

EDUCAUSE Center for Applied Research

Research Bulletin

Volume 2003, Issue 5

March 4, 2003

A Different Kind of ERP: Extending and Renewing Legacy Systems

Ed Lightfoot, University of Washington

Gail Salaway, EDUCAUSE Center for Applied Research



Overview

Before making the significant investment required to implement a vendor-supplied enterprise resource planning (ERP) system, most colleges and universities evaluate alternatives, one of which is to renew and extend the institution's existing application software, or legacy systems. Campuses that choose this approach do so for numerous reasons, often concluding that there is sufficient value embedded in their existing application programs to justify the effort, and that retaining their existing systems will be less risky and more economical than implementing a new system. Extending legacy systems enables institutions to focus resources on other strategic objectives, pursue incremental improvements in business practices, and implement newer technologies such as portals—without the disruptions of a major ERP implementation.

Legacy systems are generally thought of as the older, highly modified application software that institutions either developed internally or purchased long ago. The term “legacy” typically has negative connotations and carries the assumption of a “legacy of neglect and deferred maintenance.” Yet embedded in these systems is a rich history of changes that reflects years of decisions about how to do business in a particular market, regulatory environment, or institutional culture. Merriam-Webster's definition of legacy, therefore, may offer a more accurate description: “something transmitted by or received from an ancestor or predecessor or from the past.” However, it is not accurate to use the term legacy in this context alone. The reality is that institutions choosing a non-ERP strategy often construct and support an advanced in-house development environment, using the latest tools and technologies available in the IT marketplace. Brand new applications are developed in-house. Within this larger context, many colleges and universities explicitly commit to a legacy portfolio of applications—both old and new—believing this to be in the best interests of the campus overall and well aligned with campus goals, culture, and directions.

The EDUCAUSE Center for Applied Research (ECAR), in conjunction with Cap Gemini Ernst & Young, recently completed a study, *The Promise and Performance of Enterprise Systems in Higher Education*,¹ that queried both ERP² and non-ERP institutions about their administrative systems strategies. ECAR also conducted four case studies of non-ERP institutions to gain a deeper understanding of why certain institutions explicitly chose to renew their existing systems rather than undertake an ERP implementation. Case studies, including on-site visits, were conducted at the University of Texas at Austin (UT Austin), the Washington State Community and Technical College system, the University of Washington (UW), and the University of California, San Diego (UCSD).

This Research Bulletin presents the findings and effective practices from those studies and describes the decision and implementation processes used to create a modern application environment. While the focus is on the trade-offs between ERP and non-ERP strategies, this bulletin is intended to be useful for institutions maintaining existing systems, whether or not they have seriously considered an ERP option.

Highlights of Extending and Renewing Legacy Systems

Legacy systems abound and are likely to be with us well into the future. The ECAR survey found that non-ERP solutions are in use at nearly half the institutions in the study sample and that two-thirds of the ERP institutions continue to use legacy systems for one or more of their student, financial, or human resource systems. Further, the Campus Computing Project 2002³ survey data provide clear indications of major budget cuts and declining technology spending across all sectors of American higher education. As a consequence, some colleges and universities may decide to postpone ERP implementation plans, causing those institutions to refocus resources on maintaining legacy systems. And, of course, today's ERP system can become tomorrow's legacy.

A wealth of information was collected from the case studies of campuses that have chosen not to implement a packaged ERP solution. These data reflect a strong commonality in reasons for adopting legacy-systems strategies, general approaches to extending applications, and critical success factors. However, system-renewal implementations varied widely, depending on the technical environment and on campus priorities and directions.

Reasons for Choosing a Legacy-Systems Strategy

Despite the diversity of the four institutions studied, each chose to retain and develop its own systems for similar reasons. All four institutions had invested substantial resources into modifying existing systems to fit their unique business environments. Each considered the prospect of purchasing an ERP system and attempting to reconstruct current functionality—or modifying business practices to fit the ERP environment—an expensive, time-consuming, and potentially disruptive process that would divert resources that could otherwise be applied to high-priority projects. Several key factors emerged in their decisions to pursue a non-ERP approach.

Functionally and Technically Viable Existing Systems

The single most important reason identified in the ECAR survey for not selecting an ERP product was that “the existing system works” (32 percent), which is consistent with the case study campuses' belief that their systems “work.” Respondents stated that the underlying business functionality provided by the systems was currently meeting the basic business needs of the institution. They did acknowledge a backlog of requests for functional improvements, but gaps in business functionality were not the overriding problem. Instead, the most pressing user problems pointed to inadequate tools for accessing and analyzing data and cumbersome user interfaces, deficiencies which could be remedied without replacing the entire system. For example, when Kevin Hegarty, vice president and chief financial officer at UT Austin, spoke with the deans, he discovered their problem was a lack of information available to help them run their businesses. “They were data-rich but information-starved,” he said. “The answer isn't necessarily a better financial package. It's not your transaction generator or processor—it's the reporting tools.”

In addition to providing adequate functionality, existing core systems and their underlying technical infrastructure were “working.” If those systems were not already technically current, non-ERP respondents had two primary solutions to the challenge—restructuring systems for better maintainability or re-hosting systems to more modern applications. Such solutions are not necessarily cheap or easy, however. The Washington State Community and Technical College system, for example, faces system renewal on a large scale. They have more than four million lines of code in an HP-3000 environment, which they plan to update to run in an upgraded technology environment, adding Web interfaces and a relational database for user access.

Value of Customized Business Practices

Most legacy systems have been extensively modified to support local business practices. Implementing an ERP package requires comparison of the existing system’s functionality with that of potential ERP systems. Institutions must decide whether to customize the ERP package to continue a unique function not provided by the ERP system, or change the business practice. Choosing to keep an existing system implies a determination that the overall value built into that system over the years is worth preserving.

For example, the Washington State Community and Technical College system conducted a detailed analysis that demonstrated just how important the tailored fit of business functionality can be and how difficult it can be to replace. The colleges thoroughly evaluated their existing systems to identify any gaps between their current functionality and that of the proposed ERP system. They concluded that 30 percent of the gaps could be addressed most effectively by changing internal business processes. For the remaining gaps, however, they felt it was critical to maintain the current level of service provided to students, faculty, and staff. These functions included state reporting requirements, labor contract requirements, technical college requirements, touchtone telephone interfaces, cashiering, employee contracts, Web applications, the Web-based virtual campus, and internal reporting. The analysis estimated that nearly 50,000 hours of customization would be required to fill these gaps, at considerable cost. In the end, the colleges decided that they would be better served by keeping their existing applications and migrating them to a more modern computing environment.

Other Institutional Priorities

In the ECAR survey, the second-ranked reason (15 percent) for retaining legacy systems rather than choosing an ERP solution was “other institutional priorities.” It is not news that ERP projects are extremely costly, often prohibitively so. Campuses must absorb the initial costs for software and installation, and licensing fees continue to rise. The survey found that although ERP systems generally fulfilled their promises, ongoing costs were higher than expected, and cost savings were not derived from potential efficiencies. Sixty-nine percent of respondents that had installed an ERP system noted that central, departmental, and college workloads had actually increased, and many also reported the need for higher levels of technical skills and increased training. Survey results showed that 22 percent of ERP implementations take more than a year to

complete, and many campuses reported a significant break-in period where productivity declined until people become accustomed to the system. Especially in the initial phases of an ERP project, many campuses find that replacing core systems is resource-intensive. The result is that institutions installing an ERP system may postpone other potentially high-payoff IT projects during the implementation period and often in the future as well.

The case study institutions that choose to renew and extend legacy systems are sensitive to opportunity costs and the decrease in discretionary investments when tied to vendor licenses agreements and update processes. The direct and opportunity costs related to ERP installations are a driving factor for these institutions. Despite the significant work required to modernize old systems, they conclude that overall costs are lower. Avoiding the purchase and implementation of an ERP system that would then need modifications to meet existing needs allows institutions to leverage those resources and spend them, at least partially, on next-generation enhancements to current systems, without upheaval of core operations. Ron Johnson, vice president of computing and communications at UW, expressed this view: “You should spend the next dollar on something that will make the biggest difference for the institution and for its inhabitants, and historically that has meant communications/messaging infrastructure and enabling infrastructure that allows capable people to innovate and do things.”

Approaches to Extending Legacy Systems

Once a campus has committed to retaining its existing systems and brought them up to an acceptable level of currency, the next priority generally has been to extend their usefulness. Since most legacy systems predate extensive Web use, the initial focus on extending user services has most often involved (1) wrapping these systems in new Web interfaces, (2) providing back-end data-warehousing capabilities, and (3) developing new and redesigned components and processes. These solutions were identified both by ECAR research study respondents and the case study institutions.

Interactive Web Interfaces

The institutions profiled used a variety of techniques to build different but compelling Web interfaces. Each institution used an incremental change process to add services gradually. Two examples follow:

- UW first developed software to link its Unisys mainframe environment with Web services on both Microsoft NT and UNIX servers, providing the capability to query and update central databases interactively. The university then built the MyUW portal, initially geared primarily to students. Eventually all the university's constituent groups—students, faculty, staff, alumni, referring physicians, patients, and community members—will have portal access with personalized information, tools, and services that encompass their various relationships with the university.
- UT Austin's approach used EntireX/BROKER from Software AG to manage the interactions between its Web and host environments. UT Austin also developed

in-house a sophisticated CGI-based scripting language to control dynamic Web-page creation, manipulation, and navigation. With this technical underpinning, a comprehensive portal (called UTDirect) was created for all campuses' business functions, offering extensive workflow tools and methodologies. The advantage of this approach was driven home to Dan Updegrave when he arrived as vice president for information technology. "A striking thing to me about working at this university is that I don't touch paper," he said. "Everything I do is workflow: online time sheets, approving travel requisitions, approving personnel actions, and more."

Data-Warehousing Techniques

Each institution studied has embraced a data-warehousing approach, integrating multiple data sources from its existing systems to provide a holistic information view of the institution. In fact, the ECAR study found that ERP institutions also face the problem of providing user-friendly data access. Data warehouses are built to facilitate quick and easy access to timely information through user-friendly tools for data analysis and reporting. Ideally, this limits the proliferation of duplicate local databases and spreadsheets of questionable accuracy. Kevin Hegarty of UT Austin pointed out that data warehousing only works if everyone uses it. "Data warehousing is a good thing if you can make it a bible at the university, which means that it has to be reliable and accurate. You also have to have ownership at the top level so that when someone goes to extract information, they don't go to their spreadsheets, financial systems, or somewhere else. They go to the data warehouse." Following are two examples of data-warehousing adjuncts to legacy systems.

- UCSD integrates the data warehouse into its way of doing business, providing ready access to the business information needed by its constituents. Marty Backer, strategic project manager, described their system: "It runs on a Sybase database in a Sun Solaris environment. Every night we download data from the mainframe. We also create summary tables—data marts—so users don't have to go through all the detail each time. There is also a data dictionary called Data Link, with all the definitions of the data, codes, etc."
- UW's collaborative culture drove the need to provide schools and colleges with better information on students, courses, and faculty. Debra Friedman, associate provost for academic planning, who pioneered the data-warehousing effort, said, "The ability to access and analyze common sets of data is critical to collaborative decision making. If we are to have any semblance of professional decision making, it is necessary to have common information. Otherwise the conversation develops into my view of the world versus your view of the world, and that is no way to run a consensually based university." As a result, the university has launched a broader data-warehousing initiative to build an infrastructure to integrate student, financial, and human resource information requirements.

Developing New and Redesigned Components and Processes

An ERP strategy involves lobbying the vendor for desired user requests and, when new functionality is provided, working with campus users to install and accommodate the changes. Institutions often use external-vendor and user-group pressure to mold internal change. By contrast, non-ERP organizations do not receive a windfall of ERP new features, bells, and whistles. Thus, it is especially critical to create an effective, and ideally innovative, process to determine what is really needed and to carefully prioritize those needs within the limited resources available. Yet, in an evolutionary development strategy, the enhancement process is usually perceived as too slow and incremental. With the first cut of resources allocated to technical currency and mandated requirements, it can seem as if implementation or user requested enhancements are few and far between. The institutions studied addressed these issues by inventing creative organizational processes to encourage innovation and creativity.

- Weldon Ihrig, executive vice president at UW, described how the USER (University Services Renewal) Project was used to renew the payroll and HR systems. “We wanted to promote a cultural change and to modernize our way of doing business. We invited the best people from our client base to think about how they would design optimal payroll/human resource processes. We gave them the freedom to challenge all legal, technical, and institutional constraints. The team wanted 1,500 changes; now we are down to the last two. The key is to get information out where people need it, for them to have the ability to change it, and to involve them in defining how they would like to do it.”
- UCSD has created a business environment that blends technology solutions with continuous process improvement. One example is PWRuP, UCSD’s Web-based workload-reduction system that reduces the effort associated with departmental ledger reconciliation. By using sophisticated statistical sampling techniques to replace the traditional process of manually reconciling every transaction at month-end, users reconcile only a statistically significant sample presented to them over the Web. The campus measured how long it took staff to complete the work before and after the system was implemented. “The workload reduction was anywhere from 75 to 95 percent. It was just huge,” said Elazar Harel, assistant vice chancellor for computing and telecommunications.

Critical Success Factors

The institutions studied generally agree on which factors are critical for succeeding with a legacy systems approach.

Maintaining Technical Currency

The most critical challenge is to maintain technical currency, whether using an ERP or legacy system. The software environment must remain stable, secure, available, and highly reliable. With ERP solutions, the vendor software-release process and schedule can push institutions to make changes in both business practices and technology upgrades. When a campus commits to an ERP system, the campus also commits to

making related technical upgrades. If vendor performance problems arise, institutions affected by the problem can work together to articulate the problem to the vendor and lobby jointly for a solution.

Alternatively, when an institution chooses to embrace its own systems, no outside source pushes the multiple levels of upgrade issues. In response, these institutions have found it critical to create and sustain a management process that has a clear focus on technology tracking. The computing industry evolves quickly, with many, often unforeseen, twists and turns. Making good bets and hedges on future directions is difficult. For example, UW must continually keep an eye on the Unisys product line, its evolving technologies, and its corporate viability. UT Austin recently reevaluated and renewed its relationship with Software AG, the vendor that supplies products for its development and database environment. UCSD evaluated its IBM mainframe environment several years ago and concluded that this platform was quite effective at processing its high volumes of information despite a popular trend away from mainframe technologies.

Management must conscientiously allocate the resources required for the technical upgrades and must be vigilant in keeping competing projects from overriding this basic maintenance activity. There is a temptation to put off unexciting upgrades in favor of more appealing enhancements, and management is called upon to make unpopular resource-allocation decisions. Enterprise systems are among the institution's capital assets, however—deferring maintenance in the short run may be a less expensive strategy, but over time deferred maintenance of information systems, as with buildings, creates risks of obsolescence.

Maintaining Functional Currency

The issue of maintaining currency also applies to system functions and data. Just as technology unrelentingly marches forward, so does the proliferation of mandates from external sources. Changes in the regulatory environment continually trickle down to campus business practices, their related systems functions, and the actual data collected and stored. The analysis required to determine how to integrate these requirements into both systems and business operations is typically labor-intensive and complex. A few typical examples include frequent agency changes to student-loan and financial-aid rules, requirements of the Health Insurance Portability and Accountability Act (HIPAA) for additional security and authorization, impact of the Student and Exchange Visitor Information System (SEVIS) on student systems, changes in government and financial accounting standards that affect financial software, Internal Revenue Service changes in deduction rules, potential changes to accommodate the recent Technology, Education, and Copyright Harmonization (TEACH) Act, and eliminating the use of a Social Security number as an identifier where mandated. Projects to implement these types of changes often come with tight deadlines and take precedence over other campus work. Therefore, and again with vigilance, legacy-systems managers must create a management process to ensure the timely implementation of externally required changes.

Commitment to Staff Development

Commitment to staff and staff development is critical. Technical and business management and decision responsibilities cannot be shared across a vendor user base, instead falling squarely on the shoulders of the technology managers and staff. At the operational level, staff must be competent to evaluate what is technically feasible and reasonable and be able to make fluid changes to software that may be unusual. These institutions often have become experts in the technologies they use, and these technologies may not be mainstream. There may not be an abundance of IT professionals drawn to work on technologies off the beaten path. In some geographical areas, this may result in recruitment challenges. Technical management must create solutions to develop and retain the technical staff needed to support their unique systems.

For example, UT Austin has invested in a unique and extensive training program. It recruits highly talented—and primarily non-technical—professionals and provide them with six months of intensive training in university administrative systems development tools and methodologies. While the central IT organization provides training and supports core technologies, departments have hired graduates of the training program to staff their own local software-development, user, and managerial positions. Randy Ebeling, associate vice president for information technology, said, “We have about 185 hard-core application developers spread across the university. About 60 work in the central IT organization; the other 125 work with department administrators, reporting directly to the registrar, director of admissions, CFO, college deans, and even to the university police department—with no line or budgetary relationship to IT. The only thing we do is maintain a community.”

Outlook for the Future

The four institutions profiled here fully recognize that in the longer term they may need to replace their legacy systems with newer technologies, possibly a future version of an ERP system. However, these institutions all share a hope that future options for upgrading administrative systems will be less limited and that institutions will not have to choose between buying integrated ERP systems and enhancing their own software. Instead, they hope that smaller modules will become available from ERP vendors, smaller companies, or collaborative development among institutions. These smaller modules could provide specific functionality that could plug into different environments, perhaps by using maturing Web Services standards. For example, a campus might consider buying a payroll calculation function as a separate module, without having to purchase a fully integrated ERP system.

There is demand for standards-based, smaller, lower-cost modules, and the institutions profiled here find this type of solution compelling. Forrester, a research group, has claimed that ERP systems have failed to improve the bottom line⁴ and that the new push is toward more lithe, adaptable modules rather than large, comprehensive systems.⁵ Indeed, ECAR’s ERP survey found that the respondents at ERP and non-ERP institutions perceived no difference in the improvement of business practices. Whether

the market will respond or the Web standards necessary to realize this model will be widely used and accepted remains an open question.

This approach would permit institutions to retain control over their entire systems and, at the same time, allow them to integrate new application software components into their existing technology infrastructure, middleware, and business services. Many adopters of the legacy-system strategy believe that the technologies and economics related to managing an institution's core transactions and reporting activities are likely to improve over time and that those who hesitate may be rewarded.

What It Means to Higher Education

Both the ERP and the legacy-system strategies have strong merits—each is an investment in risk reduction and cost avoidance. The key is to invest in the solution that most closely matches the institution's priorities. The ERP versus legacy story is anchored in the cultural and technical histories of the specific institutions, their goals and resources, and the nature of their risk tolerances. For some, the risks of disruption and the dependence associated with the ERP solution far outweigh the potential benefits. For others, the risks of technological isolation and exposure to deferred maintenance are unacceptable. In cases such as those presented in this bulletin, the decision to support and leverage legacy systems is strategic and can have an extremely positive impact on the campus.

Key Questions to Ask

- Does the institution have a technology environment that will provide long-term support for legacy systems? Will this technical environment support the creation of quality user interfaces, interoperability, and data-warehousing technologies?
- Are the systems' embedded, customized business practices worth saving? Has a fit-gap analysis been done to determine the level of customization required if an ERP approach is chosen?
- Are the leadership and staffing resources in place to champion and support long-term maintenance of the legacy systems?
- Does the institution's culture support evolutionary maintenance and renewal?
- Is there a process of user involvement that can effectively direct systems changes in a productive and innovative way?

Where to Learn More

- University of Texas at Austin Information Technology Services Reports and Plans, <<http://www.utexas.edu/its/about/strategic/index.html>>.

- University of Washington Information Services Strategy, <<http://www.washington.edu/computing/directions/iss.html>> and User Project Mission, Principles, and Strategy, <<http://www.washington.edu/user/mission.html>>.
- University of California, San Diego Web site, <<http://blink.ucsd.edu>> (see Content Providers).
- EDUCAUSE Information Resource Library Data Warehouse information, <http://www.educause.edu/asp/doclib/subject_docs.asp?Term_ID=217>.
- Gartner Group, "Selecting an ERP Solution: A Process Used by 34 Colleges," P. Farley, Higher Education Technology Strategies, Oct. 5, 1999, CS-09-1405.

Endnotes

1. R. B. Kvavik and R. N. Katz, *The Promise and Performance of Enterprise Systems for Higher Education*, ECAR Research Study, Volume 4, 2002, <<http://www.educause.edu/asp/doclib/abstract.asp?ID=ERS0204>>.
2. ERP institutions are those that responded to the ECAR study survey saying they had implemented a packaged ERP solution for student, human resources, or financial systems in the past seven years.
3. K. C. Green, "Campus Computing 2002: The 13th National Survey of Computing and Information Technology in American Higher Education" (Encino, Calif.: The Campus Computing Project, 2002). <<http://www.campuscomputing.net/>>.
4. J. Menezes, "ERP Fails to Improve Bottom Line, Says Forrester," *Computing Canada*, Vol. 25, No. 45, Nov. 26, 1999, p. 4.
5. A. Parker, "ERP Future Lies in Modules, Not Monoliths," *Computer Weekly*, June 10, 1999, p. 52.

About the Authors

Ed Lightfoot (elight@washington.edu) is Director of Information Systems at the University of Washington. Gail Salaway (gsalaway@educause.edu) is a Fellow with the EDUCAUSE Center for Applied Research.

Copyright 2003 EDUCAUSE and Ed Lightfoot and Gail Salaway. All rights reserved. This ECAR Research Bulletin is proprietary and intended for use only by subscribers. Reproduction, or distribution of ECAR Research Bulletins to those not formally affiliated with the subscribing organization, is strictly prohibited unless prior permission is granted by EDUCAUSE and the authors.