employees who participated on the project teams learned an enormous amount about the

management and operations of the institution. "Going through that process," Butz explained, "those people learned an incredible amount about the system, the process, and about the business functions of other parts of the institution. One of the things I think always happens when you start looking at implementing an integrated system, people start realizing what other offices do."

In addition to individual learning, Constantine believes that a significant amount of institutional learning took place over the course of the project, enabling the Smith project teams to work more effectively as the implementation progressed. "By the time we got to our final component, the advancement and fundraising piece, we really got it in terms of taking a look at our business needs and in particular our reporting needs," she said. "How do we make use of the data to meet our business needs? . . . We looked at that issue at a much earlier point for the implementation, which was critical to its success. We wished we had understood that more thoroughly when we implemented student and financials. So I think we learned as we went on the student implementation, and then we got better as we went along."

Endnotes

1 O. Volkoff, B. Sterling, and E.F.P. Newson, "Getting Your Money's Worth from an Enterprise System," *Ivey Business Journal,* 64 (1), Sept. 1999, p. 54.

2. H. Bassirian, "Expert Warns of ERP Perils," *Computer Weekly,* Mar. 23, 2000.

3. E. Sherman, "ERP Attitude Adjustments," *Computerworld*, 52 (1), Feb. 14, 2000.

4. D. James and M.L. Wolf, "A Second Wind for ERP (Enterprise Resource-Planning)" (Statistical Data Included), *The McKinsey Quarterly,* Spring 2000, p. 100.

5. J. Pallato, "Get the Most out of ERP: Shrewd Preparation Improves Chances for Timely ROI," *Internet World,* 8 (2), Feb. 2002, p. 18.

6. Cross tabulations were run on institution size, vendor chosen, public/private, and Carnegie class against the difficulty of the implementation, using chi-squares. There was no statistical significance except for size of institution.

7. No other variable in the study (over 900 variables) was found to be statistically significant at the 0.01 or 0.05 levels.

8. Note also that the highest standard deviation was for system selection.

9. Volkoff et al., op. cit.

10. M. Vernon, "ERP Endangered Species?" *Computer Weekly*, Nov. 4, 1999, p. 32.

11. Meta Group recently did a study looking at ERP implementation for 63 companies surveyed, including small, medium, and large companies in a range of industries. The average TCO was $15 million (the highest was $300 million and lowest was $400,000). They also found that it took eight months after the new system was in (31 months total) to see any benefits. But the median annual savings from the new ERP system was $1.6 million.

12. In the private sector, Bradford and Roberts (2001) found that most companies are not able to demonstrate whether ERP systems have been profitable. Only 42 percent of companies surveyed measured their ERP system against any kind of metric.

13. Meta Group, op. cit.

14. J. Curry, "The Organizational Challenge: IT and Revolution in Higher Education," in Richard N. Katz and Associates, *Web Portals and Higher Education* (San Francisco: Jossey-Bass), 2002, pp. 125–137.

15. C. Koch, "The ABC's of ERP," *CIO ERP Research Center* (Web), retrieved on 2/15/02 from http://www.cio.com/research/erp/edit/erpbasics.html. Feb. 7, 2002.

16. Curry, op. cit.

17. Koch, op. cit.

18. Ibid.

19. Ibid.

5

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

1980s	1990s	2000s
Centralized services	Decentralized services	Confederated services
Information on schedule	Information on demand	Information in anticipation
Integration via interfaces among systems	Integration via integrated systems (ERP)	Integration via data (Web Services) independent of systems
Information is scarce, is the source of power, and is rationed	Information is plentiful but complex as shadow systems proliferate and support competitions for power	Information is ubiquitous and the source of consensual decision making
One-size-fits-all services mapped to campus organizations	Telephone and Web-based services mapped to organizations	Tailored services mapped to how institutional stakeholders use services
Culture of compliance demands multiple process checks, slowing process cycle times and increasing transaction costs	Post-processing transaction notifications and authorizations enhance process flows	Process models and simulations, performance dashboards, and balanced scorecards support accountability and continuous improvement
Tailored software	Standardized software	Software components that can be integrated to yield tailored solutions

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

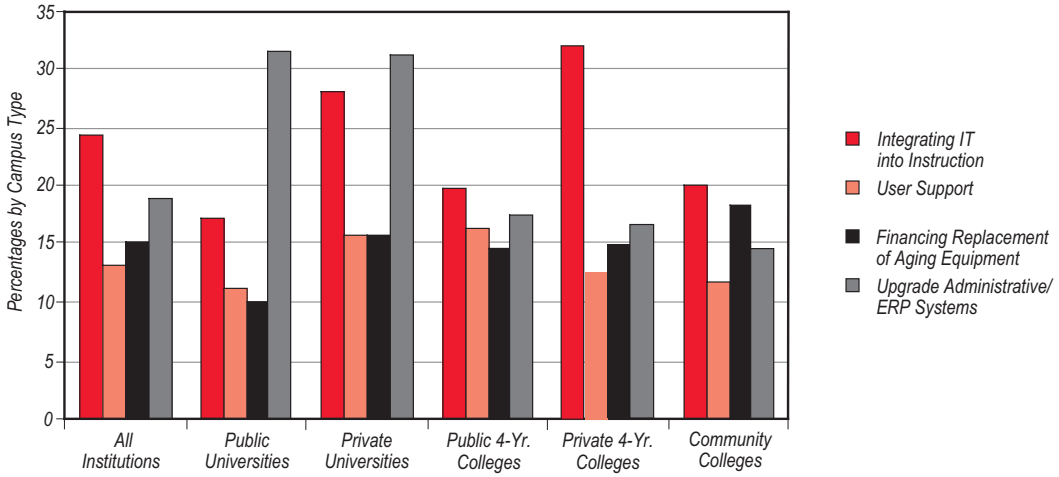
- continuing efforts to improve services to students, faculty, staff, patients, and other stakeholders;
- organizing these services and systems to liberate the consumer from temporal and geographic constraints and from the service provider's office of origin;
- exploiting the untapped functionality of 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,[6] 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.[7]

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



Source: Kenneth C. Green, Campus Computing Project, October 2002

Figure 5-1. Single Most Important IT Issue in 2002

and campus-wide learning management systems, or a student loan tracking service that allows students to monitor the status of guaranteed student loans."[8]

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. These local information systems are linked, via periodic interface exchanges, to centrally maintained systems for the purpose of supporting institution-wide reporting requirements and/or 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, cashiering, 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."[9] 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

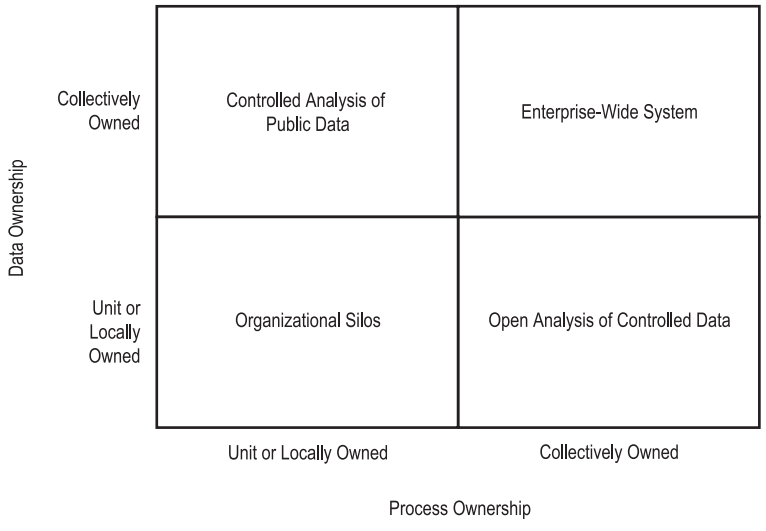


Figure 5-2. ERP and the Movement from Organizational Silos to an Enterprise-Wide System

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 preoccupation with wireless communications. Wireless networks leverage the capacity of pagers, PDA, and other evolving portable devices to keep their users continuously connected to institutional information and services. Providing real-time access to static data provides little enhanced value for the institution's stakeholders. Services that are highly personalized and "always on" in this kind of fashion depends on leadership vision, and more practically on enterprise systems, portal technologies, wireless networking, data warehousing, and workflow.

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. . . ."[10] 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-

Source: University of California

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-

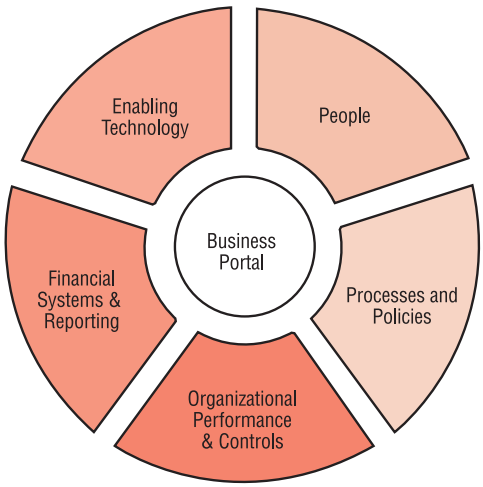


Figure 5-3. The University of California's New Business Architecture

portunities (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."[17] 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.[18]

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."[19]

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 architecture[20] 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-

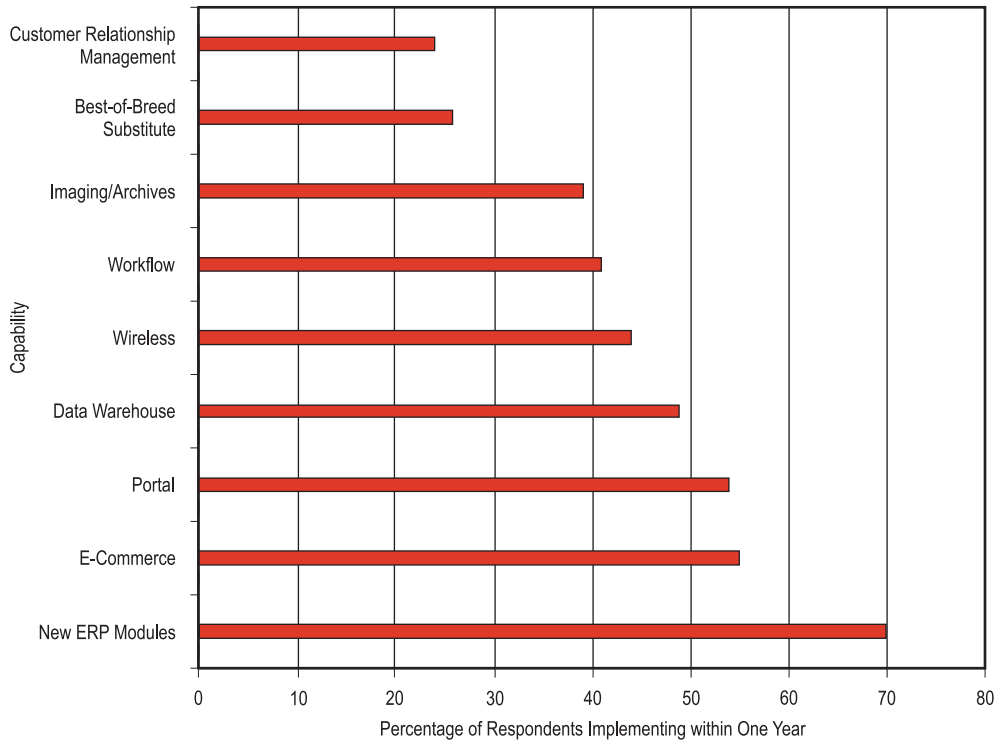
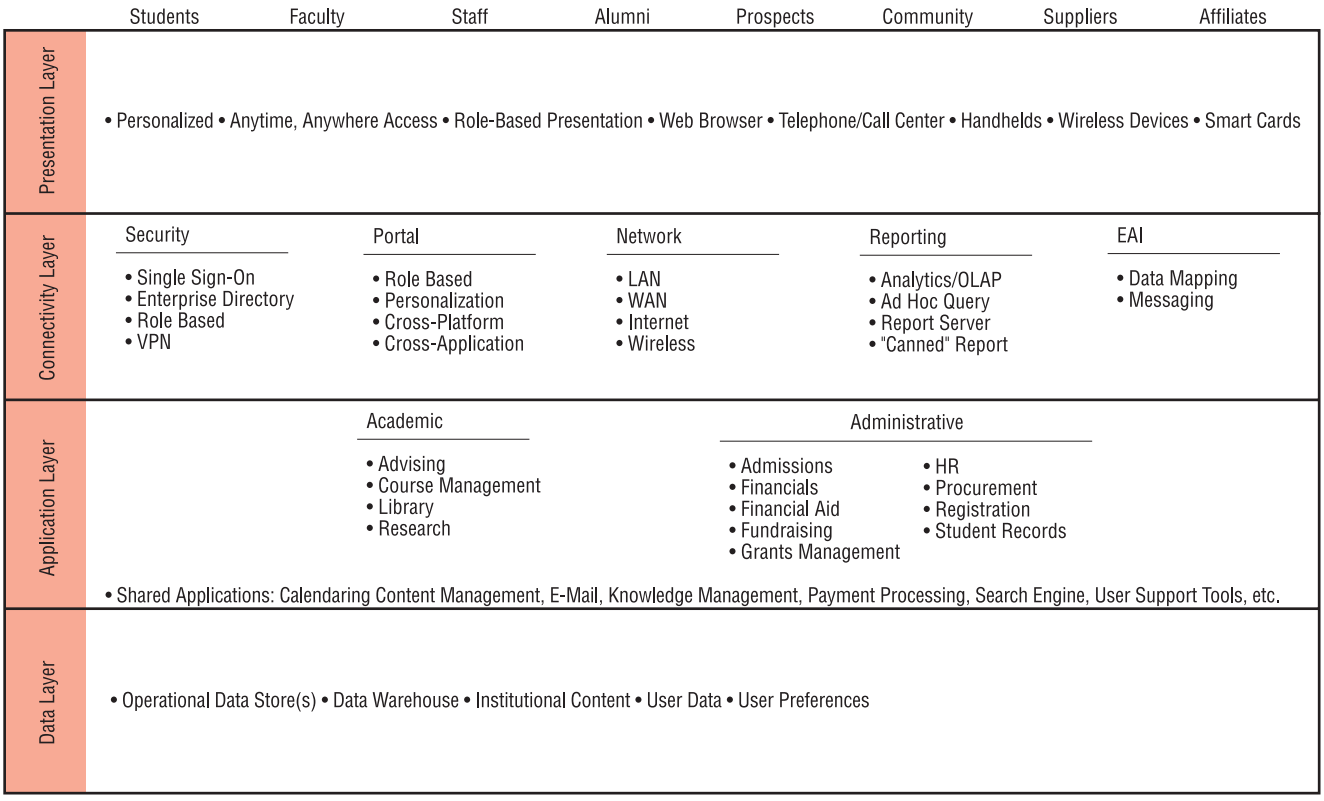


Figure 5-4. Percentage of ERP Implementers Installing New Capabilities within One Year

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*



* 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 is 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>.
4. See UC2010: *A New Business Architecture for the University of California* (Oakland: University of California), 2000.
5. Consult William E. Fulmer on *Shaping the Adaptive Organization* (New York: AMACOM), 2000. Christopher Meyer also described the adaptive organization as one able to change internally at the rate of changes going on externally. See Stan Davis and Christopher Meyer, *Blur: The Speed of Change in the Connected Economy* (New York: Warner Books), 1999.
6. For a good summary discussion of Web services in higher education, see Carl Jacobson, "Web Services: Stitching Together the Institutional

Fabric," *EDUCAUSE Review*, Mar./Apr. 2002, pp. 50–51. See also Bernard Gleason, "Integrating to the Max," *NACUBO Business Officer*, Sept. 2002, pp. 28–32.

7. See Kenneth C. Green's "Campus Computing Survey, 2002," <http://www.campuscomputing.net/>.
8. Jacobson, op. cit., p. 50.
9. Douglas Van Houweling made these comments in his acceptance remarks upon receiving the 2002 EDUCAUSE Award for Excellence in Leadership at EDUCAUSE 2002 in Atlanta, Georgia, Oct. 3, 2002.
10. University of California New Business Architecture Planning Group, UC 2010: *A New Business Architecture for the University of California* (Oakland: UC Office of the President), 2000, p. 3.
11. Ibid., p. 7.
12. Fulmer, op. cit., Chapter 6.
13. See the World Wide Web Consortium (W3C) Architecture Domain, Web Services Activity Statement, <http://www.w3.org/2002/ws/Activity>.
14. National Center for Public Policy and Higher Education, *Measuring Up 2002: State-by-State Report Card for Higher Education* (Wichita, Kan.: National Center for Public Policy and Higher Education), 2002.
15. National Association of College and University Business Officers, *Explaining College Costs: NACUBO's Methodology for Identifying the Costs of Delivering Undergraduate Education* (Washington, D.C.: NACUBO), 2002.
16. See, for example, Robert K. Herdman, "Testimony Concerning the Roles of the SEC and the FASB concerning GAAP," before the House Subcommittee on Capital Markets, Insurance, and Government Sponsored Enterprises, Committee on Financial Services, May 14, 2002.
17. George Keller, *Academic Strategy: The Management Revolution in Higher Education* (Baltimore: Johns Hopkins University Press), 1983, pp. viii-ix.
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.
19. William Graves, "New Educational Wealth as a Return on Investment in Technology," *EDUCAUSE Review*, July/Aug. 2002, pp. 40–41.
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.

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The extant literature on enterprise resource planning (ERP) introduces prospective users to systems, products, and vendors—as well as to the potential benefits and challenges of implementation. Although many journal and magazine articles do these tasks quite well, the most inclusive—and most current—basic information on ERP systems is on the Internet.

The most comprehensive coverage of ERP systems is on CIO (http://www.cio.com), an online resource for chief information officers and all information technology personnel. CIO maintains a Web area called the "ERP Research Center," where articles, research papers, and other resources can be found. The Web site is geared toward the private sector, but includes valuable information ranging from the comprehensive "The ABC's of ERP" to industry-specific articles such as "Can ERP Save A&P?" In particular, Koch's "The ABC's of ERP," a regularly updated feature of the site, provides information on ERP definitions, potential, costs, return on investment (ROI), and other areas. Many of the themes in Koch's article, such as the hidden costs of training and customization, are found throughout the ERP literature, making the CIO resources an essential starting point for those interested in beginning to plan for an ERP system.

Technet also provides a good starting point for ERP understanding and study with its "ERP Supersite" (http://techupdate.cnet.com/enterprise/0-6449811-724-6733082.html). Like CIO, this site, by ZDNet, provides a wealth of information on ERP basics, including vendor profiles, build-or-buy articles, trends, cost analysis, and an "Applications Update" section (http://techupdate.zdnet.com/techupdate/filters/mrc/0,14175,6020443,00.html) that will keep readers up-to-date on what is happening within the industry.

Another Web clearinghouse, ERP Central (http://erpcentral.com), provides resources through vendor-specific forums where clients can seek support—both technical and emotional—from their peers who use the same software. ERP Central also has links to leading research centers and has a robust job search exchange.

Within the technology information market, there are many Web sites such as "ERPassist" at IT Toolbox (http://www.erpassist.com/nav/t.asp?t=404&p=404&h1=404). Such Web sites are geared toward technical personnel with specific questions about functionality and do not shed light on the more general impact of ERP.

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Appendix 1 Participants in Qualitative Interviews

Arizona State University
- Darrel Huish, Assistant Vice Provost, Information Technology

BearingPoint, Inc. (formerly KPMG Consulting, Inc.)
- Mark Danis, Senior Vice President, Higher Education and Not-for-Profits
- Gary Grant, Managing Director
- Alicia Karam Harkness, Managing Director

Brandeis University
- Perry Hanson, Chief Information Officer and Associate Provost for Educational Technology
- Maureen Murphy, Controller

California State System University
- Hilary Baker, Senior Director, Common Management Systems
- Sheila Bickham, Director, CMS Hardware Operations and Support Services
- David Ernst, Assistant Vice Chancellor, Information Technology Services and CIO
- Benjamin F. Quillian, Vice President for Administration and CFO, California State University, Fresno
- Richard West, Executive Vice Chancellor and Chief Financial Officer
- Blaine Wright, Director, CMS Software Operations and Support Services

Contra Costa Community College District
- Helen Carr, President, Contra Costa College
- Peter Garcia, Interim President, Los Medanos College
- Chris Leivas, Director of Business Services, Diablo Valley College
- Les Littman, Purchasing Director, District Office
- Mariles Magalong, Director of Business Services, Contra Costa College
- Mojdeh Mehdizadeh, Vice Chancellor, Technology Systems, District Office
- Jeanette Moore, Director of Admissions and Records, Contra Costa College
- Gail Newman, Director of Admissions and Records, Los Medanos College
- Doug Roberts, Controller, District Office
- Linda Rosales, Payroll Director, District Office

Carol Maga, Assistant Dean of Instruction, Diablo Valley College
Chuck Spence, Chancellor

Datatel, Inc.
Jayne Edge, Vice President Strategic Planning and Marketing

H. Russell Griffith, President and CEO

Kyran Kennedy, Director, Product Marketing

Robyn Spero, Manager of Marketing Administration

Shahron Williams van Rooij, Director, Product Marketing

Illinois Wesleyan University
Jack Fields, Registrar

Fred Miller, Director of Information Technology

Scott Seibring, Associate Director of Financial Aid and Admissions

Indiana University
Norma Brenner Holland, Associate Vice President, University Information Systems

Daniel McDevitt, HRMS Project Manager

Vince Sheehan, CIO and Associate Dean for Information Technologies, School of Medicine

Barry Walsh, Senior Director, e-Business Services

Bradley Wheeler, Associate Dean for Teaching and Learning Information Technologies and Associate Professor of Information Systems

Jenzabar Inc.
Bob Maginn, Chairman and CEO

Middle Tennessee State University
Sherian Huddleston, Interim Associate Vice President for Enrollment Management

Lucinda Lea, Assistant Vice President for Information Technology

Mira Costa Community College
Ed Coate, Vice President for Business Services

Joseph Moreau, Chief Information Officer

Montana State University
LeAnn Anderson, Director of Financial Services

Craig Deaton, Associate Director for Administrative Systems

Mark Sheehan, Executive Director for Information Services and CIO

Oberlin College
John Bucher, Director of Information Technology

Millie Modic, Manager, Administrative Systems

Ross Peacock, Director of Institutional Research

Maryann Stillwell, System Manager, Admissions Office

Oracle Corporation
Patricia Neiss, Regional Manager

Ron Police, Senior Vice President, Oracle Higher Education

Mark Turner, National Sales Director, Higher Education Applications

PeopleSoft, Inc.
Susan Beidler, Product Strategy, Learning Solutions

Judy Chappelear, Director, Marketing Development for Higher Education

Karen Willett, Director of Marketing, Product Marketing, Learning Solutions

Pima Community College
Nancee Sorenson, Dean of Student Development, West Campus.

Ann Strine, Assistant Vice Chancellor, Information Technology

Princeton University
Kim Hoeritz, Project Manager, Student Systems Implementation

Dave Koehler, Director, Administrative Information Services (now at Cornell University)

Dan Scheiner, Acting Vice President, Human Resources

San Juan College
Robert Tidwell, Chief Information Officer

SAP
Eric Stine, Director of Higher Education Sales

Jerry Veal, Public Services

Jeannie Judd Wagner, Director of Higher Education Business Development

SCT
Deborah Elias-Smith, Vice President, Power Campus

Smith College
David Baker, Application Systems Analyst, Information Technology Services

Lorraine Bates, Application Systems Analyst, Information Technology Services

Kimberley Butz, Director of Administrative Technology (Former)

Ruth Constantine, Vice President for Finance and Administration

Cheryl Donaldson, Director of Desktop Technology

Tim Donelan, Application Systems Analyst, Information Technology Services

Janet Hukowicz, Application Systems Analyst, Information Technology Services

Kevin Kerwood, Human Resources Manager

Herbert Nickles, Executive Director of Information Technology Services

Tricia O'Neil, Registrar

Bill Sheehan, Chief Accountant, Controller's Office

Audrey Smith, Director of Admissions

Ruth van Erp, Director of Advancement Services

Sylvia White, Programmer/Analyst, Information Technology Services

Stanford University
Chris Handley, Executive Director of Systems

Roger Printup, Registrar

Trinity University
Diane Saphire, Assistant Vice President for Information Resources and Administrative Affairs and Director of Institutional Research

Charles White, Vice President, Information Resources and Administrative Affairs

University of California, San Diego
- Marty Backer, Strategic Projects Manager, Administrative Computing and Telecommunications
- Rick Espinosa, Campus Integrated Systems Manager, Administrative Computing and Telecommunications
- Elazar Harel, Assistant Vice Chancellor for Administrative Computing and Telecommunications
- Charlotte Klock, Data Center Director, Administrative Computing and Telecommunications
- Don Larson, Controller and Assistant Vice Chancellor, Business and Financial Services
- John McCleary, Business Initiatives Manager, Administrative Computing and Telecommunications
- Steve Relyea, Vice Chancellor for Business Affairs
- Myra Webb, Assistant Registrar

University of Colorado System
- Teresa Berryman, Vice Chancellor for Administration and Finance, Health Sciences Center
- David Makowski, Assistant Vice President, University Management Systems

University of Connecticut
- M. Dolan Evanovich, Associate Provost, Enrollment Management
- Paul Kobulnicky, Vice Chancellor Information Services
- Jeff von Munkwitz-Smith, University Registrar

University of Minnesota
- Terry Bock, Associate Vice President, Academic Health Center
- Carol Carrier, Vice President, Office of Human Resources
- Steve Cawley, Associate Vice President and CIO, Office of Information Technology
- Tim Fitzpatrick, Deputy CIO, Central Computing Operations, Office of Information Technology
- Robert Kvavik, Associate Vice President and Executive Officer
- Jill Merriam, Director of Finance, Law School
- Mark Powell, Director, Applications Development and Maintenance Group, Office of Information Technology
- Scott Ruud, Deputy CIO, Enterprise Applications/Maintenance, Office of Information Technology
- Wayne Sigler, Director, Office of Admissions
- Ted Skogman, Information Technology Professional, Office of the Bursar
- Dennis Skovsted, Information Systems Audit Manager, Department of Audits
- Craig Swan, Vice Provost, Undergraduate Education, Office of the Executive Vice President and Provost
- Sue Van Voorhis, Director, Office of the Registrar
- Miriam Ward, Director, Human Resources Management System/Payroll, Office of Human Resources

University of North Carolina at Charlotte
- John Mack, Director UNCC Information Systems, and Chair, UNC Shared Systems Alliance
- Karin Steinbrenner, Associate Provost and CIO Information Technology Services

University of Rhode Island
- Paul Gandel, Vice Provost for Information Services and Dean, University Libraries
- Dennis Stark, Vice President, Business and Finance
- Chris Wessells, Assistant Chief Information Officer

University of Texas at Austin
- Richard Burns, Assistant Director, Human Resources Services
- Patricia Clubb, Vice President for Employee and Campus Services
- Randy Ebeling, Associate Vice President for Information Technology
- Fred Freidrich, Director, Office of Accounting
- Kevin Hegarty, Vice President and Chief Financial Officer, Financial Affairs
- Rich Janes, Assistant Director, Human Resources Services
- Stephen Shannon Janes, Associate Vice President, Student Affairs
- Mary Knight, Associate Vice President and Budget Director, Financial Affairs
- Catherine Lester, Associate Director, Office of Accounting
- Lindsay Mounce, Senior Systems Analyst, Information Technology Services
- Sheila Ochner, Director for Enterprise Information Services, Information Technology Services
- Theodore Pfeifer, Registrar
- Shelby Stanfield, Director, Student Information Systems
- Daniel Updegrove, Vice President for Information Technology
- Bruce Walker, Director of Admissions and Associate Vice President, Student Affairs

University of Texas at San Antonio
- Rosalie Ambrosino, Vice President for Student Affairs
- Jeffrey Noyes, CIO and Associate Vice President for Information Technology
- Ann Roberts, Financial Services Officer, Fiscal Services

University of Washington
- Debra Friedman, Associate Provost
- Weldon Ihrig, Executive Vice President
- Ron Johnson, Ron Johnson, Vice President of Computing and Communications

University of Wisconsin–Madison
- Judith Caruso, Assistant to the CIO for Policy and Planning

University of Wisconsin–Oshkosh
- John Berens, Assistant Vice Chancellor for Information Technology
- Jill Endries, Director of Undergraduate Admissions

University of Wisconsin System
- Deborah Durcan, Vice President for Finance
- David Hart, Project Manager for University of Wisconsin Collaterals
- George Ketterer, Project Manager for Shared Financial System
- Bruce Maas, Project Manager for Online Access Student Information System, University of Wisconsin–Milwaukee
- Edward Meachen, Associate Vice President and CIO

University System of Georgia
- William Bowes, Vice Chancellor for Fiscal Affairs
- Beth Brigdon Assistant Vice Chancellor of Enterprise Systems and Services
- Barry Fullerton, Associate Vice Chancellor Student Services
- William Gauthier, Vice President of Business and Finance, State University of West Georgia
- Mark Gerspacher, Director of Budgets, State University of West Georgia
- Tonya Lam, Senior Advisor Student Enrollment and Information Services
- Richard Loftus, Team Lead for Financial Aid/Accounts Receivable
- Randall Thursby, Vice Chancellor for Information and Instructional Technology and Chief Information Officer of the University System of Georgia
- James Wolfgang, Chief Information Officer, Georgia College & State University
- Marylis Wolfgang, Director of Admissions, Georgia College & State University

Washington State Community and Technical Colleges Center for Information Services
- Vic Albino, Executive Director
- Ellen Harman, Project Manager
- Rich Henry, Chair of the Information Technology Planning Group
- Corey Knutsen, Director of Development Services
- Juanita Morgan, Student System Product Manager
- Nancy Petersen, Director of Technical Services

Wayne State University
- John Camp, Associate Vice President and Deputy CIO
- James Johnson, Vice President for Computing and Information Technology and CIO

West Virginia University
- Sara Bishop, Assistant Director, Administrative Systems Development, Information Systems
- Kenneth Orgill, Chief Information Officer and Associate Provost for Information Technology

Whitman College
- Stephanie Johnson, Executive Assistant to the Dean of Admission and Financial Aid
- Keiko Pitter, Chief Technology Officer

Appendix 2 Institutional Respondents to the Online Survey

Abilene Christian University
Adirondack Community College
Albertus Magnus College
Algonquin College
Allegheny College
Alvernia College
American University
Amherst College
Anne Arundel Community College
Aquinas College
Arapahoe Community College
Arizona State University
Arizona State University East
Asbury College
Ashland University
Austin Community College
Azusa Pacific University
Baker University
Bakersfield College
Barry University
Barton College
Bastyr University
Bates College
Baylor University
Berea College
Berklee College of Music
Berry College
Bethany College
Biola University
Birmingham Southern College
Bloomsburg University of Pennsylvania
Bluffton College
Board of Regents of the University System of Georgia
Boise State University
Brandeis University
Brazosport College
Brevard Community College
Bridgewater College
Bridgewater State College
British Columbia Institute of Technology
Brooklyn Law School
Brown University
Bryant College

Bryn Mawr College
Buffalo State College
Butler University
Caldwell College
California College of Arts and Crafts
California State University, Chico
California State University,
Office of the Chancellor
California State University–Bakersfield
California State University–Channel Islands
California State University–Dominguez Hills
California State University–Hayward
Calumet College of Saint Joseph
Calvin College
Camden County College
Canisius College
Carleton College
Carlos Albizu University Miami Campus
Carlow College
Carnegie Mellon University
Carson-Newman College
Catawba College
Cedarville University
Central Arizona College
Central Missouri State University
Central Piedmont Community College
Central State University
Central Washington University
Chandler-Gilbert Community College
Chapman University
Choate Rosemary Hall
Chowan College
City University of New York
Clarke College
Colby College
Colgate University
College Misericordia
College of Aeronautics
College of Lake County
College of Mount Saint Joseph
College of New Rochelle
College of Saint Catherine
College of the Menominee Nation
Colorado School of Mines
Columbus State University
Community College of Rhode Island
Connecticut College
Converse College
Cornerstone University
Cumberland University
Cuyahoga Community College
Dakota Wesleyan University
Dalhousie University
DeKalb Technical College
Denison University
Dickinson College
Dominican College of Blauvelt
Dordt College
Douglas College
Dowling College
Drake University
Drexel University
East Stroudsburg University of Pennsylvania
Eastern Washington University

Eastern Wyoming College
Ecole des Hautes Etudes Commerciales
Edgewood College
Edinboro University of Pennsylvania
Elon University
Embry-Riddle Aeronautical University
Emporia State University
Eureka College
Fashion Institute of Technology
Faulkner University
Fayetteville State University
Fielding Graduate Institute
Flagler College
Flathead Valley Community College
Florida Gulf Coast University
Florida Hospital College of Health Sciences
Florida State University
Fontbonne University
Fort Belknap College
Fort Berthold Community College
Fort Hays State University
Fort Lewis College
Franklin W. Olin College of Engineering
Frederick Community College
Fullerton College
Gallaudet University
George Mason University
Georgia College & State University
Georgia Perimeter College
Georgia State University
Gettysburg College
Glendale Community College (AZ)
Glendale Community College (CA)
Gonzaga University
Gordon College
Gordon-Conwell Theological Seminary
Goshen College
Graduate Theological Union
Grand Rapids Community College
Grand Valley State University
Grant MacEwan Community College
Grayson County College
Green River Community College
Grinnell College
Hamilton College
Hampshire College
Hampton University
Harford Community College
Hastings College
Haverford College
Herbert H. Lehman College/CUNY
Heritage College
Hofstra University
Holy Family College
Hood College
Horry-Georgetown Technical College
Hostos Community College/CUNY
Houghton College
Hudson Valley Community College
Humboldt State University
Huntingdon College
Illinois Central College
Illinois Wesleyan University
Indiana University Bloomington

Indiana University Northwest
Interlochen Center for the Arts
Iowa State University
Isothermal Community College
Ivy Tech State College Central Office
Jacksonville University
James Madison University
Johns Hopkins University
Johnson County Community College
Joliet Junior College
Kalamazoo College
Kent State University
Kent State University–Tuscarawas Campus
Kentucky Community & Technical College System
Keuka College
King College
LaGuardia Community College/CUNY
Lake Erie College
Lake Region State College
Lake Tahoe Community College
Lasell College
Lawrence University
Lewis University
Limestone College
Lincoln Memorial University
Linn–Benton Community College
Lock Haven University of Pennsylvania
Louisiana State University
Louisiana State University at Alexandria
Louisiana State University in Shreveport
Lourdes College
Lynchburg College
Macalester College
Malone College
Mansfield University of Pennsylvania
Maricopa Community College District
Mars Hill College
Mary Washington College
Marygrove College
Marymount Manhattan College
Massasoit Community College
McDaniel College
McMaster University
Mendocino College
Mercy College
Mesa Community College
Michigan State University
Middle Tennessee State University
Middlebury College
Millersville University of Pennsylvania
Milligan College
Mills College
Minnesota State Colleges and Universities
MiraCosta College
Moberly Area Community College
Monmouth College
Monroe Community College
Montana State University–Bozeman
Montgomery College Central Administration
Montgomery County Community College
Morehead State University
Mount Aloysius College
Mount Marty College

Mount Mary College

Mount San Antonio College

Nassau Community College

New Hampshire Community Technical College, Berlin/Laconia

New Mexico Institute of Mining and Technology

New Mexico State University at Carlsbad

Newberry College

Nipissing University

Norfolk State University

North Carolina School of the Arts

North Carolina Wesleyan College

North Central College

North Dakota University System

North Lake College

North Shore Community College

Northeastern University

Northern Arizona University

Northern Michigan University

Northern Virginia Community College Central Office

Northwestern College

Norwich University

Notre Dame College of Ohio

Oakland University

Oberlin College

Occidental College

Ohio Dominican University

Okanagan University College

Oklahoma Christian University

Oklahoma State University–Okmulgee

Onondaga Community College

Oregon Institute of Technology

Ouachita Baptist University

Ouachita Technical College

Pace University

Pacific School of Religion

Phoenix College

Pima County Community College District

Pitzer College

Point Park College

Polytechnic University of the Americas

Pomona College

Prairie Bible Institute

Prince George's Community College

Princeton University

Providence College

Purchase College, SUNY

Purdue University

Purdue University Calumet

Quinnipiac University

Radford University

Rancho Santiago Community College District

Richard Bland College

Rockefeller University

Rockland Community College

Rogers State University

Rosemont College

Rowan University

Rutgers, The State University of New Jersey New Brunswick

Saint Francis University

Saint Mary College

Saint Mary's University/Texas
Saint Meinrad School of Theology
Saint Peter's College
Samford University
San Diego Community College District
San Diego Miramar College
San Diego State University
San Juan College
Santa Fe Community College, FL
Santa Fe Community College, NM
School of the Art Institute of Chicago
Seattle Pacific University
Seminole Community College
Seton Hill College
Shepherd College
Silver Lake College
Simmons College
Simpson College
Skidmore College
South Dakota School of Mines & Technology
South Dakota State University
South Texas College of Law
Southeastern Illinois College
Southern Illinois University Edwardsville
Southern Maine Technical College
Southwest Baptist University
Southwest Texas State University
Southwestern Indian Polytechnic Institute
Southwestern University
Spring Arbor University
St. Cloud State University
St. John's College
St. Lawrence University
St. Olaf College
Stark State College of Technology
State University of West Georgia
Stephens College
Stetson University
Stillman College
Suffolk County Community College Ammerman Campus
SUNY College at Geneseo
SUNY College of Environmental Science & Forestry
SUNY College of Optometry
SUNY System Administration
Sweet Briar College
Tennessee Board of Regents
Tennessee State University
Texas Lutheran University
Texas State Technical College–Harlingen
Texas Tech University
The College of New Jersey
The College of Saint Scholastica
The Community College of Baltimore County
The George Washington University
The Ohio State University
The Pennsylvania State University
The University of Kansas Medical Center
The University of Memphis
The University of South Dakota
The University of Tennessee
Thiel College
Treasure Valley Community College

Trinity Christian College
Trinity University
Tri–State University
Troy State University
Tusculum College
Tyler Junior College
UCLA
Union College
United States Naval Academy
Unity College
Universite Laval
University at Albany, SUNY
University College of the Cariboo
University College of the Fraser Valley
University of Alabama at Birmingham
University of Alaska Southeast
University of Alaska Statewide System
University of British Columbia
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University of California Office of the President
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Merced
University of California, Riverside
University of California, San Diego
University of California, San Francisco
University of California, Santa Barbara
University of California, Santa Cruz
University of Central Florida
University of Colorado at Colorado Springs
University of Colorado System
University of Connecticut
University of Delaware
University of Detroit Mercy
University of Florida
University of Georgia
University of Hawaii at Manoa
University of Idaho
University of Illinois at Chicago
University of Indianapolis
University of Iowa
University of Kentucky
University of LaVerne
University of Lethbridge
University of Louisville
University of Manitoba
University of Mary
University of Maryland
University of Massachusetts
University of Massachusetts Amherst
University of Miami
University of Michigan–Dearborn
University of Minnesota Twin Cities
University of Minnesota Duluth
University of Missouri System
University of Missouri–Kansas City
University of Montana–Western
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University of Nebraska–Lincoln
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University of Texas at Austin

University of Texas at San Antonio

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University of Texas Southwestern Medical Center at Dallas

University of Texas System Office

University of Texas–Pan American

University of the Pacific

University of Virginia

University of Washington

University of Waterloo

University of West Florida

University of Winnipeg

University of Wisconsin–Madison

University of Wisconsin–Milwaukee

University of Wisconsin–Oshkosh

Urbana University

Ursuline College

Valparaiso University

Vancouver Community College

Virginia Tech

Walden University

Weber State University

Wellesley College

Wells College

Wesleyan University

West Virginia State College

West Virginia University

West Virginia University Institute of Technology

West Virginia Wesleyan College

Westchester Community College

Western Carolina University

Western New Mexico University

Westminster College, PA

Westminster College, UT

Wheeling Jesuit University

Whitman College

Widener University

Williams College

Worcester Polytechnic Institute

Wor–Wic Community College

Yale University

York College

Appendix 3
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