Integrating the IR into strategic goals at the University of Toledo: case study

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Introduction

The integration of institutional repositories (IRs) into higher education goals for research and instruction has gained significant momentum and support on a global scale for nearly two decades. IRs have become tools for curating digitized archival and manuscript collections, oral histories, institutional data, patents, and scholarly publications. Given these developments, the academic libraries have begun to play a significantly greater role in supporting strategic goals at their parent institutions through innovative and creative uses of IRs.

Prior to its 2006 merger with the University of Toledo (UT), the Medical College of Ohio had used various types of digital repositories and data catalogs in an effort to manage its research data. Since joining the OhioLINK Digital Resource Commons (DRC) in 2007, UT has maintained a digital repository and charged the digital initiatives task force at the University Libraries to act as the advisory group. In 2013—after drafting the 2012 Strategic Plan—a decision was made in favor of a new platform serviced by bepress, which marked the beginning of the current institutional repository. As the university gears up for the next round of strategic planning discussions, the library's role in supporting digital scholarship is likely to gain more visibility. The ongoing conversation on strategic planning has given the digital initiatives librarian at UT Libraries an opportunity to work within a broader context and collaborate on projects supporting the future strategic goals.

Literature Review

Institutional Repositories

Discourse on institutional repositories and digital curation emerged in the late 1990s in the wake of realizations that the instability of digital media and the rapid turnover in hardware

and software technologies would eventually render born-digital content inaccessible. Lynch (2003) has defined institutional repository as

> A set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials, including long-term preservation where appropriate, as well as organization and access or distribution. (Defining Institutional Repositories section, para. 1)

IRs fall into two categories: subject-based (which have eventually become synonymous with open access repositories) and institutional (multidisciplinary) repositories, which are "open web collections of working papers or manuscript copies of published scholarly articles, specific to particular scientific disciplines" (Bjork, 2014, p. 698). While the earlier digital repositories were subject-based, recent trends have favored the multidisciplinary repositories with contributions from faculty in several disciplines.

Digital Curation

An important turning point in the global conversation on digital curation was the "Digital Curation: Digital Archives, Libraries and E-Science Seminar" sponsored by the Digital Preservation Coalition and the British National Space Centre and held on October 19, 2001 (Beagrie, 2004). The event focused on the preservation of deteriorating digital content for optimal longevity, new open standards for digital file formats, metadata, interoperability, and trustworthy repositories. There are several critical definitions for digital curation, three of which are noteworthy: 1) “Actions needed to maintain digital research data and other digital materials over their entire lifecycle and over time for current and future generations of users” (Beagrie, 2004, p. 7); 2) “Umbrella concept that includes digital preservation, data curation, electronic

records management, and digital asset management" (Yakel, 2007, p. 335); and 3) "Stewardship that provides for the reproducibility and re-use of authentic digital data and other digital assets" (Lee & Tibbo, 2007, "Opportunities and challenges," para. 3). Lee and Tibbo (2007) have also pointed out the need for "trustworthy and durable repositories; principles of sound metadata creation and capture; use of open standards for file formats and data encoding; and the promotion of information management literacy" ("Opportunities and challenges," para. 3). A related concept—data curation—refers to "the active and ongoing management of data throughout its entire lifecycle of interest and usefulness to scholarship" (Cragin, Heidorn, Palmer, and Smith, 2007). The curation of data and digital content in IRs aims to preserve digital content and access to scholarly knowledge in digital formats, which deteriorate over time due to software, hardware, and storage media reaching obsolescence.

Institutional Repositories and Strategic Plans for Research and Teaching

The focus on curating research data and other digital content in IRs for long-term access perfectly complements strategic plans, which devote considerable attention to teaching, research, and learning outcomes. Vorhees (2008) points out that strategic plans focusing on and using data for realistic goals and strategies will offer more benefit to institutions creating quantitative and qualitative, and a growing number of universities have articulated the use of IRs in strategic plans to support various institutional initiatives. The University of Kansas has included using the IR as part of their State-of-The-Art Infrastructure (Objective 3) to "provide an institutional repository for preservation and dissemination of research data and publications" under "3.2, Support faculty in all phases of research administration" (2015, p. 9). Elsewhere, Yeshiva University has aimed to "Create an institutional repository of research and scholarship to recognize and publicize faculty achievements" as a strategic imperative to showcase faculty achievements in teaching and research (2016, p. 6). Marsh has investigated the central purposes

of institutional research in scholarly research and the effects of research behaviors and institutional policies. She points to the dual role of IRs to "[keep] all the research outputs from the institution online and in one place in perpetuity and [showcase] the collective intellectual output of the university" (Marsh, p. 164).

Many universities have articulated the integration of IRs at the institutional level in their strategic plans but many others delegate this task to their libraries. For instance, the strategic plan at Columbia University Libraries (2010) includes using IRs to support archiving and open access publishing purposes under "Supporting Research." A case study of the Montana State University (2013) places the development of an institutional repository under the Office of the Provost to provide access to the intellectual output of campus as part of their "Discovery Goal." At UT, the use of an institutional repository to support research appears in the strategic plan of both University Libraries and the Office of the Provost (2012).

IRs in the Academic Library

The management of digital repositories often falls under a librarian's purview, which implies that IRs should also enhance services of academic libraries. The integration of IRs in the library may affect multiple library departments even where the responsibility of managing the collections falls on the shoulders of functional specialists like digital initiatives librarians. Collaborators may include reference and subject librarians, catalogers, and others (e.g., systems, scholarly communications, and electronic services). The 2007 Census of the Council on Library and Information Resources (CLIR) has indicated that libraries play a central role in managing content in the IR by involving public and technical services—including systems staff— in the process (Markey, Rieh, Jean, Kim, & Yakel, 2007). Reference librarians also have a strategic advantage by virtue of their role to promote and manage the institutional repository, as they can

integrate the IR into various librarian roles such as marketing and outreach (Phillips, Carr, & Teal, 2005).

Attitudes Towards IRs in the Academic Community

Since the inception of IRs, library literature abounds with reports of obstacles encountered when approaching faculty for content. A significant number of articles have addressed internal and external reasons for faculty's lack of acceptance despite the benefits to authors and researchers at large. Quinn (2010) speaks about the psychology behind faculty resistance, in which motivation is affected by cognitive (e.g. misunderstanding), affective (e.g. anxiety), or behavioral states. Ware (2004) has reported on cultural factors such as departmental values and resistance to change affecting the acceptance of IRs. Jones, Andrew and MacColl (2006) have applied Diffusion of Innovation Theory (DIT) as an explanation for the sluggish adoption of IRs as new technology. Within DIT, adoption is influenced by novelty, the social system in place, the time involved, and channels of communication.

Covey (2011) points out the overall attitudes of faculty unwilling to accept IRs—and the concept of Open Access in general—as a lack of awareness, understanding, incentives or mandates; indifference; opposition to change; unwillingness to take risks; and a lack of adoption by others. Davis and Connolly (2007) and Abriza (2009) have provided good summaries of faculty concerns such as copyright, plagiarism, quality, increased workload, lack of awareness of the possibilities and benefits of IRs, expenditure of time, technical issues, redundancy, the use of personal Web pages and disciplinary repositories, reluctance to publish outside of traditional journals, and grant funders' lack of interest in self-archiving. The passage of time does not seem to have much effect, as these same concerns are being expressed in current literature (Abrizah, Hilmi, & Kassim, 2015; Marsh, 2015).

Faculty are not entirely to blame for the slow acceptance of IRs however. Librarians may not possess sufficient knowledge or hold negative opinions that may make them non-supporters (Daniel & James, 2012; Kamraninia & Abrizah, 2010). The survey by Daniel and James (2012) has revealed that librarians felt there needed to be more sufficient numbers and a variety of materials in the IR before they would promote it. Another reason given for non-promotion was that the IR was not considered an index. Kamraninia and Abrizah (2010) posit that librarians have not taken on the proper roles or developed the skills necessary to promote an IR. Poor planning may also be a factor (Salo, 2013).

Many a case has been made for mandates as a solution for the slow population of IRs, among them Pinfield (2005), Jones, Andrew, & MacColl (2006), and Thiede (2014). However not all faculty are accepting of such forceful measures that threaten their autonomy (Jantz & Wilson, 2008; Marsh, 2015; Thiede, 2014).

Marketing and Outreach Efforts to Counter Negativity

Repositories have been identified as a disruptive technology (Bell & Sarr, 2010); yet they are often established without an "expressed need" (Gaffney, 2008, p. 568), which necessitates more concerted efforts to market them (Covey, 2011; Gaffney, 2008). Several publications have addressed marketing as the crucial component to successful IR initiatives. Basic marketing and communications principles—raising awareness, creating appeal, habituation, and communication—have been recommended for developing promotional campaigns (Gierveld, 2006). Jones (2007) has recommended that those advocating for IRs should identify stakeholders, particularly persons in positions to enact change, early adopters, and departments with exceptional needs. This requires that advocates have a firm understanding of potential stakeholders, employ effective branding and publicity, and be receptive to criticism.

Reference librarians—subject or liaison librarians in particular—have been identified as being the foremost change agents in marketing and outreach efforts (Bell, Foster, & Gibbons, 2005; Daniel & James, 2012; Gaffney, 2008; Kamraninia & Abrizah, 2010; Phillips et al., 2005). As mentioned earlier, librarians may also be a barrier; Daniel and James (2012) suggest marketing to the librarians before any effort to promote to faculty.

There are a number of strategies proposed for successful promotion of IRs. It has been suggested that any marketing efforts should accentuate the benefits of contributing (e.g. increased discovery, citation and recognition, and long-term preservation) and address potential contributor's concerns (Gaffney, 2008). While it may be obvious to point out to faculty the numerous benefits of IRs, calling immediate attention to their shortcomings may allow faculty to concentrate on the positive aspects (Quinn, 2010). Also, having a variety of materials in the IR will help demonstrate its potential use; soliciting student theses and dissertations is overwhelmingly the quickest means of obtaining content, and is easiest to mandate (Davis & Connolly, 2007; Jones et al., 2006). In their application of DIT, Daniel and James (2012) believe that if the IR can be shown to be part of a "package" it will be adopted more rapidly. Therefore, it may be beneficial to discuss how the IR interrelates with other resources such as aggregators and discovery services, and how an IR may complement traditional publishing sources. Finally, time expenditure and additional effort on the part of faculty are often cited as impediments to self-archiving. If time and staffing allow, libraries may offer to check publisher's policies for authors' rights as a service (Covey, 2011).

The IR Experience at UT

Early Initiatives

The integration of the institutional repository in the higher education goals at UT has a twenty-year history during which multiple factors have shaped the institutional commitment to this kind of technology. Planning of the Faculty Publications Database (FPD) at UT began in 1996 and the site opened for public use in June 1998 (see Figure 1).

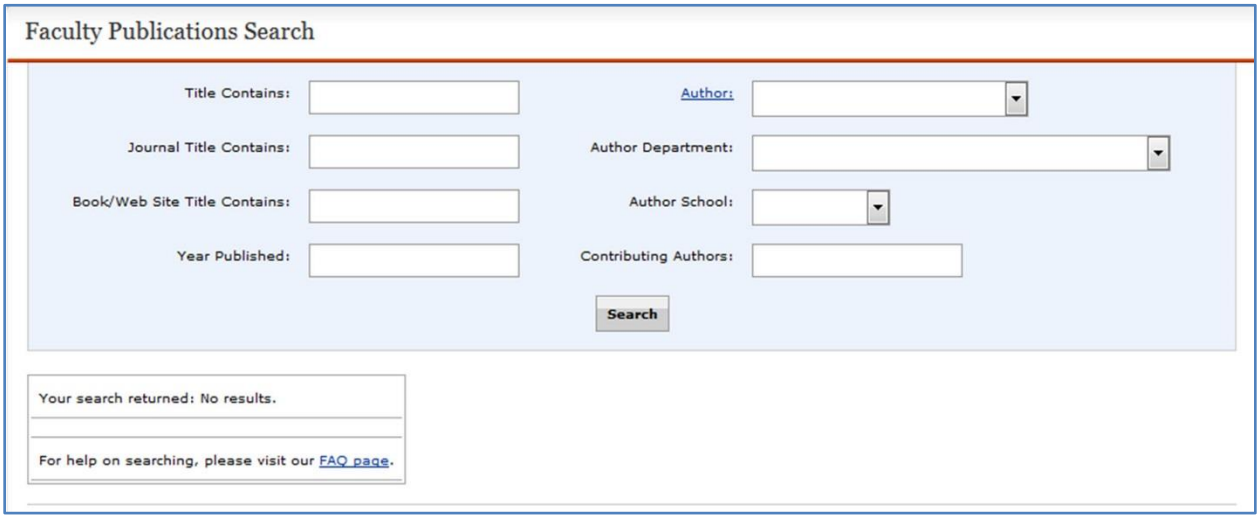

Figure 1. Faculty Publications Search interface

The FPD focused on published papers of faculty on the health science campus for the purposes of gauging medical faculty research productivity, and for use as a tool for faculty review and collaboration. Unsuccessful attempts were made to integrate the resource with a grants database and the UT Institutional Review Board, principally due to a lack of interest and support outside the library. Eventually a Faculty Expertise Database (FED) was created for use on the Health Science Campus for similar purposes (see Figure 2); however, the FED is inaccessible to anyone without UT login credentials.

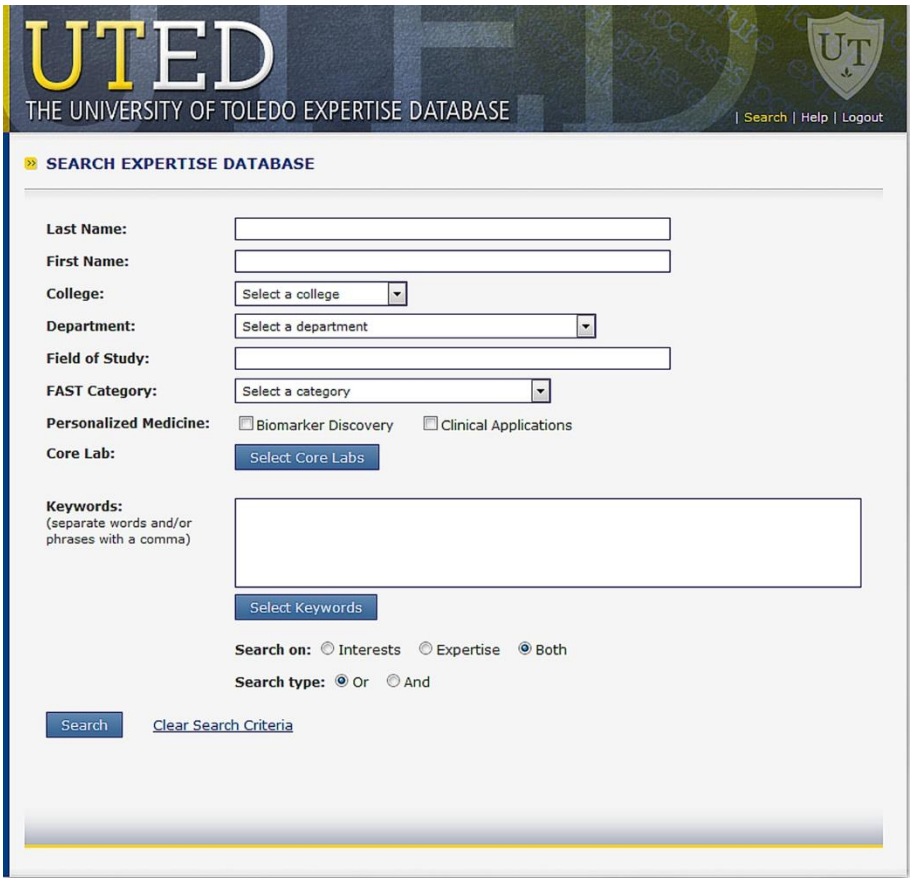

Figure 2. Search Interface of the Faculty Expertise Database

The Digital Resource Commons

In 2004, the DRC became the shared infrastructure for digitized institutional content. It utilized the open-source platform DSpace and was operated by OhioLINK, which was Ohio's statewide library consortium since 1987. Whereas UT only became a contributor in 2007, the Medical University of Ohio had already utilized DSpace as a digital repository installed in house (as opposed to using the DRC platform hosted by OhioLINK as a part of the shared infrastructure). After the merger, however, UT began contributing to the DRC with the responsibility shifting towards the consolidated library organization. The Ward M. Canaday Center had assigned the curatorship role to the Digital Initiatives Archivist in 2007, which was prior to shifting this responsibility to the Digital Initiatives Librarian in 2009. Consequently, the

earliest materials contained digitized heritage collections and institutional records from the Canaday Center collections. The eventual addition of scholarly projects (by graduate students) from the health sciences through collaboration with the coordinator of technical services allowed the expansion of the repository's curation scope to include digital scholarship.

In 2010, while the UT Library Digital Initiatives Task Force was investigating ways of expanding into the existing DRC, another group assembled to explore faculty E-publication. The E-publishing Task Force prepared a report that explored the feasibility of establishing a digital repository (using DSpace or another platform) and a publishing platform (such as Open Journal Systems), which set the stage for what eventually became the University of Toledo Digital Repository (UTDR) on the Digital Commons platform in 2013. Other efforts to consider alternate platforms for digital curation included testing the Greenstone Digital Library and requesting an installation of Archon for archival uses in early 2010. Despite the initial appeal of implementing a digital repository on a university-operated server, neither approach has come to full realization due to scalability and sustainability issues in both platforms.

Migrating the IR

Following the OhioLINK decision to terminate the DRC program, UT first selected CONTENTdm to house its digitized heritage collections in the UTOPIA (University of Toledo OPen Institutional Archive) digital repository, now decommissioned, but has eventually added Digital Commons afterwards to house scholarly research in the UTDR. However, this approach eventually resulted in a bifurcated model (discussed later in this article) for curating two dissimilar repositories, which necessitated two somewhat different metadata schemas and separate workflows.

There was yet another important factor to favor hosted—as opposed to in-house—platforms like CONTENTdm and Digital Commons: the level of information technology support. Although the Digital Initiatives Librarian—who is also the IR manager—has received continuous support from the systems librarian working with various IT offices, a long-term implementation of an in-house IR platform would have been impractical, if not altogether impossible. Platforms such as DSpace, Fedora, Omeka, and Joomla require a UNIX or Linux operating system, which in turn, depend on expertise in installation, configuration, and periodic upgrades. As much of the IT infrastructure at UT runs in a Windows environment, the options would have excluded the aforementioned open source platforms. The lack of dedicated storage space was another obstacle, which has further demonstrated the lack of understanding—hence supporting—the library in its need for massive storage space among IT staff. Therefore, the long-term investment in the Digital Commons has proven to be the best avenue, as the bepress technology team and customer service representative are very knowledgeable and customer service-oriented. This option, of course, allowed the IR manager to focus on collection development and outreach to invite faculty, committees, and administrators to use the IR.

Strategic Planning and the IR

With regards to future uses of the IR, strategic planning documents can provide a critical institutional framework for supporting new initiatives through innovative and creative ways of using this technology. A university committee presentation on the Higher Learning Commission (HLC) and Strategic Planning (Cutri, 2015) addressed areas such as "Teaching and Learning" with emphasis on quality, resources and support, and which libraries had been supporting and could deploy the IR as a new tool. Prior to that, the report titled "The HLC Self-Study: Shaping UT's Tomorrow" (University of Toledo Office of Assessment Accreditation and Program

Review, 2012) illustrated the role of the IR in meeting goals in multiple criteria established by the HLC. More specifically, in “Criterion Two: Preparing for the Future,” this included providing access to comprehensive digital resources housed in the OhioLINK Digital Resource Commons at the time to support research and teaching at UT.

After a series of group discussions organized around themes, the strategic planning document (2012) of the University Libraries incorporated verbiage on the use of IRs to support research and teaching. More specifically, the use of IRs has appeared under “Faculty Research" (Theme 7) to “expand the institutional repository (IR) to include faculty open access publications and data management” (p. 2). Under "Collections" (Theme 4) and “Community Outreach and Global Engagement" (Theme 6), the same IR would also be used for born-digital collections. The current scope for using the IR at the University of Toledo reflects these interests, and in some cases, it has gone further to explore other possibilities as discussed under current initiatives and future directions in this case study.

Current Initiatives

IR Support for Research & Teaching

The implementation of the UTDR has been in response to the various components of the university's strategic plans for teaching and research. While the process to prepare collections, publications, and datasets for access to researchers has been labor-intensive and demanded a significant amount of time, there are current and recent initiatives to support teaching in traditional, hybrid, and fully online courses using the Blackboard course management system as well. The use of the various digital repositories and data catalogs has thus far focused on digital curation—and within that activity, digital preservation—of digitized contents, but an expansion of the scope to scientific and humanistic data curation will soon support both the research and

teaching mission at UT. The projects discussed below are in varying stages of planning, completion, or abandonment for reasons beyond the library's direct control.

Digital Curation Projects

The vast majority of content in the IR is legacy content transferred in 2016 from the UTOPIA digital repository containing selections from digitized manuscript collections, institutional records, local history files, exhibition catalogs, yearbooks, theses, dissertations, project requirements, thematic digital archives, and faculty publications. Many new collections (including born-digital contents) have since been added to the IR, and there has been an ongoing effort to encourage researchers to contribute data and publications. The collections appear in a hierarchical layout to represent contextual (historical, topical, organizational, and provenancial) relationship among the collections. As was possible with DSpace before, the Digital Commons platform has enabled the curator to represent the collections in hierarchical structures as demonstrated in Figure 3.

Figure 3. Structured Representation of Collections in the IR

Manuscript Collections and Archival Records

Selections of digitized records from manuscript collections and university archives were the first records ingested into the DRC between 2007 and 2013. The ideal way to approach digital curation of legacy collections would have been to work closely with the manuscript

librarian and archivist with personal knowledge of these collections and records upon appraisal and processing. However, the turnover of staff has meant disruption in collaboration (which has prevented knowledge sharing) on the one hand and new employees' lack of personal knowledge, which has affected the quality of the metadata record until enhancement is possible. An effective approach has been to gather information about the collections during exhibitions because exhibition labels included unique details about the displayed items entered as digital surrogates into the IR along with professionally prepared metadata records.

Finding aids have been very useful in preparing most collection-level descriptions for most metadata fields. This approach also allows those missing the exhibition to view the digital collection in the IR, view the finding aid, visit the archives, and read books in the library's rare book and general collections. Although staffing support for digital initiatives has been (and still is) very low for budget-related reasons, it has been possible to employ temporary employees and student assistants for various large-scale projects to perform simple tasks such as scanning, metadata creation, and image transformation (such as cropping, renaming, and format migration).

Digitized Print Publications

The digitization of print publications has been limited to UT-owned works in the public domain such as some student newsletters, yearbooks, university press releases, and exhibition catalogs. Digital access to yearbooks, press releases, and college newspapers allows the university community, alumni, and others to find historical information on UT whereas for former students and employees these collections may contain memories. The digitized exhibition catalogs present a long record of curatorial activity at the Canaday Center since these publications contain well-researched narratives and photographs featuring UT's manuscript

collections. The practice has been to prepare a virtual exhibition with its own unique hypertext structure to navigate information on the exhibition topic, which would continue to provide access to just about the same information after the exhibition ends. The exhibition catalogs are, therefore, important tools in the digital curation process because the metadata record contains information (such as subject, author, etc.) allowing researchers to connect the information in these catalogs with publications, manuscript collections, institutional records with other digital collections. The catalogs are PDF documents supporting full-text searching with some advantage over older page-image documents that are not searchable; hence, these are potentially valuable resources to researchers in the Humanities and Digital Humanities.

Faculty Research

Institutions of higher learning have made significant progress in promoting their IRs for purposes of showcasing faculty research, but author archiving—that is, to enable researchers to upload pre- or post-print copies that have passed peer review into the digital repository—has become another important function of the IR. Many institutions have already mandated that faculty use the IR to publish via Green OA (see Suber, 2012). At the University of Toledo, there has not been a mandate to use Green or Gold OA avenues for open access publishing although there is a growing interest in doing so. The largest contingent of research-active faculty contributing publications, conference proceedings, and posters to the IR represents the University Libraries. Faculty from the Geography as well as the Mathematic programs have also contributed papers and book-size publications as archived copies of their research.

The IR platform provides detailed internal analytics with mapping tools to help authors assess the impact of their research on user downloads and hits. This allows them to correlate geographical analytics data with their history of conferences, presentations, or other forms of

interaction on those locations. The system also separates analytics associated with specific content from those related to individual researchers. Although these analytics are not comparable to impact factors calculated by research publications, they do represent relevance in an emerging landscape of digital scholarship differently from what traditional scholarship had provided.

Student Research

At the time of migrating the content from the OhioLINK DRC in 2013, there had been ongoing efforts by a librarian to develop digital collections, which included masters, doctoral, and other required projects in the areas of Nursing Practice, Physician Assistant, and Occupational Therapy. After creating the MARC records, she exported the metadata into an excel sheet where she transformed the data into a format compatible with the IR's metadata schema.

More recently, there have been significant additions of electronic theses and dissertations (ETD) to the IR. This process has required the harvesting of PDF files from the OhioLINK ETD Center, combined with metadata extracted from MARC records. The process usually begins with uploading a PDF copy of a dissertation or thesis into the OhioLINK ETD system with a sketchy metadata record. After the aforementioned colleague extracts the file from the ETD system and adds metadata from the MARC record, the ETDs go into the IR. The IR manager—who is also the digital initiatives librarian at UT—looks over the metadata worksheet and adds other necessary technical and administrative metadata before the bulk submission. While the ETD collections are accessible from a single ETD collection area, the collection tool in Digital Commons uses a filter to create surrogate collections arranged by college or program as well.

This curation strategy does not result in duplicate content, and improves the repository's information architecture by improving navigation through the collection (see Figure 4).

Figure 4. Electronic Theses and Dissertations

UT Patents

The recent inclusion of UT patents granted by the United States Patent and Trademark Office (USPTO) illustrates how the IR is ready to support such strategic areas as "Research and Technology Transfer" as well as "Learning Environments" through the development of digital collections in the libraries. Initiated by one of the subject specialists in collaboration with the Technology Transfer office at the university, which releases information on UT patents, this project aimed to import UT patents granted by the USPTO into the IR. The model was based on

a case study published at Rice University (Carlson & Spiro, 2015), which has detailed out the process for preparing the metadata worksheet with data and images available from the USPTO, Free Patents, and the PubWest sites. There was no copyright issue since these patents had passed into the public domain, and the bepress team was very helpful in setting up the collection area, which allowed this colleague to continue with the curation of UT patents on a separate LibGuide.

Thematic Digital Archives

This category of content refers to collections specifically developed to support a Department of Theatre and Film professor in his teaching. The Digital Archive of the Institute for the Study of Performance and Spirituality is a thematic digital archive focusing on ancient Greek drama in the context of theosophy—a theme included in the curriculum of the Department of Theatre and Film at UT. After obtaining permission from the Pasadena Archives that holds ownership of the materials, the professor completed the metadata worksheet with the necessary descriptions, and the IR manager completed the worksheet before submitting to the IR. This collection had first appeared in the UT DRC repository; at that time, the professor—who had just transferred to UT from the City University of New York—also moved an open access journal titled *Performance and Spirituality* to an Open Journal System at UT. With the website added, there evolved a three-way curation model whereby the interlinked sites complemented one other. The collection has been migrated twice: in 2013 to UTOPIA, and in 2016, to its current location in the UTDR.

The other thematic digital archives was created in UTOPIA when the UT Geography and Planning Department prepared for its 50th anniversary. The department assigned the project to a graduate assistant who received some instruction and coaching from the digital initiatives librarians to scan photographs and prepare the metadata. This digital archive was migrated to the

UTDR as well before UTOPIA was decommissioned. Discussions of specific oral history collections are underway, one of them planned with the purpose of teaching students how to use oral history techniques in the field of Education.

Virtual Exhibitions and Galleries

In addition to the archives of PDF documents, the IR features book and image galleries to showcase publications and image collections in a more aesthetically pleasing manner; however, from an archivist perspective, this over-structuring does not facilitate the creation of hybrid collections containing both text and images. In order to create single sets, curators would have to decide whether the series is an image gallery (thus forcing some textual material to appear as images) or series (thus forcing images inside PDF documents mixed with texts). Although a system will retrieve both in a single search results list, the separation of PDFs from image files creates an unnecessary step in the workflow of archivists trained to describe all contents in the context of single collections.

An attractive feature in Digital Commons is map-based visualization of data with geographical coordinates added to the metadata worksheet (see Figure 5). The geospatial data is based on information in the *Illustrated Historical Atlas of Lucas County and part of Wood, Ohio, 1875*. The google coordinates were added to the metadata records by the Digital Initiatives Librarian, which populated the map with the location markers. This is a data sharing functionality to foster scholarly exchange of data across disciplinary boundaries. Because it is a laborious part of the processing, curators can revisit the collection and add Geographical Information Systems (GIS) data for purposes of sharing Keyhole Markup Language (KML) files generated by the IR with researchers using Google Earth, ArcGIS, or other software.

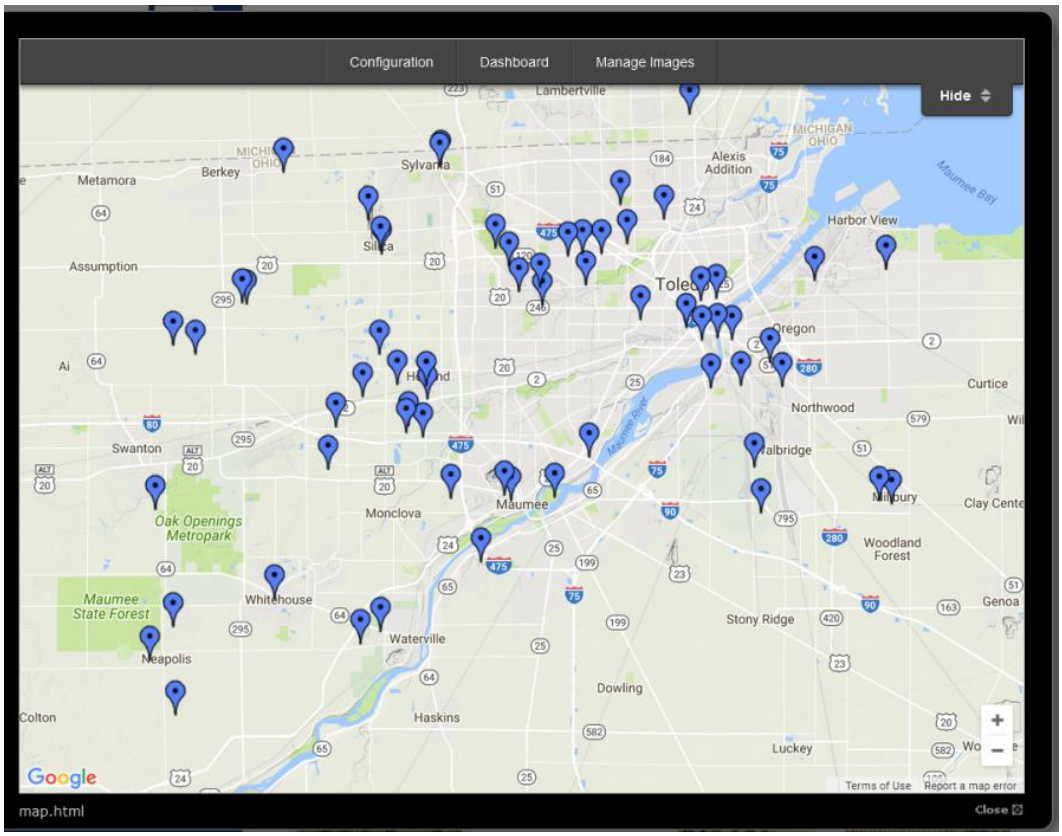

Figure 5. Map-Based Visualization of Cultural Heritage, Using Google Maps in the IR

There are many images in the manuscript collection with GIS data to support visualization. The recently completed virtual exhibition using this feature most extensively showcases a collection of rocks, minerals, fossils, and industries currently displayed at Carlson Library with scientific descriptions and geographic coordinates to support visualization. While the purpose of this collection is educational use by students and faculty, the IR also supports the sharing of exportable KML files for purposes of collaborative research projects.

Innovative Use Cases

Bepress has rolled out a number of new features to support innovative uses for the IR on top of its legacy features to provide digital access to collections and open access publications. In some cases, the specific features of the IR were not innovative in the strictest sense; instead,

through various approaches to digital curation involving some knowledge management, strategies have led to innovative uses of the IR.

Open Access Publishing

The relationship of the IR to research at UT has been multifarious. On the one hand, the IR provides space for Green OA Activity enabling researchers to contribute their pre- or post-print publications, and to use the IR for author archiving. The IR has also supported Gold OA as a publishing platform; thus far, it hosts one medical journal containing the research of medical students, and another journal managed by the College of Education focusing on teaching. The setup of these journals required several meetings to discuss the fundamental aspects of the publication (such as establishing an editorial board, policies, and workflows), branding, and archiving the issues, and bepress used the demo site for discussions and testing, after which the publication moved to the production site.

SelectedWorks and Expert Gallery

IRs have had to compete with personal and departmental web pages, and redundancy is mentioned in the literature as a reason for lack of enthusiasm for depositing into IRs (Abrizah et al., 2015). Covey (2011) remarked that the bepress product Research Showcase did not "provide a viable alternative to personal or group websites" (p. 13). Since that time, the company has developed SelectedWorks (see Figure 5) to complement its repository, and UT Faculty—especially in the College of Law—have been utilizing it to showcase their work and improve discovery of their research. Another recently developed feature, the Expert Gallery, provides analytics and downloadable graphics to measure impact. Authors contributing to the repository and/or establishing SelectedWorks profiles can use Expert Gallery to assess the impact of their research; this capability adds significant value to the IR. The combination of these features

fulfills the promise of the Faculty Publications Database by providing a means for showcasing faculty research and allowing for discovery by potential collaborators and funding bodies. A liaison librarian at UT is currently in discussions with the campus Office of Government Relations to encourage the use of SelectedWorks and the Expert Gallery to fulfill its mission in forging and maintaining valuable partnerships between UT and local, state, and federal governments and public agencies.

Figure 6. SelectedWorks Interface in the IR

Integration with the Discovery Layer

Improvements in the discovery of university researchers, who represent a sizable segment among stakeholders, are not only a technology issue but also potentially a political one for libraries to consider. With the rise of open access publishing, it may no longer be enough for library catalogs to facilitate searching for books and articles; they should now include open

access publications contributed to the IR and, where available, the publishing platforms. The recent integration of the IR with the EBSCO Discovery Service (EDS) resulted from collaborating with the system librarian who led the effort to select and evaluate this discovery layer service prior to integration. The integration speaks to a holistic (but rarely explored) approach to digital curation, as researchers may now locate works of UT scholars in the catalog and subscribed databases that includes scholarly work (books, journals, and open access publications), datasets, manuscripts, and university archival records (in the digital repository). Such a holistic approach must assume that the UT faculty—the subject of such a search—contributes to the digital repository, manuscript collections, and UT archives at the time of employment at UT.

Lessons Learned

Problems with the Bifurcated Curation Model and Solution

In 2013, when the DRC project ended, academic libraries of former member institutions elected to maintain a single digital repository or more, depending on their digital curation strategies, collections, and staffing capabilities. In the latter case and for some institutions, the problem of bifurcated curation has emerged; this was especially true for dissimilar repositories with disparate architectures, metadata schemata, and workflows. A bifurcated model does not suit well those organizations with staffing and budget shortage, and in the case of the University of Toledo, that was definitely the situation to be resolved through a merger of the two repositories into one. Most digital content falls into two broad categories: heritage collections and scholarly research, which easily supports either a unified (simplified) or bifurcated curation strategy. In the former case, all content goes into one digital repository whereas institutions favoring the bifurcated strategy may designate a separate repository for each collection category.

At UT Libraries, the bifurcated strategy evolved over an extended period; it began as the unified strategy using DSpace between 2009 and 2013 was replaced by the bifurcated strategy in CONTENTdm, which was the dedicated digital repository to house the digitized heritage collections and institutional records. During this time of transition—marked by significant and time-consuming metadata transformation—there was a need to work with one metadata schema, albeit with irreconcilable differences in the data structure. The Project Client in CONTENTdm changed the workflow, providing little flexibility in enriching the metadata once the collection was in that digital repository. While both DSpace and CONTENTdm used Dublin Core as the metadata schema, there were differences in a number of individual elements and qualifiers, which has proven to be cumbersome for the one-person digital initiatives program.

In 2014, the effects of the bifurcated curation strategy further surfaced in the wake of selecting Digital Commons to house digital scholarly collections (theses and dissertations, graduate student projects, and faculty publications). In 2016, after evaluating the cost and effectiveness of the bifurcated curation model, a suggestion to merge the two repositories into one using the Digital Commons gained support. The resulting merger has-simplified both workflow and the metadata schema, and has created a hybrid curation environment with the Digital Commons functioning as digital library, institutional repository, and open access publishing platform. The UT experience demonstrates that critical digital lifecycle events involve pendulum-like moves between unified and bifurcated strategies as supported by factors such as staffing, collecting scope, funding, and project management choices.

Marketing and Faculty Buy-in

Prior to the October 2011 during Open Access Week at UT, librarians had distributed a survey to faculty in order to gain some sense of faculty perceptions about open access. While the

number of respondents was not large (83), the information supplied indicated that OA would be accepted as a legitimate model for furthering research (see Figure 7). This was encouraging news as the UT liaison librarians moved forward to establish the UTDR.

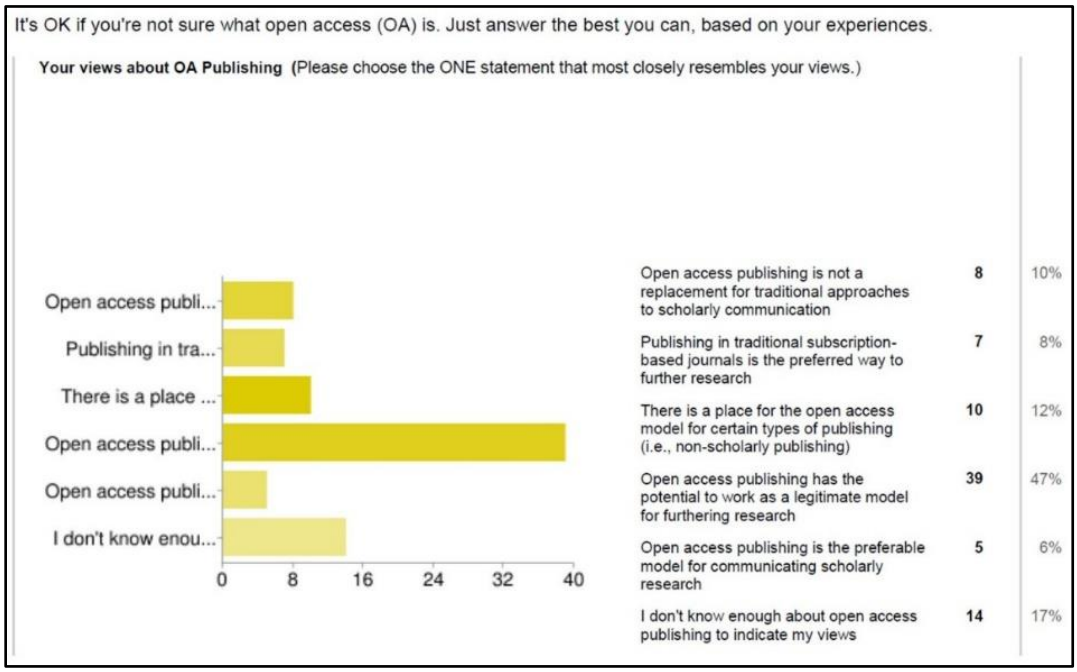

Figure 7. Chart Representing Data Obtained in the 2011 Open Access Survey

Marketing of the UTDR has been spotty since its launching, but currently there is a newfound emphasis on promotion. As was pointed out in the literature, liaison librarians are the best promoters of institutional repositories; hence, subject liaisons at UT have been approached with a plan to reach out to their respective communities. A LibGuide with background information and downloadable handouts has been created to educate the liaisons. Another LibGuide serves the purpose of educating faculty on Open Access Publishing and Scholarly Communication. Despite the infancy of this vision, liaisons in a few subject areas have raised interest in using the IR, and have attracted early adopters. In one instance, the liaison librarian for The College of Health and Human Services will soon have an audience with the faculty at an upcoming college-wide meeting, and several faculty have already expressed interest in

SelectedWorks and Expert Gallery. In addition, a presentation is being created which will be delivered to invited members of the UT community who may have potential interest or be in positions of influence. Elsewhere, the liaison to the Geography and Planning and the Anthropology Departments has succeeded in raising awareness in using the IR for author archiving, reporting, and using the system for sharing archaeological data.

Staffing Challenges

Staffing support for digital initiatives has shifted from meager to generous, depending on leadership support and funding for temporary staff and student assistants. Except for a brief period, there has not been a dedicated permanent full-time staff skilled in digitization, photographing, image editing, metadata creation, and web authoring. The University Libraries has no strategy for dividing staff time (which other institutions have implemented with varying success) to support digital initiatives. This demonstrates low priority assigned for this area of curatorial work despite the high subscription price, political investment, and rising expectations for having an institutional repository.

Concerns about Consortial Sharing

Consortial sharing during the years of OhioLINK DRC membership (from 2007 to 2013) has provided benefits and disadvantages for the University of Toledo. The advantages included a great deal of expertise in the DRC Team despite their size limitation, as there were four to five technologists to support 27 institutional repositories using DSpace with OhioLINK. Actually, the plans were to expand this service to all (nearly a hundred) institutions throughout Ohio at the time, which would have made it one of the largest digital consortiums in the US. That did not materialize, however, because of funding and staffing issues. Also, the uniform approach may have been a disadvantage for some institutions with unique collections, stakeholders, and needs

for repositories that meet such needs. Disbanding the DRC in 2013 may have given the member institutions the individual look for their repositories—albeit at a higher cost—but in hindsight, it may have also complicated the preparations for joining the Digital Public Library of America, which might have been simpler with a unified DRC profile. Smaller consortia, such as Five Colleges of Ohio—a consortium of independent liberal arts colleges established in 1996—use a shared library system. As members of the DRC community, they had maintained a shared infrastructure for digital collection; today they use Omeka to share their heritage collections and maintain a shared digital portal for all digital collections. Therefore, the consortia may be advantageous for institutions sharing characteristics such as curriculum, enrollment, and size of collections.

Usage Statistics

There are two methods to obtain analytics about the usage of content in IR: Digital Commons' (DC) internal reporting system and Google Analytics (GA). While there are some overlaps in some data they provide, there are fundamental differences in the audience and segmentation of data. DC uses downloads as the primary criteria for usage whereas GA differentiates between events like page views and sessions (or visits), neither of which implies a download. Although DC focuses on research and its data structure represents scholarly impact, downloads do not necessarily result in citations. A reputable source for citation statistics is the Web of Science for indexed publications, which will not correspond to individual articles posted in DC and because citations of articles in the IR are not counted by DC's internal analytics. DC provides researcher-centered data such as institutions by type (e.g., education, commercial, organization, government, military, and library) whereas data in GA is e-commerce-oriented and offers demographics by browser type, operating system, Internet service provider (ISP), type of

device, age, gender, interests, language, and some other categories. Both DC and GA offer geographical data produced by very different algorithms and criteria nonetheless, and are incomparable therefore. The past three years have produced data pointing to growth in the collections with sharp increases in page visits (or sessions), page views, and downloads by a growing group of users from a growing number of countries. Table 1 presents the most commonly used analytics data from both systems from 2014 through 2016, but because of massive content migrations from UTOPIA to the UTDR in 2016, the statistics do not represent a normal development and usage curve. In a 5-year period, 2016 statistics would represent a spike.

	Data from Google Analytics (GA)				**Data from Digital Commons (DC)**			
Year	**Sessions**	**Page Views**	**Users**	**Countries**	**Downloads**	**Institutions**	**Metadata Views**	**Works posted**
2014	3,431	12,167	2,080	81	49,490	664	3,599	2,205
2015	7,281	18,461	5,159	119	153,209	11,091	5,261	460
2016	11,409	38,872	8,221	131	252,642	15,322	9,335	9,998

Table 1 – Comparison of UTDR Usage Statistics from GA and DC

Conclusion

The emerging digital environment has pushed academic institutions towards new strategies for curating their record on scholarship and preserving their heritage collections through use of their institutional repositories. This case study has focused on how the IR was integrated into the strategic plans for research and teaching at UT, and the review of recent and earlier literature has provided both the conceptual and exploratory framework for this report. While institutional repositories may provide the space for archiving and showcasing a university's record on scholarly activity, the platform itself is not enough—it also requires innovative approaches to curating the IR content digitally in order to facilitate access to those

contents in ways that were not possible a few decades ago. Presently, the IR can not only showcase research but it can extend into the learning environments managed through course management systems like Blackboard, Moodle, or Sakai where courses can be interlinked with selected digital collections in the IR. The integration with the discovery layer can further enrich the resources available to classes with a complete palette of learning resources like books, research databases, open access publication, archival records, and manuscript collections. Researchers can also curate their own record of scholarly activity and measure its impact on continuing research elsewhere in the world or at the library next door.

The lessons learned are critical to the continual assessment of the strategies for using IRs in higher education. Surveys and existing literature points to the parallel trends of increasing use of IRs in the academic library while a large segment of faculty still abstain from considering Open Access as a model for scholarly activity for reasons related to copyright, plagiarism, and sustainability. Staffing and funding IR initiatives are important factors in sustaining the curation of scholarship in the digital environment. Many smaller institutions have simply discounted and underestimated the extent of collaboration required to maintain an IR, and while there are several models for staffing digital production units, both funds and politics have contributed to the success or failure of such initiatives. Well-staffed academic libraries have been able to devote adequate staffing and funding and even maintain an elaborate information architecture as exemplified by Purdue University. The advantage of their strategy is that each digital repository platform offers the workflow and metadata schema suitable for the content being curated therein. The experience with UTOPIA and the UTDR before merging the two last year has been that bifurcated metadata schema and workflows can be a disadvantage for a one-person department

with the rare addition of temporary employees and part-time student assistants who need training.

What the case study did not address in detail are future directions for utilizing the IR. Currently, a few projects are underway at Carlson Library: One showcases a scientific exhibition; another will archive oral histories for the purpose of teaching oral history as a research method outside the discipline of history. The latter demonstrates that the IR can be an effective teaching tool to prepare students for careers in the digital environment. On the one hand, they can contribute their posters, papers, and creative works to the IR and populate their digital vita (using SelectedWorks) to showcase them to potential employers. On the other hand, students now also have opportunities to learn about peer review, publishing workflows, and general collection management in the IR and prepare for careers in the digital environment. Finally, academic knowledge management may also be included in future strategic planning for academic institutions, which would combine digital curation practices, technologies, and specialists to improve access to scholarly knowledge through improved techniques to share, exchange, and transfer knowledge. These visions, however, circle back to an earlier argument about devoting adequate staffing, funding, and marketing efforts for sustainable IR initiatives.

Glossary of Terms

Algorithm: A sequence of steps involved in a computer search

Analytics: Analysis of data to study patterns or effects, or to evaluate performance or decisions

ArcGIS: A geographic information system for working with maps and geographic information

bepress: An academic software firm founded by the Berkeley Electronic Press

CLIR: Council on Library and Information Resources

CONTENTdm: Management platform for housing and preserving digital media content

Digital Commons: Institutional repository and publishing platform from bepress

Digital curation: Selection, preservation, maintenance, collection and archiving of digital assets

DIT: Diffusion of Innovation Theory

DRC: Digital Resource Commons of the OhioLINK consortium

DSpace: Open source repository software

Dublin Core: A scheme for digital cataloging that allows for improved document indexing for search engine programs

EBSCO: Elton B. Stephens Co.; an information services company

EDS: EBSCO Discovery Service; a product designed to direct library users to various materials in its collections by pointing to resources resulting from a single search (also known as "discovery layer")

ETD: Electronic theses and dissertations

FED: Faculty Expertise Database

Fedora: Open-source operating system based on Linux

FPD: Faculty Publications Database

GIS: Geographic information system for storing, managing and presenting spatial or geographic data

Gold OA: Gold Open Access; free access to articles for which a special fee has been paid by the author or funding authority

Google Earth: A virtual globe, map and geographical information program

Green OA: Green Open Access; self-archiving of articles in an institutional- or a subject repository

HLC: Higher Learning Commission

IPS: Internet Service Provider

Joomla: Open-source content management system for publishing web content

KLM: A file format used to display geographic data

KM: Knowledge management

Legacy collections: Information stored on earlier generations of computer systems and migrated to modern database technologies

LibGuide: SpringShare content management and publishing system

Linux: Open-source Unix-like computer operating system software

MARC record: MAchine-Readable Cataloging record

Metadata: Data that summarizes basic information about data for easier discoverability and workability

OhioLINK: Ohio Library and Information Network

Omeka: Open-source web-publishing platform for library, museum, archives, and scholarly collections and exhibitions

Platform: Hardware or software used to host an application or service, or technology upon which other technologies are built

Project Client: Application code required to interact with an application program interface (API)

PubWest: Trade association of book publishers, printers, editors, proofreaders, graphic designers, binderies, and related editorial and service companies

Schema: A template for cataloging and inventory systems

UNIX: Multiuser computer operating system

USTPO: United States Patent and Trademark Office

UTOPIA: University of Toledo OPen Institutional Archive; digital repository based on CONTENTdm

Vita: A biography or résumé

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