

Digital Directions in Academic Knowledge Management: Visions and Opportunities for Digital Initiatives at the University of Toledo

Arjun Sabharwal
Digital Initiatives Librarian
The University of Toledo

Abstract

Digital projects have been the focus of many academic and research libraries joining the open access and open archiving trend. Participating organizations have converted massive volumes of print, film, and analog content into digital formats, add metadata, and prepare them for online access. The LSTA grants from the IMLS as well as several other federal grants from the NHPRC, NEH, and other agencies have positively impacted this trend to digitize masses of historical material. However, fewer institutions have taken digitization to new heights with a focus on knowledge management. The Knowledge Bank at Ohio State University is an eminent example of what can be accomplished through close collaboration of the library and technologists. At academic institutions, we have much to benefit from knowledge management, and with a growing camp of academic institutions adopting business-like practices, there are new opportunities for digital initiatives (DI) departments to collaborate across the organizational gamut.

At the University of Toledo Libraries, our DI department has proposed new projects to enhance knowledge creation, transfer, and retrieval throughout the organization. In addition to continued digitization of archival content, these projects include work on a Business Philanthropy Digital Library, Geospatial Knowledge-Sharing Environment, the Solar and Renewable Energy Resource, Archival Material Tracking Database, and other projects. These projects underscore the value of digital initiatives where knowledge creation, exchange, and transfer are essential to the information ecology of the academic environment.

This paper examines the roles that DI programs can play in academic knowledge management. While information ecologies rely on the human-centered and value-driven aspects, knowledge architectures represent the structure of the environment where collaboration and cooperation are critical to the success of DI programs. The library community, university faculty, and the technology environment offer a rich context for new DI projects to maximize knowledge creation, transfer, and retrieval. While the department is too new to draw lessons learned, it is important that we fully understand the environmental aspects and requirements for a continuous DI program.

Keywords: academic knowledge management, digital initiatives, academic libraries, information ecology, knowledge architecture, University of Toledo Libraries

Introduction

Academic libraries have started Digital initiatives (DI) programs to meet such strategic goals as library virtualization, distance learning support, and digitization of archival and special collection units. DI teams have been re-formatting print, film, and analog originals, which contain knowledge otherwise hidden in archival repositories, library storage facilities, or private collections. Digitization also promotes open access and long-term preservation of brittle and fragile material, which may otherwise require conservation at a high cost. Archivists, librarians, and faculty agree that unique collections face a dire predicament unless there is a concerted and organized effort to make them accessible. Such collections include reports, memoranda, first-person accounts, correspondence, photographs, oral histories, diaries, and other material containing what knowledge management considers tacit or explicit knowledge. Some of it may also be what cultural anthropologists call local knowledge with culturally embedded discourse and symbolisms (see Geertz, 1983). Historians and archivists emphasize their value as primary sources for original research. This knowledge is often defined by locality and limited life cycle, leaving concerned scholars, archivists, and knowledge managers with a sense of urgency to preserve knowledge and media in accessible forms. Through digitization, open access to this body of knowledge can be ensured while the process also aids in the long-term preservation of the medium itself.

The steady shift towards virtual libraries will also require greater utilization of DI teams and programs, which is also why the role of DI program in academic knowledge management needs to be examined and emphasized. We can be certain that the virtual library model will focus more on knowledge creation, organization, retrieval, and transfer and less on acquisition and processing of physical collections themselves. This can already be seen in the trend favoring subscription (rather than ownership) of periodical databases, electronic books, and other electronic resources over print collections. Virtual libraries will be able to support online programs more effectively, and the increasing demand for online courses underscores the need for robust infrastructures to provide access to these collections. This is also a transforming environment where archives and special collections will want to remain relevant to different audiences with new information-seeking behaviors. By virtue of their mission archives will continue to preserve paper- and film-based collections, analog recordings, and other artifacts to support historical, but they will have the opportunity to develop digital collections, support online learning. A broadly based DI program will facilitate their integration into virtual libraries aiming to provide global audiences with access to scholarly knowledge.

The creation of knowledge is at the heart of discourse in higher education, which virtual libraries are charged to support. We must understand knowledge as a multifaceted concept with different interpretations in various operational (i.e., cross-domain) contexts where each context is founded on autonomous but related and interoperable knowledge domains. For present purposes, this paper considers three domains of knowledge: 1) scholarly; 2) operational; and 3) curricular knowledge.

With the exception of published scholarly knowledge in monographs, periodicals, and reference sources, a considerable body of knowledge remains unpublished, personal, and experiential in form, which the field of knowledge management regards as tacit (Nonaka and Takeuchi, 1995). Each domain above can potentially produce knowledge that can be converted into explicit via publication, and can contribute to the other domains; thus, academia presents an integrated knowledge ecology where collaboration and communication can lead to innovation and progress.

Institutions of higher education are under growing pressure and scrutiny to assess and improve strategies in an effort to raise efficiency, maintain accountability to stakeholders, meet industry and government standards, and respond to media inquiries. Serban and Luan (2002) report on the lack of organized KM in higher education, and point out that “since higher education is about the creation, transformation, and transmission of knowledge (Laudon and Laudon, 1999), such oversight is striking” (p. 13), but also acknowledge the isolated efforts made by colleges and universities making progress in KM implementation. Knowledge management (KM) practice has proven valuable in the private business sector since the 1980s, turning businesses into competitive and efficiently run enterprises in the marketplace. For instance, the Honda City experience from 1978 in to the 1990s in Japan underscores this success (Nonaka & Takeuchi, 1995) while other KM experiments on the global scene have followed with different outcomes. Corporations, academic institutions, and the general public equally benefit from well managed knowledge, regardless of the context in which knowledge is generated. According to Townley (2001) “knowledge management may be defined as the set of processes that create and share knowledge across an organization to optimize the use of judgment in the attainment of mission and goals” (What is knowledge management section, para. 1). Townley also reports that libraries have selectively utilized KM techniques, but have done little to apply KM strategies to improve library operations and resources. This is in spite of the fact that KM relies on techniques developed by librarians in the past. Elsewhere Broadbent addresses the relevance of KM to libraries, and clarifies that “knowledge management is not about managing or organizing books or journals, searching the Internet for clients or arranging for the circulation of materials [but] these activities can in some way be part of the knowledge management spectrum and processes” (p.2). By the same token, Digital initiatives projects do not constitute KM in entirety, but contribute to a number of critical processes such as knowledge description, organization, storage, and retrieval.

The current academic KM landscape offers DI departments the opportunities to develop and collaborate in ambitious programs and projects at their parent institutions. This landscape has been transformed through Web technologies, cloud computing, open-source solutions, open archiving initiatives, and expanding distance learning programs. Knowledge management can not only manage the information overload in scholarly communication (see Woodward and Estelle, 2010), but offer organizations the tool to take advantage of these changes. Since the early 1990s, libraries have shifted from a paradigm of ownership, print and analog resources, and reactive strategies to one of resource sharing and shared access, electronic and digital resources, and proactive strategies (Fuseler, 1993). The new social, political, economic, and technological realities now demand new information products, more cohesive and inclusive information ecologies, and organizational realignment to support new initiatives. This new environment presents academic libraries and DI teams with the opportunity and the challenges to expand the scope of digitization programs while staying abreast with global initiatives to allow universal access to cultural heritage content of the community that supported the organization.

A DI program can fill knowledge gaps across the organizational gamut and, therefore, play an essential role in academic KM environments as well. Knowledge creation, transfer, and retrieval require serious investment beyond just the acquisition of digital technology and trained specialists; the virtual library aiming to deliver knowledge also requires adequate technical support and a committed realignment in organizational culture. At higher education institutions and academic libraries, this must be central to the mission and processes of departments engaged in knowledge work. Once in place, the virtual library environment then can present an operational and intellectual context for a DI program. With the appropriate level of administrative and

technical support, digital initiatives programs can play an important and expanding role in academic knowledge management and contribute significantly to institutional goals.

This paper focuses on DI roles, visions, and opportunities at the University of Toledo in Northwest Ohio where it was initially created to meet digitization goals but was later presented with expectations to support virtualization efforts. Academic knowledge management processes may be enhanced and improved through collaboration with the DI team. The description of DI projects in the context of KM theory and practice aim to demonstrate the applicability of DI operation in KM context. While the DI unit *per se* is not responsible for managing knowledge beyond its own operational domain, it can investigate, propose, initiative, and collaborate on KM-related or KM-based projects throughout the university. In addition to providing access to scholarly knowledge by digitizing collections at the archives, DI can also collaborate on projects focusing on sharing, transferring, preserving other types of organizational knowledge and information as well. Project experiences described herein have allowed us to identify a few lessons learned, but more time is needed to validate some assumptions and criticisms presented in the discussions.

From digitization of cultural heritage to knowledge repositories

Federal and private grants have funded digitization projects throughout the United States resulting in digital archives and libraries maintained by government agencies, academic institutions, and private organizations. The mass digitization projects ushered in a new environment of open archiving, sharing, and allowing Internet users to access mostly public domain content in the beginning, but eventually expanding to open-access publishing of peer-reviewed and scholarly content. An example of this is the Knowledge Bank at Ohio State University where an institutional repository is the hub of digitization activities as well as scholarly communication featuring publications by faculty, research papers, and honors theses by students.

The digitization projects connect global audiences with monumental collections like the American Memory Project, Colorado Digitization Project, Europeana, Digital Library of India, and Bibliotheca Alexandrina. Several countries, unions, regions, and municipalities initiated their own digital programs in partnership with local academic institutions and shared content over the internet. As a result, universities such as MIT, Cornell, Johns Hopkins, Harvard, University of Michigan, and others have created digital collections of national and regional significance throughout the U.S. Consortial initiatives by OhioLINK (Digital Resource Commons), the Michigan Electronic Library, and the Digital Library Federation engaged several institutions and state libraries in grant-funded projects to develop historical and cultural heritage content. Sources for digitization grants included the National Endowment for Humanities (“Emory University,” 2002), Digital Library Federation, Institute of Museum and Library Services, Alfred P. Sloan Foundation (“Digitizing American imprints”, 2007), and several others.

As digital libraries are gaining recognition as tools in academic knowledge management, the role of digital archivists, digital initiatives librarians, and interested collaborators will expand into new territories. Marek (2008) reports that digital libraries as information products play an important role in knowledge creation and conversion: through a conversion process called internalization, users can develop new tacit knowledge with the help of digitally published explicit knowledge. Libraries (both, physical and digital) create and deliver information products and are regarded critical in the KM landscape. Digital libraries can be customized to suit specific research interests, and the ease of access makes them an essential KM tool, Marek reports. In this context,

digital collections could support the work of social or literary historians, geographers or environmentalists, and others to access contents specifically organized for them. Some digital libraries, as Marek points out contain strictly those materials that were created by members of the organization and may contain personal knowledge. Knowledge archives and knowledge-bases would specifically support KM processes that promote learning in the organizations, and promote knowledge preservation efforts. The ultimate test, however, is the relevance of the digital resource to the user community. Marek emphasizes that if there is a robust product that was inspired by specific information needs, that product will have a high potential for local use.

The global digitization trend and the need for digital libraries for knowledge management purposes offer universities the opportunity to place their DI programs in a new strategic context where DI teams can collaborate in local, regional, national, and global knowledge-sharing initiatives. At the University of Toledo, for example, the DI is involved with the Toledo's Attic project which delivers local history knowledge to interested researchers and community members. Its relevance to community interests has been the factor keeping this project afloat since its launch in 1995.

Academic Knowledge Management as context for DI programs

KM can improve the streamlining of processes involved in knowledge creation, team building, and technology use, but the environment ultimately dictates those needs and informs KM processes where they are in use. Some institutions have succeeded in implementing KM programs at the enterprise level while others have targeted selected divisions for implementation. Corporations have reported employing information professionals to collaborate on KMSs; therefore, the size of the organization may be a factor supporting or precluding such collaboration across the organizational spectrum. Thus, DIs by virtue of their affiliation with the academic library may or may not be called upon to join cross-functional teams with university-wide missions.

KM literature addresses knowledge conversion, knowledge transfer, the data-information-knowledge-action cycle, developing domain ontologies, and knowledge preservation as processes and strategies central to academic knowledge management. As DI staff are trained in digital conversion, metadata creation, and other areas, these skill sets are essential to building digital libraries and archives and, thus, to a DI presence and role in academic knowledge management where an expanded role is possible or encouraged. Discussing the entire theoretical base of KM would stretch discussions beyond the scope of this study, but it will be necessary to address a few fundamental areas to present context for future DI missions.

Academic institutions manage multiple knowledge domains with opportunities for DI units to collaborate across domain boundaries. The scope of cross-domain collaboration may be multi-disciplinary and inter-departmental where knowledge domains enter into partial or more pervasive relationships, depending on the level of participation. These domains are:

- 1) scholarly (subject and interdisciplinary) knowledge, which is transferred and exchanged in the classroom, at conferences, roundtables, electronic discussion lists, and during collaborative research projects;
- 2) curricular knowledge, which is related to scheduling, enrollment, and design of academic programs and shared through the syllabus and learning management software such as Blackboard (see Kourik and Maher, 2008), WebCT, Moodle, or Sakai; and

- 3) operational knowledge, which is created in the process of collection management, circulation, reference, technical services, and other areas of library operations, shared, and transferred at various levels of institutional processes at various departments, working teams, and governance structures (such as committees, task forces).

A significant level of academic knowledge management activity can take place in libraries with faculty and staff managing knowledge from some or all these domains. For instance, emerging research fields may require new acquisitions and subscriptions to new research databases. If there is a workflow for knowledge sharing, there is opportunity for librarians in reference, collection development, instruction areas to exchange knowledge with circulation staff, which can quickly develop into action items for acquisition librarians to purchase the develop or expand needed collections. This presents an example of cross-domain interaction between operation and scholarly knowledge. Knowledge of information products can also impact scholarly knowledge exchanged in classroom as professors may need library resources to facilitate knowledge creation through discovery and collaboration. Knowledge creation in asynchronous online learning environments has been related to learning theories (behaviorism, cognitivism, and constructivism) by Marshall et al. (2006) who agree with Dalgarno (2001) regard constructivism as the viable paradigm for online learning:

Constructivism focuses on the process by which people acquire knowledge. The constructivist model of learning emphasizes three main ideas which are important in a digital library context. First, there is no single “correct” representation of knowledge; second, people learn through active exploration, where exploration uncovers inconsistencies between experience and current understanding; third, learning occurs in a social context. (p. 2)

With the popularity of online learning on the rise, libraries and DI units will have new opportunities for active role in the knowledge creation process in the online learning environment. As in traditional teaching methods, methods of knowledge conversion can be utilized in the online environment. The DI's active involvement in the work of the eLibrary Services Task Force (and through this relationship, with the instructional designers and technologists in the university's distance learning program) offers expanding opportunities to play a more visible role in the knowledge creating and conversion process.

DI as knowledge creation and conversion agent

Knowledge management theory is grounded in decades of business experience, and can offer a framework for potential DI role in knowledge management in academia. As academic institutions are focused on knowledge creation through the various knowledge conversion methods identified in KM literature, DI departments can select some of these conversion strategies to facilitate knowledge creation. Nonaka and Takeuchi (1995) regard knowledge creation as a step towards organizational learning and innovation, and identify two interrelated dimensions of knowledge creation: ontological and epistemological. The ontological dimension is concerned with the hierarchy of knowledge-creating units and their interaction within particular structural contexts. The epistemological dimension related to the process of creating knowledge itself by converting tacit knowledge from tacit to explicit, following Polanyi's (1966) distinction between

two cognitively based states of knowledge. The ontological dimension impacts the level of interaction between a DI unit and other departments within the library and beyond. For example, as a department in the library, its ability to interact with Technical Services would be different from achieving the same with Information Technology. While an organization's governance structure affects this aspect of DI work, the epistemological dimension remains more autonomous of the DI unit's strategic location. Both dimensions, however, reinforce the human-centered aspect of knowledge creation, as the authors explain:

In a strict sense, knowledge is created only by individuals. An organization cannot create knowledge without individuals. The organization supports creative individuals or provides contexts for them to create knowledge. Organizational knowledge creation, therefore, should be understood as a process that “organizationally” amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organization. (p. 59)

Both dimensions also reinforce the “human-centered” model of information ecology presented by Nardi and O’Day (1999) who define information ecologies as “a system of people, practices, values, and technologies in a particular local environment. In information ecologies, the spotlight is not on technology but on human activities that are served by technology” (p. 49). The authors regard libraries to be part of information ecologies with a value-driven service to provide information. Perrault (2007) extends this definition to apply to schools as well, which we can further extend to institutions of higher education where the value system of information ecology is shared throughout the organization. DI operations are a part of this ecology that is focused on practices and values focused on knowledge creation.

Nonaka and Takeuchi (1995) base their epistemological definition on a distinction between tacit and explicit knowledge after Polanyi's psychological approach to knowledge embedded in human cognitive processes, which forms the basis of their KM theory: “Tacit knowledge is personal, context-specific, and therefore hard to formalize and communicate. Explicit is ‘codified’ knowledge, on the other hand, refers to knowledge that is transmittable in formal systematic language” (p. 59). The authors also identify four knowledge conversion methods: socialization, combination, externalization, and internalization. Although these methods have roots in ancient non-Western traditions (such as socialization) and were developed throughout history, they were adaptable to technology assisted environments that we see emerging today. The four methods of knowledge conversion with the authors' descriptions and possible application to DI work are:

- 1) Socialization (from tacit to tacit): “process of sharing experience and thereby creating tacit knowledge such as shared mental models and technical skills” (p. 62). This technique can be used to train DI staff and, if available, student assistants to scan, save, and copy files between computer and other storage.
- 2) Externalization (from tacit to explicit): “process of articulating tacit knowledge into explicit concepts. It is an essential knowledge creation process in that tacit knowledge becomes explicit, taking the shapes of metaphors, analogies, concepts, hypotheses, or models” (p. 64). The DI Librarian can use this technique to present to group about digitization, metadata creation, information retrieval, and the relevance of knowledge management to their work.

- 3) Combination (from explicit to explicit): “process of systemizing concepts into a knowledge system. This mode of conversion involves combining different bodies of explicit knowledge. Individuals exchange and combine knowledge through such media as documents, meetings, telephone conversations, or computerized communication networks” (p. 67). This method allows knowledgeable individuals to expand existing knowledge with available learning materials such as books, periodicals, and other published materials.
- 4) Internalization (from explicit to tacit): “process of embodying explicit knowledge into tacit knowledge. It is closely related to ‘learning by doing.’ When experiences through socialization, externalization, and combination are internalized into individuals’ tacit knowledge bases in the form of shared mental models or technical know-how, they become valuable assets” (p. 70). Finally, this method allows trainees to study the published information in order to develop new (tacit) knowledge to pass through the methods described above.

Knowledge conversion implies that data, information, and knowledge are converted through exchanges between knowledge agents such as instructors, students, in fact, all the people involved in scholarly communication. Another foundational theory addresses the development of knowledge through the data-information-knowledge spectrum, which culminates in an informed action. KM literature traces this theory to Zeleny (1987) and Ackoff (1989) who analyze the formulation of knowledge through the four cumulative stages. Zeleny stresses that information in one context (such as a project) may be data in another or knowledge in yet another context; therefore, there is no absolute format to these stages. Depending on the stage the project teams have reached, data collected by one team that has not processed the data may be handled differently in another team that has begun or completed data processing, and the dataset might already have reached subsequent stages as information or knowledge based on which the team can recommend action items.

We can also follow this cross-domain shifting in the academic environment. In each case of knowledge conversion, the shape and size of content varies and receives multiple interpretations. For example, an instruction session may include raw data that may have been used to make decisions in a past project, but if the students have not had the same project background that data remains data and may not be converted into information and knowledge via combination, internalization, or externalization. Conversely, a training session between instructor and student may allow knowledge creation if both, student and instructor, are in possession of similar datasets and information. This parity allows students to observe the progression of data into the successive staged as information and knowledge. Knowledge conversion, however, is not limited to formal instruction settings such as workshops, seminars, or presentations; they can also be extended into electronic (internet and/or intranet) environments with the application of appropriate technologies. Participants would need to understand context to see data as information, and ability to act in order to turn information into knowledge.

Another aspect of knowledge creation across disciplinary boundaries deserve attention, as academia has steadily moved towards integrative approaches, and DI teams need to consider working with interdisciplinary communities on campus. Knowledge management in academic institutions is considerably richer in content, as knowledge alone can be subdivided along scholarly, curricular, and operational lines. We can further divide scholarly knowledge into

multidisciplinary domains of knowledge (Klein, 1990; see also Payne, 1999; Aram, 2004) where each disciplinary domain contributes to the matrix where epistemologies engage in a discursive environment that re-constructs new epistemologies. Integrative approaches to research and problem solving has moved researchers from disparate knowledge domains to collaborate and explore new paradigms of research through a variety of methods. Klein (1990) cites earlier works identifying integrative approaches—“cross-disciplinary,” “multidisciplinary,” “interdisciplinary,” and “transdisciplinary”—that developed over the past decades and progressively expanded across traditional disciplinary boundaries. Libraries at all levels of operation must follow these trends to deliver effective services, especially in reference and collection development, as these two areas have been defined by disciplinary affiliations with faculty. Hence, libraries should also consider re-alignment on the basis of what academia is doing, and bring subject specialists into collaboration. In turn, the DI team must also consider these developments to create resources that are more relevant to current and emerging fields. Hence, the Geospatial Knowledge Archive (discussed later) focuses on Geographic Information Systems, which is a transdisciplinary approach in relation with such disciplines as Economics, Medicine, and Sociology.

Knowledge architecture as structural context for DI

Knowledge architectures present a structural context for organizational processes leading to the capture, creation, transfer, storage, and retrieval of knowledge. Most digitization projects managed by DI departments require storage, digital library software, and some level of technical support. Applehans, Globe, and Laugero (1999) present a model of knowledge architecture that joins three components— people, content, and technology—into a cohesive working relationship. A DI unit needs to be placed strategically in this structure create content (digital content and metadata), rely on appropriate technology support, and deliver to people. Knowledge architectures also form across departmental, local, and regional levels, so the DI must be visible and supported. In addition to developing university-wide resources, the DI department at the University of Toledo also works in collaboration with local organizations to maintain a virtual museum (Toledo’s Attic), and maintains a digital collection in a statewide digital library (Digital Resources Commons) managed by OhioLINK. Being able to engage with people, content, and technology at these levels, the DI can initiate collaboration across these domains where one domain can inform the others, turning this environment into an integrated super-architecture.

“People” include researchers, teaching faculty, students, librarians, archivists, administrators, technologists, and support staff who contribute to the university with knowledge. DI collaboration with librarians, archivists, faculty, and staff would take place on multiple ontological levels: department, cross-functional team, community of practice, committees, task forces, and other combinations. “Content” includes digitized collections of text, photographs, audio-video recordings on film and magnetic media, finding aids, and metadata (descriptive, technical, structural, and administrative). Here fall all other content such as data, information, and knowledge with its own metadata. Thus, content is the record of people’s personal, professional, and other types of activities, which require preservation, description, organization, storage, and retrieval. Without this capability, the knowledge management environment will not serve its environment effectively. “Technology” must be provided through a robust and inclusive infrastructure. For DI purposes specifically, technology support needs must be articulated on multiple levels: 1) desktop with software and hardware; 2) intranet access and a departmental share; and 3) internet access using a Web server, digital library software, and realistic storage

capabilities. The three components of knowledge architectures are interdependent in principle, but it is not uncommon for organizations to emphasize one (technology) over the other two (people, content).

Knowledge transfer is an important outcomes of digital knowledge work, and the ability of teams and individuals to interact, communicate, exchange knowledge, and manage workflow is affected by their location. Milton (2005) breaks down these types of knowledge transfers into three categories:

1. Serial transfer – occurs with a series of (successive) projects in the same location (such as a small department engaged in a process requiring repetitive projects. Archives are an example where staff-student teams can engage in successive projects, but knowledge transfer often fails when students graduate, re-locate, or find other employment on campus, leaving unprocessed knowledge, data and information behind.
2. Parallel transfer – occurs between/among projects running simultaneously where mutual contacts can be managed through knowledge visits and peer assists, often using online forums (blog, listserv, email, wiki). When one member is involved with multiple teams, knowledge transfer can be managed through such a double/triple/etc. agent as long as there is no conflict of interest. This is the case with the DI being involved in several collaborative relationships with benefits that the coordinator can cross-fertilize project ideas, and apply knowledge and lessons learned on one domain to another.
3. Near/Far Transfer – occur in different times and places, requiring asynchronous collaboration models as needed. Milton considered two distinct methods and called those in similar contexts *near transfer*, and those in different contexts, *far transfer*. Such transfers nearly always require documentation because successive projects may take off in different contexts. Near transfer is common in archives and other small departments where projects completed by one group can be continued with the next team. An example of a far transfer would be when a geospatial project ends while the continuation is considered by another team without consultation or study of the previous project by the new team. This knowledge gap is what DI has aimed to close with a project like the Geospatial Knowledge Archive.

Milton has identified these categories based on the relative location of collaborating teams, but it is clear that with current technological capabilities, teams can easily overcome limitations due to locality. Two opposing models need to be addressed at this point: the “information ecology” model Nardi and O’Day (1999) define as “a system of people, practices, values, and technologies in a particular local environment” (p. 49), and the knowledge architecture model presented by Amin and Cohendet (2003) who believe that knowledge is no longer constructed locally and limited to geographical spaces. In fact, we may consider both, knowledge architectures and information ecologies as global, interregional, and international in terms of scope, content, and value. Digitization projects on a global scale point to the possibility that both models can be reconciled: With more collections now housed on remote servers (cloud computing), the physical locus of knowledge may no longer relevant; it is the intellectual and symbolic reference that identifies the location (see Geertz, 1983), and these references help visitors of virtual museums and digital libraries return to use those resources from across the globe.

DI projects at the University of Toledo

The Digital Initiatives department at the University of Toledo was created with a mission to plan and implement projects throughout the university. The DI program has been bifurcated from the outset, as it has originally began in the Ward M. Canaday Center for Special Collections, and gradually expanded to other areas that had not yet considered plans to use DI teams. At the center, the projects include digitizing special collections, finding aids, and developing virtual exhibits. From a KM perspective, these projects present opportunities to convert knowledge from tacit to explicit forms, as there is a significant amount of knowledge preserved in the archival records donated to the archives. Archives, however, present a conundrum to all-out digitization efforts because of the legal agreements in the deeds of gift, some of which may rule out publication (including digital exhibit) of specified content. At the best, the DI can develop digital collections, using samples from the collection where priority falls on people, organizations, places, and events. Where reference statistics suggest high usage of certain collections, such items in those collections are prioritized, and this is one process that benefits from knowledge exchange between archival staff and the DI team. Developing an in-house digital library is also underway to house university-specific collections including photographs of university administrators, faculty, and facilities.

Digitizing finding aids knowledge transfer on two levels: First, it presents researchers with a synopsis of the collection published by the archivist(s) who spend a great deal of time studying, analyzing, and processing collections that are not organized like libraries. On the second level, researchers also encounter the knowledge of the archivist who has conducted outside research, presented, and published on the information in the collection. Thus, researchers have the benefit of finding both, tacit and explicit knowledge in an archival collection and reference interviews. Applications like MS Access, Archivist Toolkit, and Archon that many archives use to manage their collection and knowledge of the collections allow archives staff to operate more efficiently.

A recent archival database management project using Microsoft Access aimed to consolidate data, information, and tacit knowledge into a searchable form in order to enable querying and reporting in the archives. Some of the tacit knowledge could then be converted into explicit knowledge through director's reports and presentations (Sabharwal, 2009). The knowledge of issues related to specific collections (such missing, damaged, and misplaced items) can present the staff with action items to repair and digitize items requiring remedial attention. Using databases technologies can maximize knowledge conversion through such methods as combination, internalization, and externalization, but it is also important to train staff to integrate these technologies into daily routines.

With the Digital Initiatives mission expanded to work university-wide, there were new opportunities to collaborate on projects with other library-based groups and with academic departments. For example, the rising popularity of Libguides and a recent subscription to this resource at the University of Toledo Libraries granted an opportunity to demonstrate how knowledge-creation strategies can benefit students, faculty, and librarians. As a tool for collaboration and outreach, librarians can collaborate on developing subject guides and reach out to faculty and students. Subject liaisons can develop extensive tacit knowledge of library and Web resources as well as what faculty and students in their assigned areas need. Since Libguides allows the electronic publication of the guides created in this system, it essentially allows librarians to convert such tacit knowledge into explicit via externalization. The results were even more compelling when a number of subject specialists collaborating on an interdisciplinary guide for the

Solar and Renewable Energy program at UT. Another instance of Libguides-based collaboration was the creation of an Intellectual Property Portal initiated by the DI team, but completed by a smaller working group consisting of librarians with subject knowledge of copyright, patents, and related issues that we believed everyone at an academic institution should know. Another knowledge conversion is combination, as portal users (faculty, advanced graduate students, and some staff members) would be able to combine this explicit knowledge with published knowledge.

A third subject guide was proposed as part of a Geospatial Knowledge Archive project. When that project proposal was presented, members of the Geography faculty were interested in easy access to geospatial data available to the public. The Libguides environment was suitable for this purpose, and a Geographic Information Systems guide was developed in collaboration with the Geography subject liaison. This resource would provide access to data, information, knowledge, and other digital content to students and faculty in the GIS programs. Libguides have, therefore, provided an excellent opportunity for interdisciplinary collaboration, which should inspire more integrative possibilities.

The knowledge archive was proposed as a database to organize, store, and retrieve geospatial tacit knowledge created during active phases of geospatial projects. It would house project documentation and other types of tacit knowledge that had not gone through the conversion process yet could be valuable to future project teams. Intended users would not find links to publicly available datasets from federal, state, and regional agencies, but access lessons learned, personal experiences, field photographs, interviews, and unpublished reports. The project idea was presented to faculty at the Geography and Planning, and has gained sufficient support to move on to successive stages of implementation. As for successive stages of implementation, the project involves the systems librarian who installs and configures the required software and whose position as the point person for communication with IT is central.

Organizational dimensions of DI work

The DI Department works in loose collaboration with other members of the Digital Initiatives Task Force, which is a cross-functional team and an advisory body to library leadership. The current membership also includes the library director, systems librarian, a digital services librarian, the assistant archivist, and the media specialist. Maintaining a close relationship with the systems librarian has been an important aspect of DI work; the department received extensive technical support from the systems librarian in getting software and servers set up for testing and production purposes. Thus far, task force meetings have focused on project ideas, scoping, and progress reports along with discussing challenges, obstacles, and solutions where there were. This approach, however, is reaching its limits since its broad knowledge-base is still defined by the affiliation of members to the library. Baker (2007) reports that at Washington University, the libraries organized a Digital Archives Task Force that facilitated library-faculty collaboration. Having somebody outside of the library is also a step towards broadening the scope of engagement throughout the university. Therefore, suggestions were submitted and a few attempts were made to broaden the scope of discussions with invitations of people from different departments. For instance, in order to understand digitization needs at the Law Library, the director there was invited to share his knowledge about the collections, their condition, and the team discussed a possible course of action, and a follow-up visit to the facility allowed the DI coordinator to assess the work needed to be done. A colleague's suggestion to involve a member of the University

Library Committee (as a bridge to faculty and administration) has been taken into consideration for future modification in the current task force.

Task forces can be favored from a vantage point of governance and workplace politics, but as Milton (2005) points out, they may have less effect on the outcome of projects. For an outcomes-oriented operation, working groups and communities of practice are more likely to succeed due to a mutual interest in supporting the project. Milton identified three KM approaches: default, partial, and holistic. The default approach relies on the leadership network and is aligned with the top-down political structure of the organization with some consideration of real interest in the program. A partial approach selectively relies on knowledge-creating strategies that are far too reliant on technology-, community-, or document-led solutions and can be detrimental to the success of the project therefore. The holistic approach Milton favors, combines all concerns, dimensions, and capabilities into a knowledge management system addressing

1. tacit and explicit knowledge (knowledge conversion)
2. knowledge transfer (communication, capture, storage, and retrieval)
3. people, content, process, technology, and cultural aspects
4. learning before, during, and after (flow of knowledge between project teams); and
5. communities of practice

Milton's recommendation of a holistic approach to knowledge management with greater reliance on communities of practice and project teams would benefit the Digital Initiatives program as well as the entire library organization in multiple ways:

1. Members would be more interested (and therefore) motivated to support the projects
2. Members (therefore) may bring more data, information, and knowledge to the table, which could support action items; and
3. Members are likely to consider collaborating on publications and presentations (an area of professional activity that is important to an organization whose librarians are tenure-track faculty).

Such changes may be in the works but will certainly require changes in organizational culture, structure, and adaptability. Warne, Hasan, and Ali (2005) offer advice and techniques to transforming organizational cultures that aspire to take knowledge management to new heights. The list of objectives offered by these authors include that inquiring organizations (1) develop social and ethical obligations; (2) look for opportunities to improve services (which is a professional obligation also); (3) develop and promote a network-centric philosophy and structure; (4) apply systems thinking to practices; (5) provide adequate resources to employees; and (6) "encourage reflection and innovation" (Warne, Hasan, and Ali, 2005, p. 317). While DI is mostly operational at the level of the parent organization (library), in order that it can successfully collaborate across the organizational spectrum, these recommendations need also apply to other units in their interaction with the library.

Conclusion

The digital initiatives program at the University of Toledo is still very new to allow us to draw conclusions. Some of the lessons learned through the first year of the DI program are that implementing it requires administrative, technical support, and other community support (e.g.,

marketing). While communication and collaboration are critical, A DI team should be further integrated into the library's organization through structural and cultural changes. A transition to the virtual library model may cause anxiety (and, therefore, feelings of isolation), and it will be important for DI to reach out to others as well. Collaboration with the Canaday Center has been a success, as that is where most of the digitization projects still are and where integration was also successful. The same does not apply to relationships with other departments due to lack of communication, interaction, and perhaps interest, but this may be changing. The proposed, current, and completed projects demonstrate that there is strong potential for a greater Digital Initiatives role in certain areas of academic knowledge management. Projects like the Geospatial Knowledge Archive have sparked some interest in the Geography department for instance, and this experience has opened doors to collaborating with librarians with possibility to present or publish. DI teams will be focusing on digital libraries and special knowledge repositories in order to store knowledge and support curriculum and other knowledge-creating endeavors throughout the institution. How can institutions measure the effectiveness of DI programs?

Measurements tools to assess the effectiveness of digital resources in libraries, and include ARL-funded projects like E-Metrics, DigiQUAL, and MINES for Libraries. E-Metrics is an assessment tool to measure the electronic resources in research libraries while DigiQUAL (an extension of LibQUAL) measures digital library services and MINES assesses the impact of networked resources and the demographics of users. Additional surveys can be designed to elicit responses from specific users of DI services. The data obtained with these tools can be used jointly with a SWOT analysis to identify strengths, weaknesses, opportunities, and threats, and list action items as a proactive remedial measure. Knowledge management techniques can be effective in improving, expanding, and otherwise modifying library (including digital initiatives) programs, and any knowledge developed through this process can be published for future administrations to consult.

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