Role of the library service in the research enterprise

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ABSTRACT

Libraries are very important in research. Have provided services to researchers for many years. Changes in technology and new publishing models provide opportunities for libraries to be more involved in the research enterprise. Within this article, the author reviews traditional library services, briefly describes the eScience and publishing landscape as it relates to libraries, and explores possible library programs in support of research. Many of the new opportunities require new partnerships, both within the institution and externally. So that how can we improve our research? And how can useful library service in our research enterprise?? That is two most important questions for our research and answer is specifying in this article.

Keywords: *Library, Library service, Research Enterprise*

Digital technologies, from sensors to analytical instrumentation, are increasingly a core component of observational and experimental research. Meanwhile, changes in scholarly publishing offer new opportunities for researchers to share the products of their work in ways that weren't previously possible.

There has been an increasing interest in the library field to better connect with the research needs of faculty and students, and to explore how the skills, knowledge, and practices of librarianship could be applied towards supporting evolving e Science paradigms, particularly in the area of data curation.

TRADITIONAL LIBRARY SERVICES

In the naïve view, all researchers want from the library are journals, journals, and more journals – free and online. They see little need to visit the library or communicate with librarians. Information professionals can certainly do many things to improve the usability of the journal literature. More and better tools are available to study researcher use of articles, from reading to citation patterns, which can be leveraged to better target purchasing and licensing decisions. Search engines, from Google Scholar to PubMed, are continually being improved to enhance retrieval of relevant information. Libraries have long provided training and research consultation services to improve the efficiency with which end-users search literature databases. Librarians help researchers manage citations and articles, providing training and support for products such

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as EndNote and RefWorks. Support researcher access to the literature, especially in times of shrinking budgets in higher education. Increasingly, when researchers can't access the journal articles they need, they bypass traditional library services such as document delivery and interlibrary loan, which may be perceived as expensive and cumbersome, and instead email authors and colleagues. Commercial organizations, from publishers to aggregators, are marketing individual articles via pay-perview, in partnership or competition with libraries. Breaking down the traditional unit of the journal volume or issue into commercially marketable units challenges the old models of collecting and acquiring journal literature for researchers.

As Jim Gray described it, eScience is a "transformed scientific method" or "the fourth paradigm." Research was originally empirical. In the last few hundred years, theoretical models emerged. More recently, researchers have been able to use computational tools to explore simulations of complex environments. Now we have access to vast quantities of data from experiments and instruments, massive simulations, metaanalysis of research results, and more. Gray argues that this is a new way of doing research and requires a new model for conducting scientific inquiry (Gray 2009). However, not all research that falls under the rubric of e Science is conducted at the grand scale of particle physics or genomic experiments. There are many challenges facing researchers working at a variety of scales of data.

The explosion of publishing, driven by an increasingly competitive tenure and promotion environment and the growing specialization of science, has made a vast amount of journal literature available to researchers. Researchers are reading more and more articles every year, yet spend less and less time reading each individual article (Tenopir 2009). It is clear that technology is also presenting new data management challenges for researchers. Resource Navigators working with the eagle-i Consortium discovered that the vast majority of academic biomedical research laboratories do not have an effective inventory system for managing physical or digital resources (Shaffer 2012). The proliferation of computer files can transform the traditional lab notebook into a complex mess of spreadsheets and documents that can only be interpreted by the producer, if they can be found and interpreted at all.

Beyond the simple, yet massive, increase in the volume of research data collection, the complexity and diversity of data is increasing. Data manipulation technologies and algorithms can be so intricate that some researchers have posed fundamental questions about the reproducibility of computational research (Stodden 2010). Technology is also allowing the integration of quantitative and qualitative data in ways not previously possible, raising new data management issues (Estabrooks 2009). Funding agencies are beginning to mandate data sharing plans in grant applications to facilitate data reuse and eliminate redundancy. Technology is facilitating the sharing of research information prior to traditional publishing patterns, as seen in the emergence of "Science 2.0" or open science (Waldrop 2008).

Technology is also changing the culture of research. The emergence of team science challenges investigators to work together in new ways. In the example of health sciences, the dominance of the R01 grant is slowly giving way to the rise of Program Project and Center Grants. Wuchty, et al. (2007) showed that teams are growing larger, and their articles are more highly cited than solo authored articles. The National Institutes of Health's emphasis on translational science is bringing basic science investigators together with   clinicians to speed the transfer of knowledge

from the bench to the bedside. Schools are revising tenure policies to recognize that not every researcher will have the opportunity to be first author, and articles with 20 or more authors are not uncommon. The institutional organization needed to manage multidisciplinary and team research and is promoting the development of new skill sets and support structures (Boardman 2013). Superstar researchers are managing teams of hundreds, rather than individual labs staffed with a small group of students, research associates, and postdoctoral scholars.

In order to identify new roles for libraries in the research enterprise, librarians must first gain a deep and multi-faceted understanding of the research environment at their own institutions. In the DuraSpace/ARL/DLF EScience Institute, teams from dozens of research libraries examined their local environments through interviews with stakeholders, surveys, identification of primary areas of research emphasis, and analysis of institutional culture. The landscape analysis conducted by the teams took place with an understanding that an exploration of the research environment must include perspectives that are outside of the normal context of library research. Participation in planning by researchers, research administrators, and other service providers is essential. Outside voices provide important contextual information and opinions that help to inform the broader discussions taking place around e Science and data management.

The E-Science Institute teams, which included at least one person external to the library, created an inventory of the services and resources currently available to research teams. Some teams found that there was significant centralization of research administration, information technology, financial services, and other units providing services, while other teams found silos and fragmentation. Understanding the often complex array over overlapping services and providers helped libraries begin to identify gaps, which the library might help fill. Libraries also discovered unexpected pockets of research in institutes, departments, and units that were not traditionally considered research centers on their campuses (The Dura Space/ARL/ DLF 2012 E-science Institute 2012).

At the University of North Carolina at Chapel Hill (UNC), the Provost's Task Force on the Stewardship of Digital Research Data, which included representatives from the Library and across the campus, conducted a research data stewardship survey (Provost's Task Force on the Stewardship of Digital Research Data 2012). In partnership with the Oregon Health & Science University (OHSU) Research Council, the OHSU Library implemented the UNC survey (revised to better fit the local setting in Oregon). Getting direct feedback from researchers at the local institution is crucial to identifying their pain points in management of data and other research products.

THE ROLE OF THE LIBRARY

There are many roles that libraries have assumed in supporting e Science. In 2009, the Association of American Universities, Association of Research Libraries, Coalition for Networked Information, and the National Association of State Universities and Land Grant Colleges issued a call to action urging libraries to become involved in the dissemination of the full range of products of faculty research and scholarship throughout the research lifecycle (Hahn 2009). The e Science Institute was one of many responses to that call. However, there is little consensus on which, if any, objectives research libraries should pursue in this arena. New NSF and NIH regulations requiring researchers to include data management plans in grant

applications appear to offer libraries a new entrée into the research process. The data lifecycle model of describing the products of research provides a way for librarians to examine issues related to the curtain of information from the inception of an experiment or project through the publication of results (Humphrey 2012).

Research data services can be seen as a natural extension of the research library's mission to collect, preserve, and make available to scholars a documented record of research. Libraries have traditionally fulfilled this charge at the end of the research process: making articles available via journal subscriptions, assisting with citation management, assessing research impact through bibliometrics and citation analysis, and assisting researchers with finding relevant published literature. In recent years, libraries have begun assisting with regulatory compliance, most notably in assisting researchers with required deposit of article manuscripts in Pub Med Central to comply with the NIH Public Access Policy. In response to changes in scholarly communication, librarians have promoted open access and formed organizations like the Scholarly Publishing and Academic Resources Coalition (SPARC). Librarian expertise with metadata design, selection, and application could be applied to the data curtain and sharing process. Lessons learned in preservation and archiving seem to be applicable to the challenges researchers face in storing data and making it available for analysis and reuse. The suggestion that data citations could be used in tenure and promotion has a clear analogue to article citation and bibliometric analysis.

However, there are many potential barriers to data sharing. Some potential partners, such as technology transfer and business development offices, might want to restrict data sharing in ways that seem antithetical to many librarians' philosophy of free and open sharing of information. Libraries must find ways to work with these partners in the service of researchers, rather than treating them as competitors and wasting limited resources on conflict. There are many reasons that privacy of information may be more important to the institution or the re searcher than data sharing. The severe penalties associated with release of individually identifiable health information under the Health Information Portability and Accountability Act, protection of the safety of researchers working in controversial fields like primate research, and the need to respect the cultural and privacy rights of study populations are just three examples. In some disciplines, researchers have a natural inclination to keep data secret to prevent being 'scooped,' or because they fear data misuse. In any case, curetting data – publishing and archiving for preservation - is difficult and time consuming. This should not be discounted as perhaps the largest impediment to data sharing.

There are also potential roles for libraries in promoting the scholarly outputs of their institutions. At OHSU, the Library participates in Research Week, an annual celebration of campus research that brings together people from across disciplines. Librarians and bioinformaticists at the Bernard Becker Medical Library of Washington University have developed a model for assessment of research impact (Sarli 2010). Expertise systems are being used by libraries on some campuses to highlight interests and accomplishments of researchers at an institution.

Expertise systems, such as VIVO, SciVal Experts, and Harvard Profiles, have been implemented at many research institutions. These tools can be used to promote an institution, to help build multidisciplinary or translational research teams, and to help research administrators make

investment and recruiting decisions. The eagle-i Consortium is indexing research resources, such as core facilities, model organisms, antibodies, and plasmids, to facilitate sharing and re-use (Vasilevsky 2012). At many campuses, libraries are key players in building and publicizing expertise systems. However, other campuses have implemented systems without library involvement, so this is an area where the role of the library is not universally accepted.

The OHSU Library Ontology Development Group is developing an Integrated Semantic Framework (ISF), which will merge expertise and resource ontologies and allow for the integration of linked open data between disparate systems (Torniai 2011). This project is one of many multi-institution ontology collaborations with partners from industry and academia, bringing together domain specialists, computer scientists, librarians, and other information scientists.

The E-Science Institute demonstrated that there is wide interest in providing e Science services by libraries. It also demonstrated that libraries are all over the map in developing and implementing services. There is as yet no consensus on what services should or will be considered essential for libraries to provide. This is not the first time that libraries have developed new services and programs, which are then seen as essential for research libraries to adopt in order to stay current. However, the institutional repository serves as a cautionary warning. Even where there is a defined need and service to respond to the need, it's not clear that libraries will be the ones to take on new roles – competing service providers may be more successful (Carlson 2013). Perhaps the library can play a role as a connecting unit that helps unify the institution it serves, as the "Switzerland" of the research enterprise (Wirz 2012).

The five organizational stages for data curtain developed by Kenney and McGovern (2003) could provide libraries that are considering development of e Science services a tool with which measure their current status and future potential. Institutions may acknowledge that there is an issue to address (stage 1), determine that e-research is of interest locally; act (stage 2), initiating relevant projects; consolidate (stage 3), shifting from projects to programs; institutionalize (stage 4), incorporate the broader environment and rationalizing programs; or externalize (stage 5) embracing inter-institutional collaboration and dependencies.

There are also questions about the workforce required for e-science initiatives. In addition to traditional library roles, such as cataloger, systems specialist, and reference librarian, libraries will also need new types of expertise, such as domain specialists, ontologists, and data curators. Will the existing workforce need retooling? Will nonlibrarians need to be hired? Or will new professional roles need to be developed? In the remainder of this issue, librarians and information scientists will try to answer these questions, as they describe a new kind of collaboration: information professionals embedded in research teams as informationists.

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