Knowledge Management and the Academy

By **Timothy J. Cain, Joseph J. Branin,** and **W. Michael Sherman**

Universities and colleges generate extraordinary quantities of knowledge and innovation, but in many ways the academy struggles to keep pace with the digital revolution. Growing pressures are reshaping how universities must do business—students expecting enhanced access and support, administrators eager to make data-driven strategic decisions, researchers working in virtual global collaboratories, faculty looking for ways to assess learning outcomes, and computer hackers probing networks for vulnerabilities.

Many universities seek creative and innovative ways to enhance their nimbleness in knowledge translation, access, and usability.[1] Successful universities embrace these challenges creatively, including revisiting and repurposing the roles of their academic libraries and IT organizations.[2] As information transitions away from printed works, universities are enhancing their digital collections and repositories, creating "commons" to synergize support for technology and information access and forging partnerships between library, information, and technology professionals.[3]

The need to manage and assimilate a constantly growing pool of information, technology, and human expertise creates unique challenges for faculty, staff, administrators, and students in the modern university. To meet the needs of these diverse user communities on The Ohio State University (OSU) campus, the Center for Knowledge Management (CKM) was created in 2003 as a unit within the John A. Prior Health Sciences Library. The center's goal is to leverage the strengths of people, processes, data, and technology to foster the creation, analysis, and dissemination of new knowledge. As previously chronicled, our teaming of technology professionals (programmers, media designers, and so forth) with information stewards (librar-

Strategies and solutions at The Ohio State University are changing how expertise and knowledge are documented and shared

ians) has significantly enhanced our ability to transform information services, streamline academic computing support, augment research stewardship, and accelerate the creation of knowledge-based solutions and innovations.[4] A hallmark of this partnership is a robust knowledge management solution that is transforming the ways the expertise and knowledge of faculty and staff are documented and shared at OSU.

Tracking Our Greatest Asset

Knowledge found in the activities, talent, and expertise of people is one of the greatest assets of a university. Understanding, codifying, and mapping where knowledge and expertise exist within an organization is a cardinal tenet of *knowledge management*—a term coined by Davenport and Prusak[5] to describe a set of best practices ensuring competitiveness and viability for business and industry.

Academia needs to understand where expertise is embedded across departments and colleges, but requires better tools for the purpose. Universities expend a significant amount of time and resources tracking and reporting on this valuable asset. OSU has over 150 academic departments organized into 19 colleges, requiring methodologies to document, organize, track, and access the efforts of more than 18,000 professional staff and faculty. Access to and retrieval of this information is typically tedious, inconsistent, and cumbersome, often relying on traditional paper methods and simple electronic processes, given the lack of robust, electronic alternatives suited to the needs of universities and colleges.

The information gathering required for faculty appointment, promotion, and tenure (AP&T) at most institutions, including OSU, is largely paper-driven. The AP&T workflow typically starts with faculty ferreting data from their personal records and detailing the presentations they have given, courses they have taught, committees on which they have served, and students and junior faculty they have mentored, among other activities. Once compiled, this information requires constant updating to ensure timely responses to requests for information, annual performance discussions, and professional advancement. When the dean's office calls requesting information for a media inquiry, or the chair needs updates for the annual department report, or the communications staff asks for updated information for the department's website, faculty scramble to find, assemble, and make the pertinent information available.

As part of CKM's planning efforts, we queried members of the Association of American Universities Data Exchange (AAUDE), a higher education consortium that fosters information sharing between institutions to support decision making. In our informal online poll in October 2005, we invited member schools to share how they track and manage faculty scholarly activity data (publications, sponsored projects, courses taught, outreach efforts, and so forth), with a particular emphasis on AP&T workflow. As detailed in supplemental materials to this report (see the sidebar), nearly 20 peer institutions responded, revealing a common set of patchwork strategies to track and report on faculty efforts. Many participating schools echoed the need for better ways to streamline the collection, reporting, and sharing of expertise data within and between universities.

While introducing new strategies and information systems faces little resistance in the corporate sector—where business viability, management practices, and competitiveness can drive adoption of new systems—universities with distributed academic departments pose different challenges. Borrowing from the corporate model, however, using knowledge management strategies makes tracking knowledge and expertise across the academic enterprise easier.

Putting Solutions in Place

In 2003, responding to a call for solutions to identify areas of expertise across a subset of the OSU campus, a small team within the CKM began working on a proof of concept using Adobe ColdFusion 8 and Microsoft SQL Server 2000 middleware technologies. In these early stages, we conceived a federated data model that leveraged preexisting institutional data sets to provide more complete views of faculty activities. Through the support of a number of institutional partners, including the offices of academic affairs, health sciences, information technology, research, and libraries, the knowledge management solution we built and termed OSU:*pro* is being positioned as a single-point information resource and institutional strategy for supporting the data needs of AP&T workflow.

Using authoritative data derived from such enterprise sources as human resources, the registrar (for course assignments), libraries, and research foundation databases (which track research awards), data are confederated in OSU:*pro* to provide users with prepopulated and contextualized views of their professional activities. Middleware solutions and web service protocols enable management, analysis, and sharing of faculty and staff profile data through global search capabilities and

Supplemental Resources

The OSU:*pro* home page can be accessed online at http://pro.osu.edu. It provides a brief explanation of the service, notes training opportunities, lists internal partners, explains system requirements, and provides access to faculty and staff directories.

Sample reports, tables, and figures (including screenshots) with accompanying explanations that illustrate data and system features relevant to this article are available online at https://pro.osu.edu/eq/.

institution-wide reporting. In cases where data elements are not being captured by authoritative systems (for example, language expertise, service to professional societies, honors and recognitions, and so forth), users have a straightforward way to add and edit profile information. Thus, we can leverage the utility and flexibility of OSU:*pro* to capture important data that previously went unrecorded and accommodate the addition of new data categories.

OSU:*pro* offers users three distinct views of faculty and staff expertise across OSU: users, public, and administrative. In the first view, faculty and staff—once authenticated—can securely access their profiles to view, add, and edit activity data in addition to accessing a number of utilities and features (such as generating curriculum vitae, biographical sketches, prefilled administrative forms, and language expertise and assigning profile management to others). Users can specify what profile information is displayed and searchable through the public view of OSU:*pro*. A simple interface provides visitors with robust search capabilities. A third view of profile data provides authorized administrative staff with organization-wide reporting tools that enable ad hoc queries, trending, and benchmarking studies. (See the supplemental resources noted in the sidebar for sample screenshots of these views.)

The addition of bibliographic citations to profiles was streamlined through resources provided by the Ohio Library and Information Network (OhioLINK), a consortium of the State Library of Ohio and 86 Ohio college and university libraries. OSU:*pro* provides users with direct query access to upwards of 20 bibliographic databases and gives users the ability to pull journal citation records directly into their profiles from OhioLINK. This dynamic harvesting approach not only streamlines collection of pertinent data elements (title, authors, journal, volume, year, and so on), it also creates dynamic linkages back to the journal article itself within OhioLINK's Electronic Journal Center.

Toward a Campus Solution and Beyond

In 2004 the CKM began piloting the use of OSU:*pro* with targeted constituencies, gathering user feedback and following up with usability, functionality, and system enhancements. These efforts and successive rounds of institutional investment laid the groundwork for extending the scope of OSU:*pro* to the wider university community. The project staff grew to include metadata librarians and project managers who worked alongside the technical staff to define data standards and information architecture, develop a campus implementation model, coordinate communication and training activities, and assemble a modest data support team. With five dedicated staff—programmers, interface designers, project managers, and customer liaisons—a campus-wide implementation began in earnest in the spring of 2006.

More often than not, technological innovations face resistance to widespread adoption, especially when such advances alter traditional workflow patterns and practices. Such workflow changes take thoughtful planning and time. OSU is one of the largest and most comprehensive universities in the nation with over 5,000 faculty and 13,000 professional staff. The project team, stakeholders, and partners quickly recognized the challenges in implementing a new workflow methodology on such a grand scale. To position OSU:*pro* for successful campus-wide adoption, the project team devised a two-pronged introduction strategy: Individual users were provided with tools and utilities that bring value to their OSU:*pro* activities, while university officials have fingertip access to institution-wide data and reports.

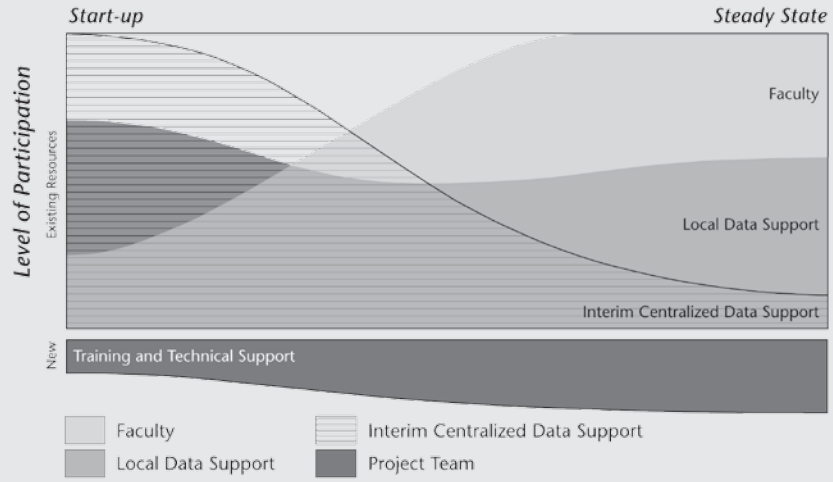
A global implementation model was devised and resources identified. The project team anticipated the degree to which campus constituencies would be asked to participate, as illustrated in Figure 1. In addition, the team envisioned the transition of data maintenance to faculty following linking of OSU:*pro* use to required university practices such as AP&T, annual reviews, and reporting. Faculty would have a strong incentive to maintain and validate the accuracy of their profiles. During the start-up phase, however, institutional partners recognized the value of assembling a small team to facilitate the initial collection and entry of non-automated data into OSU:*pro* to reach targeted milestones. As university-wide adoption proceeds, data support will shift to the more distributed model. In addition, taking an incremental approach to campus implementation has allowed us to apply lessons learned from early adopters and ramp up training and technical support in a more planned way.

Anchored by the principle of asking users to do it once, the project team most often gears system enhancements and customer feature requests to bring increasing value to users. The system provides a variety of reporting tools and output utilities that accommodate an ever-growing set of requested formats (for example, AP&T dossier, curriculum vitae, and biosketch) and file types (doc, xls, txt, and so forth).

Anticipating that the barriers to entry for faculty in the arts might differ for their mathematics, engineering, or law colleagues across campus, the project team developed customized, college-based implementation plans and templates to address local concerns about using OSU:*pro* to meet discipline-focused needs (see Figure 2). Providing local leadership with customized plans and timelines helped ease concerns, and through

Figure 1

Planning a Pilot-to-Enterprise Trajectory



this process the project team identified training needs, delineated ownership of tasks, helped craft appropriate communications, and set local expectations. This method also provided a forum for gathering input from departments and colleges on policy considerations—who should have access to what, for example—that were taken to senior administrators for discussion.

Steady Rate of Progress

Adoption of OSU:*pro* has progressed at a respectable rate since its introduction in the fall of 2006 as a methodology for documenting faculty and staff efforts. Recognizing the support challenges of full adoption by more than 150 academic departments, we opted to target the capture of key data elements that would expose a broad audience to the capabilities and efficiencies offered by OSU:*pro*. The data elements focused on during the campus startup traditionally have been difficult to compile. Following a call for information from the Office of Academic Affairs, college deans were asked to compile annual information relating to discrete activities in which their faculty participated.

The net effect of this and other tandem efforts was the capture of more than 5,600 faculty honors, nearly 5,500 educational degrees, and more than 1,000 community engagement projects across all colleges. In addition, more than

Figure 2

Implementation Strategies at the College Level

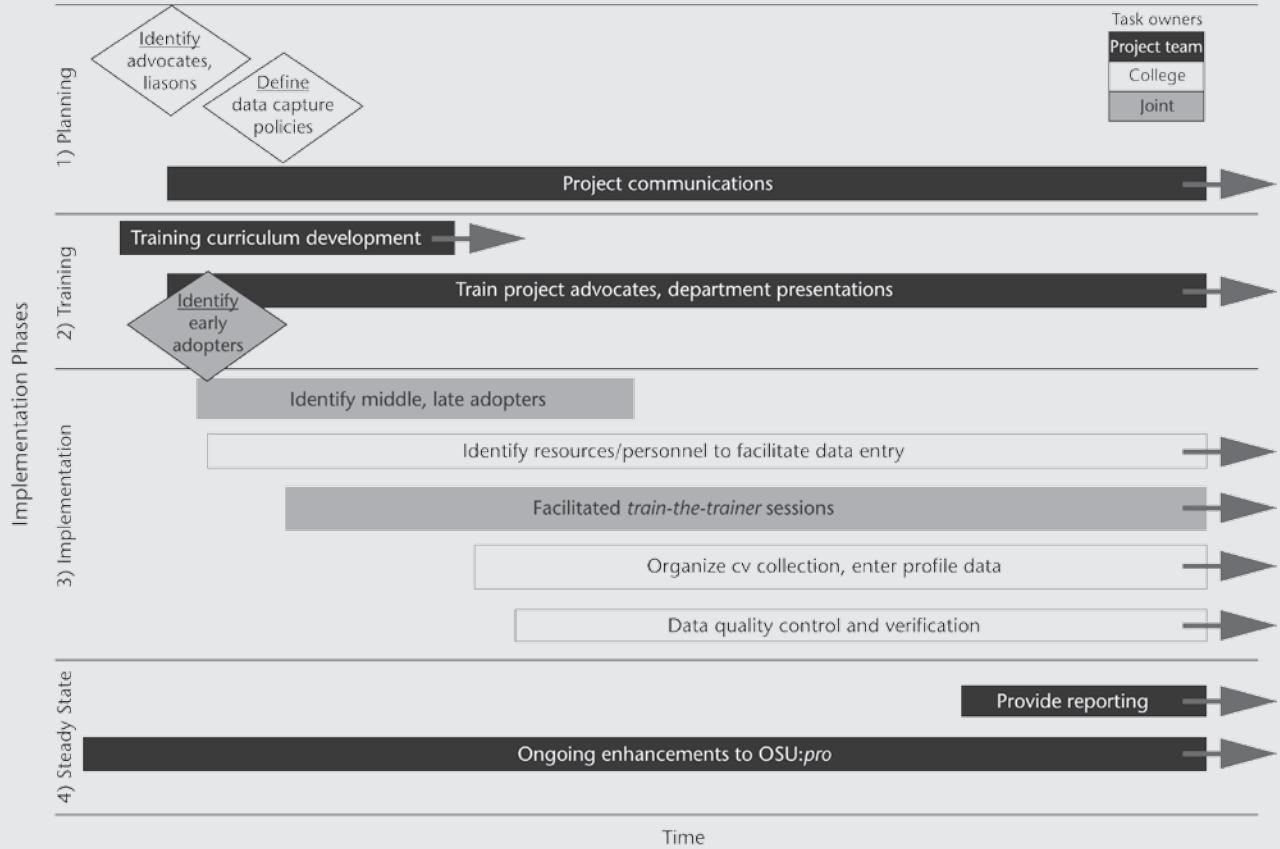
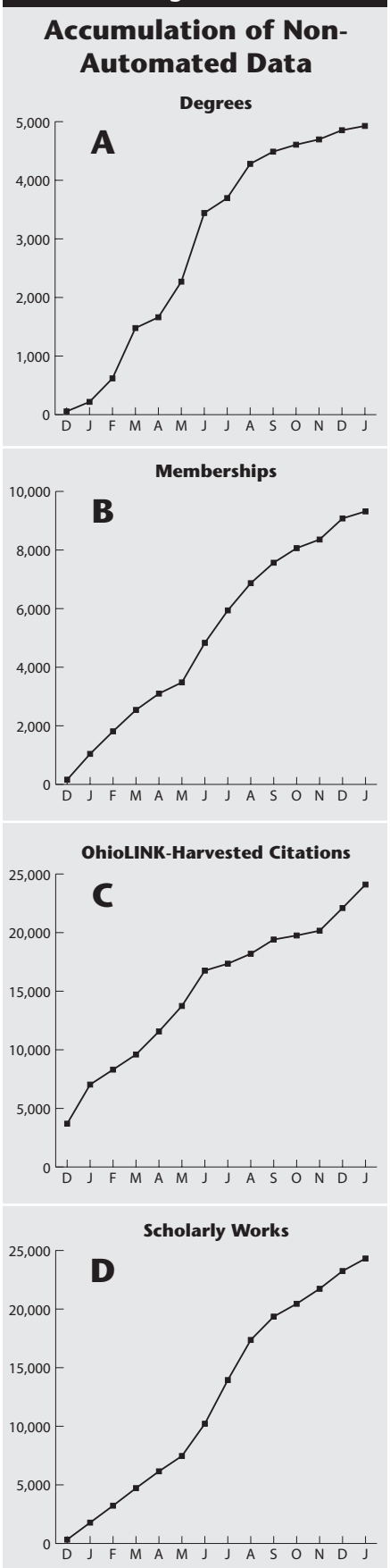


Figure 3



27,000 journal citations were harvested from OhioLINK-derived databases, enabling us for the first time to perform a campus-wide analysis of the journals in which our faculty publish. Citations to over 56,000 scholarly works (including abstracts, presentations, book chapters, performances, and lectures) have been collected in OSU:*pro* to date.

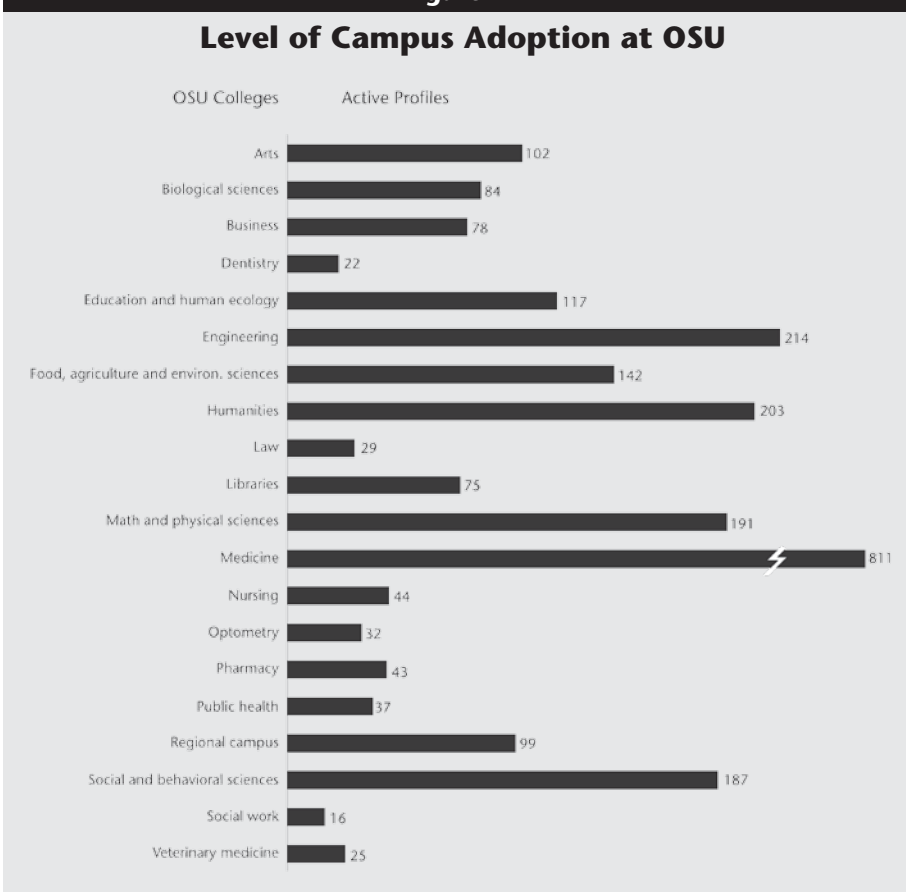
We closely monitored the rates of data capture and breadth of campus-wide adoption. During 2007, we saw demonstrable progress in capturing data not available through authoritative campus sources. The four charts in Figure 3 illustrate the growing record count in various categories: (A) degrees and educational training; (B) professional memberships; (C) scholarly activities; and (D) journal records harvested from OhioLINK citation databases.

The number of active profiles within each of the university's 19 colleges, regional campuses, and libraries shows that adoption of OSU:*pro* across the enterprise is proceeding at a steady rate, with more than one-quarter of all university faculty having active profiles as of 2007. Figure 4 details the growth by college, with the College of Medicine having the highest number of active profiles at 811, representing over half of its regular faculty.

Meaningful Access to Institutional Expertise

Historically, providing institutional views of data on the teaching, research, and service activities of faculty requires labor-intensive efforts. While institutional enterprise resource planning (ERP) systems attempt to aggregate and align meaningful data sets around core processes, we have found a paucity of robust ERP solutions available to support workflow and data management of faculty activities. When faculty data are recorded in ERPs (for example, grants activities, demographics, and appointments), generating contextualized views to meet a host of institutional needs and outputs is often arduous.

Figure 4



An analysis conducted by a third-party technology consulting firm brought in to vet the OSU:*pro* model verified the difficulty of existing processes: During their environmental scan of 18 peer universities, the consulting firm found few systems that offered the flexibility needed to track faculty information at an enterprise level.[6] OSU used web services and middleware technologies to build custom data collection and display interfaces and system tools to aggregate data streams from a variety of sources. This has given us the agility to aggregate and analyze our institutional expertise in ways not possible traditionally. On several occasions the project team encountered departments that had vested efforts in locally deployed data solutions for tracking faculty activities. In these cases, the project team worked with the departments to optimize integration of their historical faculty data and to learn from their established workflow patterns.

New Ways of Viewing and Sharing Faculty Data

In addition to providing authorized users with access to reports in a variety of output formats (spreadsheets, text documents), OSU:*pro* takes advantage of the growing availability of application program interfaces (API) to other systems. During its start-up year, for example, OSU:*pro* was used to collect degree information on faculty and has captured more than 5,500 degree records to date. We leveraged a publicly accessible API into Google Maps to prototype a degree-mapping report that displays the geographical location of institutions where OSU faculty earned their degrees (see Figure 5). This example, while simple in execution, was of great interest to university officials—often looking for tools to enhance networking and outreach—and illustrates the flexibility and agility that new technologies offer. A similar approach could enable students, administrators, and faculty to locate and interact with alumni scattered around the world.

Another report of great interest to university leadership is the citation analysis. As illustrated in the supplemental materials (see the sidebar), the journal citation records contained in faculty profiles are aggregated by year and journal title into a comprehensive report showing where OSU faculty have published their work. Such rich data and the ability to contextualize faculty publishing activities along career progression and across disciplines offers new opportunities for institutional benchmarking, planning, and self-study.

Online visitors have used the public search interface into OSU:*pro* extensively. More than 88 percent of the 105,000 unique visitors to OSU:*pro* during 2007 discovered profiles through public search engines (such as Google, AOL, MSN, and Yahoo). While nearly 75 percent of the visitors to OSU:*pro* were in the United States, the system attracted online visitors from 158 countries/territories around the globe during 2007. Such online exposure to the professional activities and expertise of OSU faculty and staff helps expand opportunities for the community to interact and engage with the university in new and different ways.

Recognizing user reluctance to add yet another data management task to their regular repertoire, the project team looked for opportunities to maximize system output while asking faculty to do it once. One such example is the reuse of faculty activity and expertise information captured via OSU:*pro*. Using system-generated XML files, campus organizations can now recapture their information for repurposing. The OSU College of Optometry, for example, was interested in highlighting faculty scholarly publications on their college website. Rather than having users rekey the pertinent information in yet another system, College of Optometry web developers simply consumed and redisplayed the XML data available through OSU:*pro*. Updates made to optometry faculty profiles in OSU:*pro* trigger a refresh sequence updating the college's website.

Figure 5

Visualizing Faculty Training

Value Through Access and Context

This knowledge management strategy continues to mature, providing opportunities for deriving meaningful value from data collected in OSU:*pro*. By documenting the time, effort, and cost savings to organizations across the institution, we found that this model is realizing numerous benefits.

Benefits to Administrators

- Streamlining data collection and understanding of faculty activities
- Enhancing reporting accuracy by providing a single view of institutional data
- Generating reports to easily showcase university strengths and areas of innovation
- Facilitating departmental and college reporting of faculty achievements
- Attracting scholars to OSU

Benefits to Faculty and Staff

- Managing and reporting research, teaching, and service activities using a one-stop access point
- Identifying potential collaborators across traditional disciplines
- Generating curriculum vitae and other administrative materials through an easy-to-use web portal
- Sharing best practices, lessons learned, research models, and methodologies
- Facilitating faculty recruitment

Benefits to Students and Greater Community

- Finding faculty advisors and mentors in student areas of interest
- Advertising faculty scholarship to prospective graduate students
- Creating opportunities for greater interaction between faculty and undergraduate students, including research experiences and seminars
- Finding university professionals who specialize in a particular area
- Expanding the availability of information to facilitate outreach engagement efforts

Valuing Our Most Strategic Asset

Expertise profiling as realized through the strategies employed with OSU:*pro* is a hallmark of knowledge management, first described more than 10 years ago.[7] While the concept seems unfamiliar to higher education, its fundamental principles and practices find their genesis in the academy. The principles of codifying, communicating, and mentoring are found in our laboratories, libraries, classrooms, clinics, conferences, and publications. Raw data collected by scholars are forged into new information through documentation, interpretation, and the application of context and purpose. Knowledge grows from a further refinement of this newly acquired information and is shaped by the know-how, expertise, and talents of a university's most valuable asset—its people.

Universities have begun to recognize knowledge as their most important strategic asset and product. Rooney[8] describes universities as complex intellectual enterprises traditionally focused on knowledge artifacts, not as dynamic and highly social environments that fuel progress and innovation. In describing ways that knowledge management can bring value to activities in higher education, Piccoli and her colleagues[9] stress the benefits that inventorying the university's knowledge assets can bring to revving up the knowledge creation delivery cycle. The trend toward interdisciplinary centers and programs in higher education speaks to the observation that new ideas and innovations often arise when investigators interact with colleagues at the nexus between traditional disciplines. Providing individuals with tools and resources that allow them to readily identify and locate potential collaborators has become a mainstay in business and is gaining traction in higher education.

Recognizing the competitive importance of tracking their intellectual capital, business and government organizations can choose from a growing list of vendor-based expertise location and management (ELM) solutions, which Gartner, among others, touts as a still-maturing technology that shows great promise.[10] For nearly 10 years now, HP and Microsoft have used expertise systems to capture and track knowledge competencies of personnel. Several United States government agencies, with teams spread across geographical regions, have also seen the benefits ELM strategies can bring to their operations. For example, NASA and the National Security Agency leverage ELM technologies extensively, allowing them to more quickly locate experts and match positions with needed skills.[11]

While all too often the tendency is to focus on the tools and technologies, those organizations that have successfully introduced and sustained the use of ELM systems in employee and organizational workflow patterns have recognized the importance of fostering a corporate culture of knowledge sharing. Many have convincingly argued that starting with the technology rather than goals and outcomes dooms most initiatives. Success with knowledge management efforts requires a holistic approach to understanding the needs and culture of users—what motivates them, how they work, how they communicate, where they learn, how they interact with the technology, and what processes can be enhanced.[12]

While the use of ELM systems has gained a solid foothold in business and industry, adoption of such expertise solutions on a university-wide scale has lagged, due in large part to the decentralized administrative nature of universities and the lack of solutions customized to meet their needs. A quick Google query of "faculty expertise" reveals a growing number of locally deployed and often discipline-specific databases. Several models—including the Louisiana Board of Regents–funded LaGenius and Florida-based SAGE—are being tested to address faculty expertise mapping needs across multiple institutions. We have found little evidence, however, of universities using the utilities of expertise data capture and tracking to support AP&T workflow patterns in any significant way.

OSU:*pro* has had a notable impact on our institutional thinking. Since the introduction of this new data management strategy, leadership across campus has started to reexamine the methods traditionally used to document activities and share the knowledge, experience, and expertise of our people. Having followed the maturation of the OSU:*pro* middleware solution, the provost, vice provosts, and staff in the Office of Academic Affairs, among other institutional stakeholders, began exploring how this innovative strategy could be leveraged over time to complement college annual reporting, enhance AP&T, and streamline information sharing across the campus. Consequently, over future years OSU intends to incrementally implement the utilities OSU:*pro* affords to support AP&T processes, beginning first with new faculty and those undertaking fourth-year review.

While the success of such enterprise-wide knowledge management initiatives requires attention to goals, objectives, and deliverables, the role of technology cannot be overlooked. As detailed in its most recent report examining the issues and challenges facing university CIOs

and senior IT leaders, the EDUCAUSE Current Issues Committee reminds us that funding and administrative/ERP systems consistently appear among the top three issues of greatest concern.[13] The middleware strategy embodied in OSU:*pro* builds upon rather than replaces institutional investments in systems of record, leveraging preexisting information assets. OSU:*pro* was not conceived to replace currently deployed human resources, student information, or grants management ERP systems but rather to augment their institutional value through the contextualization of faculty information and enhancement of AP&T, among other administrative functions now possible.

OSU:*pro* follows in the footsteps of other major digital initiatives at OSU, including the introduction of a digital institutional repository, or Knowledge Bank, for the intellectual works of faculty, staff, and students.[14] Future enhancements to OSU:*pro* include creating points of synergy with the Knowledge Bank, our enterprise learning management system, and our new student-information system, among other institutionally important resources. Such connections will allow for dynamic click-through pathways for users.

OSU:*pro* illustrates the value of partnering technology and information professionals to transform information services, foster knowledge management, and stimulate intellectual asset development. While still in its infancy, OSU:*pro* is a knowledge-based initiative that closely parallels the mission of OSU—to enhance the scholarship of our students and faculty, improve outreach to surrounding communities, and increase opportunities for collaboration between faculty and professional staff. The strategy realized in this federated data model has allowed OSU to rethink the traditional methodologies employed for tracking vita-based information across the enterprise. The lessons learned as OSU:*pro* moves from pilot to enterprise can benefit other institutions eager to identify, implement, and support knowledge solutions and activities. *e*

Acknowledgments

We are indebted to project team members Meg Buzzi, Cheryl Brilmyer, Chris Fish, Victoria Cannon, Phoebe Kim, Joshua Logsdon, Beth Sabatino, and John Wilkins, whose talents and efforts have helped propel OSU:*pro* along its pilot-to-enterprise path. Additional thanks are owed to Beth Bohlander and Cheryl Brilmyer for their editorial contributions to this manuscript. Vice Provost Carole Anderson has been instrumental in facilitating the integration of OSU:*pro* with the AP&T process, as have the deans of the colleges at OSU.

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