The Use of Institutional Repositories: The Ohio State University Experience

Tschera Harkness Connell

In this paper the author compares the use of digital materials that have been deposited in The Ohio State University (OSU) Knowledge Bank (KB). Comparisons are made for content considered in scope of the university archives and those considered out of scope, for materials originating from different campus sources, and for different types of content. Results show that both mediated and unmediated content is used and therefore justifies the preservation costs for unmediated content. Results also show articles and undergraduate theses are most frequently used type of materials leading to the conclusion that it is important to collect content from all levels of the educational process.

All institutional repositories face the issue of content recruitment. The fact that we speak of recruitment rather than collection development implies that nonlibrarians or nonarchivists have a major role in what goes into the repository and by extension, what is preserved. However, for many universities, librarians and/or archivists set the selection policy for the institutional repository. This selective approach enables the library and archives to decide where to commit tight resources for long-term preservation and maintenance. However, such policies have the potential to diminish a sense of ownership and participation among other units on campus, thus making the repository more a library/archives project than an institutional initiative.

The goals for the institutional repository (IR) determine its content. The concept of the "Knowledge Bank" at the Ohio State University began with a high-level university task force on distance learning. After a year of work, this task force approached the then- Director of Libraries, Joseph J. Branin, with a conceptual model for better managing and using the intellectual digital assets of the institution.[1] This history of interest beyond the libraries has influenced greatly the goals, policies, and management of the Knowledge Bank. The responsibility for getting content is a distributed one. From its inception, the Knowledge Bank was seen as a project of the university and not of the libraries. The role of the libraries is one of knowledge management providing hardware, software, training, and support to entities on campus wanting to make available their digital assets. Many collections originate with subject specialists from the libraries and archives but there are also many collections that originate outside the libraries and archives.

In the summer of 2009, the staffs of the libraries and the archives discussed ways

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to increase collaboration between the two units and to tag content contributed by end-user communities that is also within the scope of the archives. An offshoot result was the desire to know more about the use of IR content. In this paper, the author examines the use of digital materials that have been deposited in The Ohio State University (OSU) Knowledge Bank (KB) from three perspectives:

1) Are there differences in the frequency of use of materials identified by the archives as within scope of their collections and all other materials in the Knowledge Bank?

2) Are there differences in the frequency of use among categories of sources for content? Categories of sources examined are academic units, research centers, support units, and informal communities.

3) Are there differences in the frequency of use among different types of content? Type refers to the nature of the materials; text and moving-image are examples of two of the twenty types of materials examined.

Literature Review

The literature on IRs consistently defines their role as capturing, disseminating, and preserving the intellectual output of an institution.[2] What is meant by intellectual output is not so clear. Writers have described intellectual works, narrowly, as scholarly works,[3] and more broadly as digital materials created by the institution and its community members.[4] A persistent theme is that the primary content of IRs is intended to be faculty research—preprints and postprints. This theme is heavily reflected in early definitions of IRs that emphasize IRs as alternatives to scholarly publishing. As early as 1994, the Association of Research Libraries published an Internet discussion subtitled a "subversive" proposal for electronic publishing.[5] Although this discussion predates IRs, many of the issues raised formed a rationale for their development. The desire to provide alternatives to traditional scholarly publishing is evident in the 2002 *Scholarly Publishing and Academic Resources Coalition* (SPARC) position paper on IRs. Raym Crow writes that, defined broadly, "a digital institutional repository could be any collection of digital material"[6] defined by the institution; but, given the SPARC's emphasis on scholarly communication, SPARC limits its definition to scholarly material. In terms of repository goals, SPARC emphasizes that content must be cumulative and perpetual, and open and interoperable.[7] SPARC's goal is to revise the current model of scholarly publishing.

Clifford Lynch, likewise, sees IRs as a means for "accelerating changes in scholarship and scholarly communication."[8] But he also writes of meeting the needs of the local institutional community. He defines IRs 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."[9] This definition emphasizes the responsibility of the organization in capturing, organizing, distributing, and preserving the institution's digital assets—the services and collaboration of multiple units of the institution. In terms of content, Lynch includes documentation of the activities of the institution as well as research and pedagogical materials.

As the institutional repository experience expands, most writers tie content of the IR to the purpose the individual institutional repository is designed to achieve. Sarah Shreeves and Melissa Cragin write that "just as there is a range of motivations driving the implementation of IRs, the type of content contained in repositories can also vary; this variation is often dependent, of course, upon the goal of the repository."[10] Susan Gibbons notes that Lynch's "set of services" is undefined, because "to be successful an IR must provide the set of services needed by its unique community of users, and these services will and should differ from institution to institution."[11] Marianne Buehler and Marcia Trauernicht

note that "each institution has to make its own philosophical decisions of what items and types of materials are to be included in an IR."[12] Julie Bobay writes that the "original vision for institutional repositories … was to support a worldwide network of interoperable open-access collections of journal articles that had been formally published elsewhere" but that for large academic libraries IRs are "becoming more than repositories of peer-reviewed articles."[13] The content of Western Kentucky University's repository (TopSCHOLAR) is the "scholarly research, creative activity and other full-text learning resources that merit enduring and archival value and permanent access."[14] The Rochester Institute of Technology (RIT) libraries define their content as "peer-reviewed intellectual work, related to research and teaching that also includes materials representing RIT's cultural, historical, and administrative documentation."[15] In addition to peer-reviewed journal articles, Bobay lists access to administrative records, dissertations, grey literature, monographs, small datasets, and retrospective issues of published journals as content institutional repositories may provide.[16] A 2009 article on the IR at Humboldt State University (HSU) describes not only what is collected but what is not. HSU repository collects scholarship produced by HSU faculty, students, and staff. Major emphasis is on theses and projects produced by graduate students. Administrative records and course materials are not included due to the lack of resources for that additional commitment.[17]

Related to what is collected is the issue of who chooses what to collect. Gibbons, when advising on the formulation of policies for an IR, asks this question: "Who can make deposits into an IR: All members of the organization or just one class of members, such as academic faculty? … Will all material be welcome or just those approved by appointed people within the organization?"[18] Lynch places the responsibility for building the collection on the campus community as a whole. Although acknowledging the practical resource constraints such as having enough storage space for large datasets, he argues:

> that complex, cumbersome "gate keeping" policies for admitting materials to institutional repositories—particularly those that emulate practices from traditional scholarly publication such as the use of peer reviewers—are highly counterproductive; this will prevent institutional repositories from supporting and empowering faculty innovators and leaders. Membership in the campus community—certainly, if nothing else, membership in the campus faculty—should be sufficient credential to place materials in the institutional repository.[19]

Crow takes a similar view in stating that "the aim of institutional repositories is to preserve the entire intellectual output of the institution,"[20] which he views in contrast to archives where "university archivists exercise broad discretion in determining which papers and other digital objects to collect and store."[21]

Crow raises the issue of the relationship of IRs and archives. University archives are charged with the responsibility of maintaining university administrative records and preserving materials related to the history of the institution and the activities of the campus community. He also notes that IRs and archives can complement each other or compete with each other.[22] Douglas Bicknese, an archivist, notes that the "role of campus archives is often overlooked"[23] when IRs are established. Looking at issues of selection, he notes that "trying to preserve the entire intellectual output of an institution is a noble goal for an on-line digital repository, although realistically some appraisal of its contents will eventually be required."[24] He offers the expertise and experience of archivists for "selecting records of enduring value" for an online

digital repository (374, p. 88).[25] Don Boadle relates his experience of managing a regional Australian archive. He makes the point that, "like all university-based combined function regional repositories, our most pressing concern remains the scarcity of resources in relation to the number of functions we are expected to perform."[26] Lack of resources and support for IRs are a concern as Dorothea Salo discusses in her 2008 article appraising the state of IRs.[27]

Much of the literature on assessment of IRs focuses the evaluation of the overall system in terms of management, operation and sustainability. The Open Archival Information System (OAIS) Reference Model and the Trustworthy Repository checklist are two frequently discussed tools for planning and evaluating progress of an institutional repository. In 2008, Yong Ho Kim and Hyun Hee Kim analyzed 10 studies of digital libraries and IRs focusing "on criteria and indicators of procedural evaluation."[28] In their review of the literature they identified the inclusion and quality of metadata to be a major consideration in content evaluation. Metadata quality indicators included number of elements, completeness, accuracy, and consistency. Other criteria for evaluating content include currency (number of documents published in last 3 years [% of total]), size, and diversity (number of document types). They also looked at indicators of use. Using the results of the literature review as a base, they "devised the diagnostic IR evaluation framework."[29] Testing that framework, they concluded that the factors of use were the "most crucial performance criterion."[30]

Overall, the literature on evaluating the content of IRs is limited and needed. Martha Whittaker writes that "accountability and the emphasis on return on investment make the assessment of the usage of digital resources essential."[31] This paper helps fill the gap in the literature by examining the use of digital materials that have been deposited in The Ohio State University (OSU) Knowledge Bank (KB).

Background

Description of OSU's selection policy and Knowledge Bank content

The Knowledge Bank is only one of several media that OSU uses to distribute its digital content. For example, OSU mandates that student theses (Masters) and dissertations are submitted to the online OhioLINK Electronic Theses and Dissertation Center. In addition, the libraries have deposited collections with the OhioLINK Digital Media Center. On campus, several enterprisewide systems are used for distributing scholarly content. Carmen (Desire2Learn learning technology) is used by OSU for the management of course content. The Colleges of the Arts and Sciences offers a locally developed tool, Media Manager, to help faculty organize, share, and present digital media files. Media Manager is not meant to be a permanent archive but a working space where faculty can develop resources to share as part of their research and teaching. The libraries publish current electronic journals using both the Open Journal System software and the Knowledge Bank (DSpace software).

In this environment of multiple options, one of the roles of members of the Knowledge Bank management team is to refer potential content to the systems best suited to the goals of the community wanting to make the material available. For example, if a group of faculty is collaborating on the development of an interdisciplinary learning module, they may be referred to the staff of Media Manager; or, if a faculty member wants to limit distribution of the material to current enrollment in her classes, she is encouraged to use Carmen. The content in the Knowledge Bank is openly accessible. This attempt at a distributed approach to knowledge management ties back to the goals of the Knowledge Bank initiators. By the time of the implementation of DSpace at OSU, the original campuswide committee had expanded their vision of knowledge management to include:

> the full array of digital assets and information services available to or being created by OSU faculty, staff, and students. Using this broader definition, many components of the Knowledge Bank already exist. … The institutional repository then became another component, yet to be built, within the larger Knowledge Bank. The advantage of this approach is that it promotes integration of all forms of academic digital content and the recognition that seemingly independent initiatives are actually related.[32]

For clarity, in the remainder of this paper, the term "knowledge management" will be used when referring to the larger vision (all the options); "Knowledge Bank" will be used to refer to OSU's public installation of DSpace. Operationally, OSU has emphasized the service aspect of Lynch's definition of an IR.

> The OSU Knowledge Bank consists of collections submitted by OSU communities. A Knowledge Bank 'community' has an affiliation with the Ohio State University, a focused research interest, has a defined OSU manager/director, and has the ability to set community policies. A community can be an academic department, an administrative unit, or an interdisciplinary center. (The Ohio State University Knowledge Bank Institutional Repository Policies: http://library.osu.edu/sites/kbinfo/policies.html).

It is difficult to give a meaningful number of the collections in the KB because communities choose the granularity at which they present materials and organize their collections. Collections may represent whole scrapbooks or individual photographs, issues of journals or individual articles, or even abstracts. Community responsibilities include selection, deciding policy regarding content to be submitted, deciding who may submit content, and limiting access to content in accordance with the KB Access Policy. Content that has access restrictions is content that has been embargoed for a period of time—one, three, or five years.

Units That Have Collections in the KB

There are 17 academic units (schools, colleges, and departments) that have collections in the Knowledge Bank. These units include the Austin E. Knowlton School of Architecture, the College of Pharmacy, the Department of History, multiple units within Food, Agricultural and Environmental Sciences, the John Glenn School of Public Affairs, the College of Social Work, the School of Earth Sciences, and the Newark campus of the university. The collections of these academic units feature the research of faculty, staff, and students through articles, reports, working papers, newsletters, and journals.

Eleven cross-disciplinary units (laboratories, centers, and institutes) have collections. Examples of units from this group are the East Asian Studies Center, the Institute for Excellence in Justice, the Mershon Center for International Security Studies, the Ohio Agricultural Research and Development Center (OARDC), the Ohio Water Resources Center, and the Olentangy River Wetland Research Park. In addition to research in various formats, these collections contain lectures, speaker series, seminars, and conferences in a variety of formats (audio, video, and/or textual).

Eleven support units have collections in the KB. The Academy of Teaching, the Council on Graduate Students, The Honors and Scholars Program, the University Archives, the Office of Outreach and Engagement, and the University Libraries are examples of this group. The Honors and Scholars Program theses collections are some of our fastest growing collections; the program strongly encourages honors students to deposit their undergraduate theses in the KB before they graduate. The Council on Graduate

Students submits the winners of multiple discipline competitions from the Edward F. Hayes Graduate Research Forum. These support units also contribute newsletters, research lectures, events (for example, a video of a conference), and seminars.

Informal community groups also provide content. Examples from this group are the Ohio State Digital Story Telling community, the Gay community, and the Ukrainian Cultural Association of Central Ohio (which includes members from the university community). Collections from these communities include digital stories, press releases, legal documents, photographs, interviews, lectures, and seminars.

There are several serials in the Knowledge Bank. Some of these are current publications such as newsletters or current journals that are using the KB for distribution. There are also retrospective serials. Both current and retrospective serials are present in the collections of communities described above. In addition, the libraries have added three runs of serials as their own communities. The largest of these is the *Ohio Journal of Science* (OJS), published by the Ohio Academy of Science and made available from 1900 to two years prior to the current year in collaboration with the libraries. This journal is one of the most frequently used resources in the Knowledge Bank. Two other retrospective serials have also been added by the libraries as their own communities: *The Ohio Mining Journal* (1882–1899) and the *Ohio State Engineer* (1918–1945).

Institutional repositories such as the Knowledge Bank require resources to acquire, upgrade, and maintain hardware and software and to staff and manage the repository program. Good stewardship demands that managers of repositories evaluate their efforts. Since 2004, several internal assessments have been made by members of the Digital Initiatives Steering Committee (DISC) of the libraries. In 2007, a gap analysis of OSUL's compliance (in terms of the KB) with the Research Libraries Group and the National Archives and Records Administration (RLG-NARA) Task Force's Trustworthy Repository standard was performed. In 2008, members reviewed the OSU Libraries' compliance with the Open Archival Information System (OAIS) Functional Model. Also in 2008, a subcommittee of DISC performed a general assessment of the operations of the KB. In 2009, the management of the KB initiated a users' group of representatives of KB communities to gather feedback on services and next steps. This research study reported here is the first to look at the frequency of use of materials in the KB.

In this paper, one of the specific comparisons of use is between materials identified by the archives as within the scope (referred to as In-Scope) of their collections and all other materials (Out-Scope) in the Knowledge Bank. In some ways, the goals for the KB and the mission of the University Archives overlap. Both may be collecting material within the scope of the Archives. "The Archives identifies, preserves, and makes available the documentation of continuing and historical value in documenting the University." (http://library.osu.edu/sites/archives/) The KB model to help manage and use the intellectual digital assets of the institution has resulted in a nonrestrictive policy for what is accepted for deposit. The content of the Knowledge Bank includes content of historical value in documenting the university, but it includes other materials as well. The archives use the Knowledge Bank to present and preserve some of the materials that they are charged to collect. Today's technological environment makes it easy for campus units to create and distribute materials that may be of interest to University Archives but are never brought to the attention of archives staff. The Knowledge Bank provides one more way of informing archivists of material of potential interest. In 2009, in addition to the Knowledge Bank Archives collections, university archivists identified items in other collections that they considered to be of historical value for the university.

This study compares the frequency of use of materials In-Scope and Out-Scope. The frequency use of materials is compared among different categories of sources for the material: academic units, research centers, support units, and informal communities. Finally, the frequency of use of different types of materials is compared.

Methods

In the DSpace software, materials are organized by items within a collection. Each item consists of metadata and bitstreams (units of content). An item may have multiple bitstreams. An example of an item with multiple bitstreams might be a multivolume book. The item is the whole work, but the content of the work may be contained in multiple bitstreams, perhaps one bitstream for each volume. This study looked at the use of bitstreams that were deposited in the KB prior to June 1, 2009. Use data were collected for January 1, 2007, through May 31, 2009.

For the purposes of this study, a use is defined as a single download of a bitstream. Although downloads do not necessarily show that the content is used, downloads show, at least potentially, more interest in the content than simply hits on the metadata describing the content.

All KB collections except the Byrd Expedition Photo Albums of the Byrd Polar Research Center and the OSU International Symposium on Molecular Spectroscopy community collections of abstracts were included in the study. There are four photo albums of the 1928–1930 Byrd Antarctic Expedition. Each photo in the albums is an individual bitstream and is represented by its own descriptive metadata. However, because many of the photos in the albums have very similar metadata, it is almost impossible to locate an individual photo.[33] The collections of abstracts from the symposiums on molecular spectroscopy were omitted because the abstract contained in the bitstream is repeated in the metadata for the item. The version of the abstracts in the metadata has been encoded with TeX to facilitate searching by symbols and chemical formulas. The implication in terms of this study is that a user can view the content of the abstract without downloading the bitstream. Therefore, downloads for these collections may not have the same meaning as downloads for other collections.

Use data were collected using AWStats, an open source logfile analyzer available from the open source software development Web site, SourceForge (http://awstats.sourceforge.net/). The "Pages—URL (full list)" portion of the AWStats report provided the number of downloads of the URL for each bitstream that was downloaded; collection and item level hits were eliminated from the data.

Calculations were performed by the use of each bitstream and for the use of each collection. (See table 1.)

To illustrate the definitions in the table, consider the Digital Stories Collection in the Digital Storytelling Community. In 2007, there were 2 bitstreams in this collection. Bitstream #1 was downloaded 24 times in five months. Bitstream #1 use:

TABLE 1
Definitions of Use

Definitions of Use	Description
Bitstream use: Mean number of downloads per month	Sum of number of downloads of the bitstream for the year divided by the number of months the bitstream is in the KB
Collection use: mean bitstream use per collection	Sum of "bitstream use" for all bitstreams in the collection divided by the number of bitstreams in the collection

24/5 = 4.8. Bitstream #2 was downloaded 41 times in five months. Bitstream #2 use: 41/5 = 8.2. The collection use is 6.5—the sum of the bitstream uses (4.8 + 8.2) divided by the two bitstreams in the collection.

Collections in the Knowledge Bank were analyzed as individual collections even in instances where communities of content were presented to the public as multiple collections based on chronological periods. Divided collections fell into two categories: publications (serials) where individual years were presented as a collection and recurring events (conferences and speaker series) where each conference or series is presented as a single collection. Examples of the first case are *Empirical Musicology Review* (EMR) and *The Ohio Journal of Science* (OJS). The four separate collections representing four years of EMR and the 6,546 collections of OJS, each representing a separate issue, were analyzed as separate collections. An example of recurring events collections is the National Symposiums on Doctoral Research in Social Work. The 21 Individual years were analyzed as 21 collections.

The first research question requires a comparison of the use of In-Scope and Out-Scope materials. In the summer of 2009, the staff of the University Archives identified content that was outside their own KB community but that they appraised as having continuing value to OSU's history. This information was shared with staff responsible for the day-to-day operations of the KB in the form of a list. The managers of the KB agreed to add to the metadata an indication of the Archives' interest in the items, thus moving these items to the In-Scope category. As well, University Archives are notified of new collections to determine if they should be added to the list. This list is the source for identifying In-Scope collections to compare with other materials in the KB. The null hypothesis is that the use of In-Scope and Out-Scope collections is the same.

The second research question requires a comparison of the use of materials from different sources. The categories are described above in the "Units That Have Collections in the KB" portion of this paper. The source categories compared are academic units, research centers, support units, and informal communities. The libraries' retrospective serial preservation projects fall with other library content under the support unit category. The null hypothesis is that the use of bitstreams from each source is equal to the use of bitstreams of each of the other sources.

The third research question requires a comparison of the use of materials of different types. For this research, the Dublin Core Metadata Initiative (DCMI) definition of type is used. Type is defined as the nature or genre of the resource (http://dublincore.org/groups/collections/collection-application-profile/index.shtml#vocabs). The DCMI types used to categorize content in this study are: Event, Moving Image, Sound, Still Image, and Text. The types and their definitions as used in this study are included in table 2. In addition, "text" was broken down into subcategories to get a more granular view of the data. The subcategories of text used in this study are: abstract, annual report, article, book or book chapter, data, diary, journal (downloads of entire issues, not articles), newsletter, official university document, oral history, plan or blueprint, poster, presentation (written text of presentation), proceedings, promotional materials (fliers and press releases), slides (presentation slides), technical report, thesis (honors theses), working paper. Material that does not fit into the other textual categories such as handouts, resources to accompany presentations, best practices, and syllabi) were categorized as "other text." The null hypothesis is that the use of the bitstreams of each type are equal to the use of the bitstreams of each other type. The second null hypothesis is that the use of each of the subcategories of text is equal to the use of each of the other subcategories.

T-tests were used to determine if there was a real difference between bitstream

TABLE 2
Working Definitions of Types

DCMI Type	Definition
Event	Used for summaries of events, conference programs, and promotional web pages, etc.
Moving Image	Used for streaming video, including videos of presentations
Sound	Used for streaming audio, including audio of presentations
Still Image	Used for drawings, photos, and images of woodcuts
Text	Used for bitstreams other than those in the above categories

use of the groups tested. For example, the bitstream use for text was 9.7 and the bitstream use for event was 5.0 in 2007. A t-test was performed to see if the difference was great enough that it was not likely to be the result of chance alone. In all cases where t-tests were used, the t-tests were two-tailed, and an unequal variance was presumed.

Analysis and Results

Comparison of the use of materials identified by the archives as within scope of their collections and the out-of-scope materials in the Knowledge Bank

The data in table 3 show that the bitstreams identified as within scope of the university archive collections are downloaded less frequently than the bitstreams considered out of scope. Making the assumption that the bitstreams in this study are a representative sample of the KB content at a future date, and performing a t-test between the groups for each year shows that the differences in use are significant. For all years the results are significant at a level less than .00l. (2007 p-value <.001; 2008 p-value <.001; 2009 p-value <.001) The null hypothesis is rejected.

Figures 1–3 graphically show the differences in use.

Analysis was also performed eliminating the retrospective journal collections (*Ohio Journal of Science*, *The Ohio Mining Journal*, and the *Ohio State Engineer*). These three journals represented over 57 percent (8896/15490) of all the bitstreams in the collections considered out of scope. The *Ohio Journal of Science*, especially, is heavily used so the additional analysis was to determine whether the use of these three journals overwhelmed the results of the comparison of use for all other bitstreams. The results of the comparison with the three journals eliminated shows a significant difference in use for 2008 and 2009. (2007 p-value =.10; 2008 and 2009 p-values <.001) For 2007, the null hypothesis is accepted. For 2008 and 2009, the null hypothesis is rejected.

Comparison of the Use of Materials from Different Sources

The second research question required

TABLE 3
Comparison of Use of Bitstreams Between Materials within Scope for the Archives and Materials Not in Scope for the Archives

	2007		2008		2009	
	In-Scope	Out-of-Scope	In-Scope	Out-of-Scope	In-Scope	Out-of-Scope
No. of collections	1,247	8,384	2,370	11,184	2,513	15,450
Average collection use per month per bitstream	3.6	10.4	2.8	8.2	2.2	5.0

FIGURE 1
Comparison of Average Use for Collections in Scope and Out of Scope of University Archives: 2007

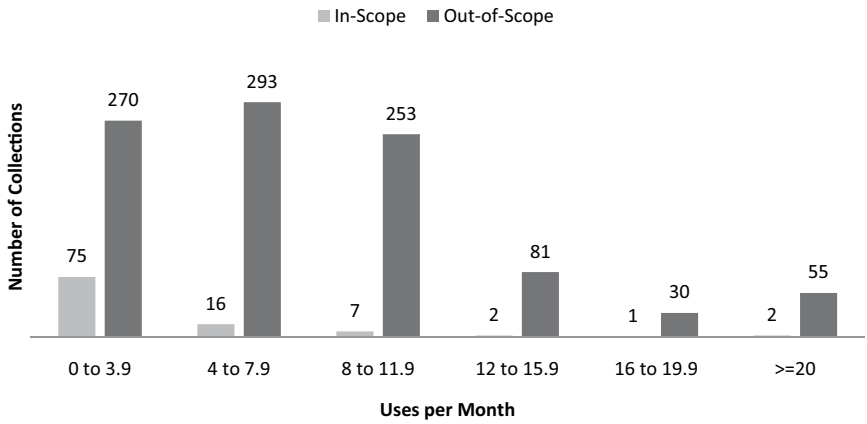
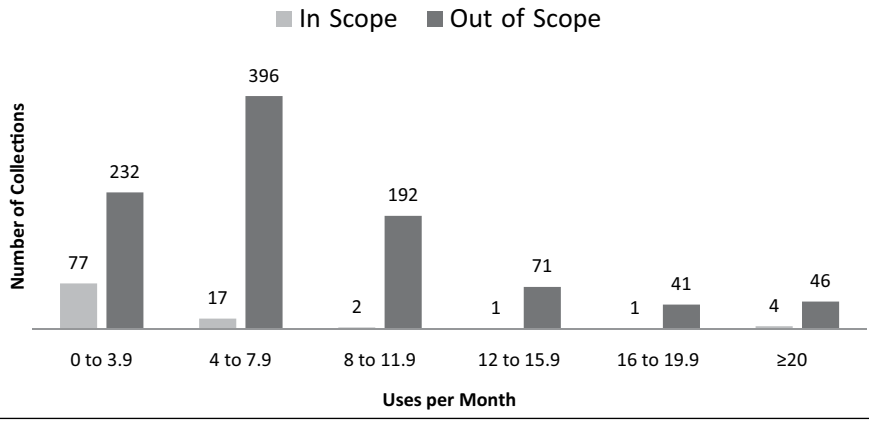


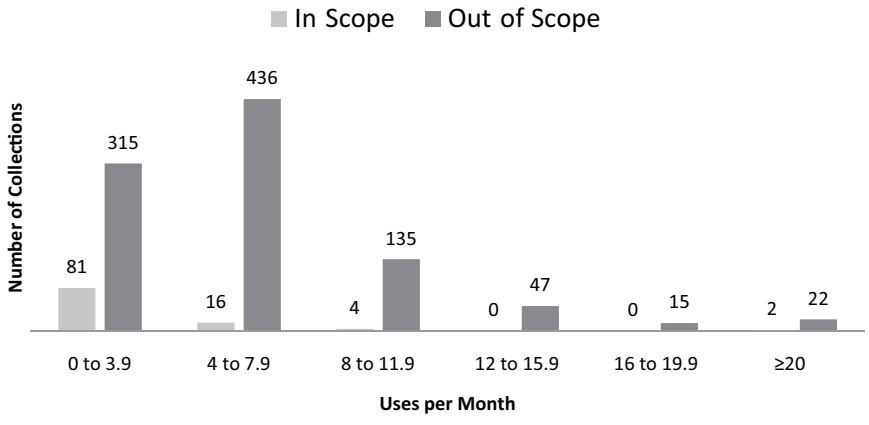
FIGURE 2
Comparison of Average Use for Collections in Scope and Out of Scope of University Archives: 2008



a comparison of the use of bitstreams by the source of the collection in which they were contained. Table 4 shows the number of collections from each source and the source average use. Comparing the use of materials from each type of source with the use of each of the other types of sources indicates that there were no significant differences in use of bitstreams between the types of sources. For 2007, the *p*-values ranged between .25 and .97. For 2008, $p = .45–.84$; for 2009, $p = .29–.88$. For example, a t-test comparing the use of bitstreams from academic units and the use of bitstreams from informal units returned the following *p*-values: 2007 = .44; 2008 = .84; 2009 = .67. A t-test comparing the use of bitstreams from research centers and support units returned the following *p*-values: 2007 = .74; 2008 = .75; 2009 = .88.

A second comparison was performed for the different sources, eliminating the bitstreams of three retrospective journals from the support unit source. The second

FIGURE 3
Comparison of Average Use for Collections in Scope and Out of Scope of University Archives: 2009



analysis also resulted in no significant difference in use. The null hypothesis is accepted.

Comparison of the Use of Materials of Different Types.

The results for t-tests for each pair of types show that, in most cases, the differences in use are significant at a confidence level of 95 percent or above. In some cases, the comparison could not be made because all types of bitstreams were not present in the KB for all years. The null hypothesis that the use of "event" bitstreams and "moving image" bitstreams is the same is accepted for all of the three years. Similarly, the null hypothesis is accepted for the use of event bitstreams and sound bitstreams, and for image bitstreams and sound bitstreams in 2009. In all other cases where comparisons are applicable, the null hypotheses are rejected. (See table 5 for results of the comparisons.)

Because of the large proportion of bitstreams (35,031/37,289, or 94%) categorized as text, comparisons of use were made for different types of text. Text was divided into 20 subtypes: abstract, annual report, article, book or book chapter, data, diary, journal, newsletter, official university document, oral history, plan or blueprint, poster, presentation, proceedings, promotional materials, slides, technical report, other text, thesis, and working paper. The use of each subtype was compared with the use of each other subtype. For example, the use of abstracts was compared with the use of annual

TABLE 4
Use by Source of Material

Source	2007		2008		2009	
	Number of collections	Average use	Number of collections	Average use	Number of collections	Average use
Academic unit	629	4.2	791	4.8	799	3.8
Informal community	15	9.7	42	8.3	97	8.2
Research Center	866	7.9	1951	5.1	2360	3.7
Support unit	8,121	10.1	10,770	7.8	11,654	6.0

TABLE 5
Significance of Results of Comparison of Bitstream Use between Types: *p*-values*

Types Compared	Average Bitstream Use 2007	2007 *p*-value	Average Bitstream Use 2008	2008 *p*-value	Average Bitstream Use 2009	2009 *p*-value
Event / Image					**1.8** / 0.4	< .001
Event / Moving Image	5.0 / 4.5	.558	3.1 / 3.0	.984	1.8 / 2.4	.260
Event / Sound			**3.1** / 0.1	< .001	1.8 / 1.4	.279
Event / Text	5.0 / **9.7**	< .001	3.1 / **7.6**	< .001	1.8 / **6.2**	< .001
Image / Moving Image					0.4 / **2.4**	< .001
Image / Sound					0.4 / **1.4**	.018
Image / Text					0.4 / **6.2**	< .001
Moving Image / Sound			3.0 / 0.1	< .001	2.4 / 1.4	.100
Moving Image / Text	4.5 / **9.7**	< .001	3.0 / **6.2**	< .001	2.4 / **6.2**	< .001

*measure of how rare the result would be if the null hypothesis were true
Difference in use significant when $p < .05$
Bold indicates type with greatest use, when difference is significant
Blank = Not applicable; one of the types had no bitstreams

reports, and articles, and books or book chapters, and so on. If all of the subtypes had been present for all three years, there would be 57 comparisons per type (19 per year times 3). However, two of the subtypes were not present all years. Official university documents were present for only 2008 and 2009; data were only present in 2009. In all, 1,018 comparisons were made. (A complete list can be found in the appendix.)

Of the 1,018 comparisons, nearly half (502/1,018) showed significant differences in use at a .05 level of significance. Figure 4 reflects the 502 instances of significant differences in use. The 20 subtypes are ranked by the portion of cases where use was significantly higher than for other types. For example: Article was compared 54 times; 42 of the comparisons resulted in significant differences in use. Of those 42, article was used more frequently 41 times; less frequently one time; and about the same 13 times (that is to say, no significant difference in use). The one instance when article was used less frequently than another subtype was in 2008 when diary was used more. However, for 2007, article was used more frequently; and, in 2009, it was used the same amount.

At the other extreme, in 54 comparisons of the use of plans or blueprints with other subtypes, there were 28 significant differences in use. In only one instance were plans used more than another subtype (plans were used more than official university documents in 2008). In 27 instances, plans were used less frequently than other types; and, in 26 instances, there were no differences in use.

Discussion

There is clearly a difference in use of materials identified by the archives as within scope of their collections and the out-of-scope materials in the Knowledge Bank. This difference remains even when large runs of retrospective journals are removed from consideration.

What this means is not so clear. Many of the documents in the University Archives Knowledge Bank collections are also available on the university's Web sites, especially if the content is current. Examples

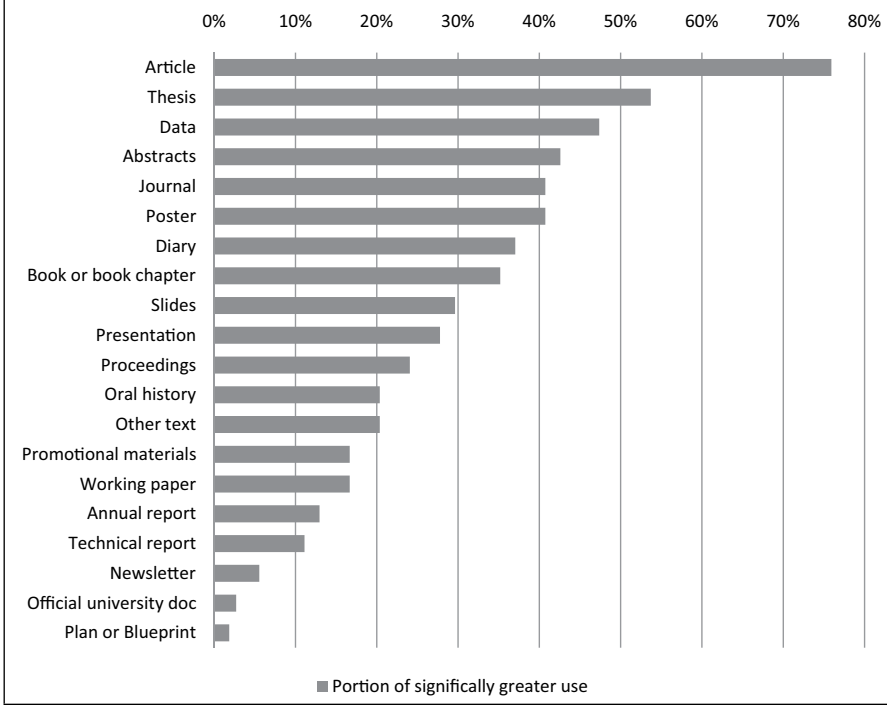
include the Board of Trustees Bylaws, the Code of Student Conduct, and the Rules of the University. The Fifteenth Day Enrollment Highlights (for each quarter) have both current and retrospective content, but this collection is an exception. Even in cases where the content considered in scope for the archives but is in other collections, the content may be also available on the university's Web. Two examples are the videos of the University Distinguished Lectures and the conference material of the Mershon Center for International Security Studies. In both these cases, the content is currently available from the Office of Academic Affairs site and the Mershon Center's site respectively. These Web sites are older than the Knowledge Bank and likely have users who are accustomed to going to the Web sites for information and have had no need to get this information from the Knowledge Bank. Over time this may change as the content of the sites change. If older material is removed from the sites, it will still be available from the Knowledge Bank.

A related issue is how the archives are used. By their nature, archives are historical collections. The Knowledge Bank is six years old and most of the material identified as of interest to the archives is not yet historical. As well, the materials of interest to the Archives are not extensive. The Archives Knowledge Bank collections are still being established. Without a critical mass, it is difficult to know how these collections will be used. In this case, a comparison with use ten years from now will be helpful.

Future availability points out another important purpose of archives:

> Institutional archivists who use a digital repository for administrative records employ it not only for informational purposes but also evi-

FIGURE 4
Text Types Ranked by Portion of Significantly Greater Use



> dential. In the latter case, use is only part of the rationale, the other being the importance of the documents in providing evidence for administrative, legal, and historical reasons of the functions and transactions of the organization.[34]

From this perspective, use cannot be the only metric for evaluating archives content in an institutional repository. However, even without knowing whether the use of material of interest to the archives is indicative of future use, or if archives content is fulfilling other purposes, the results of this study show that nonmediated selection of materials has yielded content that is used.

The second research question addressed the issue whether there were differences in use between different sources of material. The four sources examined were academic units, informal groups, research centers, and support units. The speculation was that these different units would offer content that was different in nature from the content of the other sources. For example, perhaps the research centers archived research results, but the informal groups archived material more documentary in nature. Perhaps the academic units archived faculty papers, while the support units archived policies, procedures, and content that could be considered reference in nature. However, there were no differences in the use of bitstreams from the four sources defined in this study. A closer examination of the bitstreams from each of the sources revealed that all the sources had a broad range of content. Research centers, academic and support units documented conferences, archived research papers, and posted videos of lectures. All four of the groups contained primary sources. The use of "sources" as defined in this study was not a good way to look at differences in the nature or purposes of the content.

There were differences in the amount of use for the different types of content. In all cases, text was most used and images were least used. Images in the Knowledge Bank are not well presented, which could be one factor in their low use. Users of images need to be able to zoom and to browse, neither of which is possible in the current version of the Knowledge Bank.

Ninety-four percent of Knowledge Bank content is text. Text is by far the most used type of material. It is not known if this result is due to the predominance of text in the Knowledge Bank or whether it represents a true preference on the part of users. Additional study is needed.

An examination of 20 subtypes of text reveals that articles and theses are the most used. In many ways, articles and theses are similar. They are both a record of research. The principal difference is that theses are the work of undergraduate students, while articles can be the work of faculty or students. However, most articles in the Knowledge Bank are the work of faculty or graduate students. This study shows that these forms of reporting research results are the most frequently used types of text in the Knowledge Bank.

Posters, presentations, and slides are all media for documenting oral presentations. These three text types fall lower on the ranked list of types use when compared with articles, theses, data, abstracts, and journals. Oral presentations are often new information, presented before it is written and published. It would be useful to know why formerly published material is used more frequently. One possibility is that the Knowledge Bank is open access, which allows people anywhere free access to the information. For journal articles, open access provides an avenue to the content without cost to the user. For theses, the content is unique and is distributed through the Knowledge Bank. Another possibility is that articles, theses, and journals all go through a process of review: articles and journals by editors or peer reviewers and theses by faculty advisors. Oral presentations, while timely, often are given without prereview.

The two types least used are plans or blueprints and official university documents. Almost all the plans come from a single collection, the Herrick archives. John H. Herrick compiled building documentation for every known structure at The Ohio State University from the inception of the university in the 1870s through 1988. The plans are drawings of the structures. The fact that all the plans represent a single, narrow topic is likely to limit their use. Official university documents are a relatively new addition to the Knowledge Bank; at the time, the data gathered numbered only 64. Until more documents are collected, they will probably have limited use. And, as was noted in the results section, most of these documents are also available on the university's Web site.

Conclusions

The results of this study begin to inform an understanding of the use of materials in the Knowledge Bank. Currently, services relating to depositing material in the Knowledge Bank are free to the university community. If, at some point, the libraries decide to charge for storage of large collections, it would be interesting to know how such a decision would affect both the content and the use of community collections.

Although there were differences in the amount of use between materials in scope and out of scope, the implications of this result are not clear. Due to the fact that Knowledge Bank materials out of scope to the Archives are used significantly more frequently, it is reasonable to conclude that these materials are useful as well. From this perspective, the results show that nonmediated selection yields content that is used and therefore justifies the preservation costs.

The goal of determining whether there were differences in use between different sources of material was based on the assumption that different units offer content that was different in nature from the content of the other sources. The reasons that this was not a good approach to the issue have been discussed. Future research is needed to determine whether the nature of the content (research, policies, procedures) is a determinant of use.

All types of materials that comprise the Knowledge Bank are used and this supports continuing to collect a variety of types of material. Whether the fact that text is used more frequently than any other type of content is due to users' preference for text or that text is the most predominant form of content in the Knowledge Bank has not been determined.

The fact that undergraduate theses rank almost as highly as articles underlines the importance of collecting content from all levels of the educational process. Future research can help to determine if this result is due to the egalitarian nature of the Internet, where a searcher has no direct way of determining whether results are peer reviewed. The results of a study of download statistics for the open access institutional repository at the University of Wollongong, Australia, revealed that, during the six months studied, 95.8 percent of the referrals to the repository came from Google. Most of these referrals linked directly from the search results to the pdf of the document.[35] The extensive use of theses and articles could also be evidence of a cultural shift, in which users value access and/or currency over peer-reviewed information.

Appendix: Comparison of Each Text Subtype with the Use of Each Other Text Subtype

Key:
A symbol in the cell means that the difference in use between the type listed in the row and the type listed in the header is significant at the .05 level.

Plus "+" means that type listed in the row is used more frequently than type listed in header.

Minus "-" means that type listed in the row is used less frequently than type listed in header.

Abstract	**2007**	**2008**	**2009**	**Annual report**	**2007**	**2008**	**2009**
				Abstract		+	
Annual report		-					
Article	+	+	+	Article	+	+	+
Book/book chapter			+	Book/book chapter		+	+
Data	NA	NA	+	Data	NA	NA	+
Diary		+		Diary		+	
Journal			+	Journal		+	+
Newsletter		-	-	Newsletter	-	-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history				Oral history			
Plan or Blueprint		-	-	Plan or Blueprint	-	-	-
Poster		+	+	Poster		+	+
Presentation			+	Presentation		+	+
Proceedings		+	+	Proceedings	-	+	+
Promo materials	-			Promo materials	+		
Slides			+	Slides		+	
Technical report				Technical report			
Text			+	Text		+	+
Thesis		+	+	Thesis	+	+	+
Working paper			+	Working paper			

Article	**2007**	**2008**	**2009**	**Book/book chapter**	**2007**	**2008**	**2009**
Abstract	-	-	-	Abstract			-
Annual report	-	-	-	Annual report		-	-
				Article	+	+	
Book/book chapter	-	-					
Data	NA	NA	-	Data	NA	NA	
Diary	-	+		Diary		+	
Journal	-		-	Journal	+		-

Newsletter	-	-	-	Newsletter	-	-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history	-	-	-	Oral history		-	-
Plan or Blueprint	-	-	-	Plan or Blueprint	-	-	-
Poster	-	-	-	Poster	+		-
Presentation		-	-	Presentation			-
Proceedings	-		-	Proceedings	-	+	
Promo materials	-	-	-	Promo materials		-	-
Slides	-	-	-	Slides			-
Technical report	-	-	-	Technical report			-
Text	-	-		Text			
Thesis		-		Thesis	+	+	
Working paper	-	-	-	Working paper			-

Data	**2007**	**2008**	**2009**	**Diary**	**2007**	**2008**	**2009**
Abstract	NA	NA	-	Abstract		-	
Annual report	NA	NA	-	Annual report		-	
Article	NA	NA	+	Article	+	+	
Book/book chapter	NA	NA		Book/book chapter		-	
				Data	NA	NA	
Diary	NA	NA					
Journal	NA	NA		Journal	+	-	
Newsletter	NA	NA	-	Newsletter	-	-	
Official univ doc	NA	NA	-	Official univ doc	NA	-	
Oral history	NA	NA	-	Oral history		-	
Plan or Blueprint	NA	NA	-	Plan or Blueprint	-	-	-
Poster	NA	NA		Poster	+	-	
Presentation	NA	NA		Presentation		-	-
Proceedings	NA	NA		Proceedings	-	-	
Promo materials	NA	NA	-	Promo materials		-	
Slides	NA	NA	-	Slides	+	-	
Technical report	NA	NA	-	Technical report		-	-
Text	NA	NA		Text		-	
Thesis	NA	NA		Thesis	+		
Working paper	NA	NA		Working paper		-	

Journal	**2007**	**2008**	**2009**	**Newsletter**	**2007**	**2008**	**2009**
Abstract			-	Abstract		+	+
Annual report		-	-	Annual report	+	+	+
Article	+		+	Article	+	+	+

Book/book chapter	-		+	Book/book chapter	+	+	+
Data	NA	NA		Data	NA	NA	+
Diary	-	+		Diary	+	+	
				Journal	+	+	+
Newsletter	-	-	-				
Official univ doc	NA	-	-	Official univ doc	NA	-	
Oral history	-	-	-	Oral history	+	+	+
Plan or Blueprint	-	-	-	Plan or Blueprint		-	-
Poster			-	Poster	+	+	+
Presentation			-	Presentation		+	+
Proceedings	-	+		Proceedings		+	+
Promo materials	-	-	-	Promo materials	+	+	
Slides		-	-	Slides	+	+	+
Technical report			-	Technical report	+		
Text				Text	+	+	+
Thesis		+	+	Thesis	+	+	+
Working paper	-			Working paper	+	+	+

Official university document	**2007**	**2008**	**2009**	**Oral history**	**2007**	**2008**	**2009**
Abstract	NA	+	+	Abstract			
Annual report	NA	+	+	Annual report			
Article	NA	+	+	Article	+	-	+
Book/book chapter	NA	+	+	Book/book chapter		+	+
Data	NA	NA	+	Data	NA	NA	+
Diary	NA	+		Diary		+	
Journal	NA	+	+	Journal	+	+	+
Newsletter	NA	+		Newsletter	-	-	-
				Official univ doc	NA	-	-
Oral history	NA	+	+				
Plan or Blueprint	NA	+	-	Plan or Blueprint	-	-	-
Poster	NA	+	+	Poster	+	+	+
Presentation	NA	+	+	Presentation		+	+
Proceedings	NA	+	+	Proceedings	-	+	+
Promo materials	NA	+	+	Promo materials	+	-	
Slides	NA	+	+	Slides	+	+	+
Technical report	NA	+		Technical report			
Text	NA	+	+	Text	+		+
Thesis	NA	+	+	Thesis	+		+
Working paper	NA	+	+	Working paper			

Plan or Blueprint	2007	2008	2009	Poster	2007	2008	2009
Abstract		+	+	Abstract		-	-
Annual report	+	+	+	Annual report		-	-
Article	+	+	+	Article	+	+	
Book/book chapter	+	+	+	Book/book chapter	-		-
Data	NA	NA	+	Data	NA	NA	
Diary	+	+	+	Diary	-	+	
Journal	+	+	+	Journal			+
Newsletter		+	+	Newsletter	-	-	-
Official univ doc	NA	-	+	Official univ doc	NA	-	-
Oral history	+	+	+	Oral history	-	-	-
				Plan or Blueprint	-	-	-
Poster	+	+	+				
Presentation		+	+	Presentation			
Proceedings		+	+	Proceedings	-	+	
Promo materials	+	+	+	Promo materials	-	-	-
Slides	+	+	+	Slides		-	
Technical report	+		+	Technical report			-
Text	+	+	+	Text			
Thesis	+	+	+	Thesis		+	+
Working paper	+	+	+	Working paper	-		

Presentation	2007	2008	2009	Proceedings	2007	2008	2009
Abstract			-	Abstract		-	-
Annual report		-	-	Annual report	+	-	-
Article		+	+	Article	+		+
Book/book chapter		+		Book/book chapter	+	-	
Data	NA	NA		Data	NA	NA	
Diary		+		Diary	+	+	
Journal			+	Journal	+	-	
Newsletter		-	-	Newsletter		-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history	-	-	-	Oral history	+	-	-
Plan or Blueprint		-	-	Plan or Blueprint		-	-
Poster				Poster	+	-	
				Presentation		+	-
Proceedings		+	+				
Promo materials	-	-		Promo materials	+	-	-
Slides		-		Slides	+	-	-

Technical report				Technical report	+	-	-
Text				Text	+	-	
Thesis		+	+	Thesis	+		
Working paper				Working paper	+	-	

Promotional materials	**2007**	**2008**	**2009**	**Slides**	**2007**	**2008**	**2009**
Abstract		+		Abstract			-
Annual report		+		Annual report		-	
Article	+	+	+	Article	+	+	+
Book/book chapter	+	+		Book/book chapter	-		+
Data	NA	NA	+	Data	NA	NA	+
Diary		+		Diary	-	+	
Journal	+	+	+	Journal		+	+
Newsletter	-	-		Newsletter	-	-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history	-	+		Oral history	-	-	-
Plan or Blueprint	-	-	-	Plan or Blueprint	-	-	-
Poster	+	+	+	Poster		+	
Presentation		+	+	Presentation		+	
Proceedings	-	+	+	Proceedings	-	+	+
				Promo materials	-	-	-
Slides	+	+	+				
Technical report				Technical report			
Text		+	+	Text			
Thesis	+	+	+	Thesis		+	+
Working paper		-		Working paper	-		

Tech report	**2007**	**2008**	**2009**	**Text**	**2007**	**2008**	**2009**
Abstract				Abstract			-
Annual report				Annual report		-	-
Article	+	+	+	Article	+	+	
Book/book chapter			+	Book/book chapter			
Data	NA	NA	+	Data	NA	NA	
Diary		+		Diary		+	
Journal			+	Journal			
Newsletter	-			Newsletter	-	-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history				Oral history	-		-
Plan or Blueprint	-		-	Plan or Blueprint	-	-	-

Poster			+	Poster			
Presentation				Presentation			
Proceedings	-	+	+	Proceedings	-	+	
Promo materials				Promo materials		-	-
Slides				Slides			
				Technical report			-
Text			+				
Thesis		+	+	Thesis		+	
Working paper				Working paper			

Thesis	**2007**	**2008**	**2009**	**Working paper**	**2007**	**2008**	**2009**
Abstract		-	-	Abstract			-
Annual report	-	-	-	Annual report			
Article				Article	+	+	+
Book/book chapter	-	-		Book/book chapter			+
Data	NA	NA		Data	NA	NA	
Diary	+			Diary		+	
Journal		-	-	Journal	+		
Newsletter	-	-	-	Newsletter	-	-	-
Official univ doc	NA	-	-	Official univ doc	NA	-	-
Oral history	-		-	Oral history			
Plan or Blueprint	-	-	-	Plan or Blueprint	-	-	-
Poster		-	-	Poster	+		
Presentation		-	-	Presentation			
Proceedings	-			Proceedings	-	+	
Promo materials	-	-	-	Promo materials	-		
Slides		-	-	Slides	+		
Technical report		-	-	Technical report			
Text		-		Text			
				Thesis	+	+	+
Working paper	-	-	-				

Notes

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