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Understanding the 21st Century Research Landscape: Emerging Trends and Needs Within and Across Disciplines

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INTRODUCTION (MIKE DIAZ)

The needs of researchers in key disciplines are changing rapidly, and this has important implications for the library's role in enhancing research productivity and impact. It is critical that librarians create a roadmap for supporting 21st century research needs that draws on published research and librarians' collective experience. It is important to understand the extent to which there are common threads to 21st century research needs that cut across all subject areas. It is also critical to observe the extent to which emerging trends in research needs are common to the sciences, social sciences, or humanities and the degree to which they are discipline specific.

AVAILABLE RESEARCH

An abundance of free, openly available research is available to academic libraries at no cost to assess current trends in researcher needs. Research Information Network has published a number of key overviews on this topic. Recent ones include a presentation at the Fiesole Collection Development Retreat, *Patterns of Information Use and Exchange Across Disciplines* (May 2011), a report on the humanities, Reinventing Research – Information Practices in the Humanities (April 2011), and a report on the sciences in partnership with the British Library, Case Studies of Researchers in the Life Sciences (November 2009). Ithaka also offers a Faculty Survey and discipline reports in Education, Economics , History, and Biosciences, and they have just announced new discipline reports in Chemistry (with JISC) and History (with National Endowment for the Humanities). Other recent reports which offer notable finding are JISC/RIN/OCLC –The Digital Information Seeker and Social Media and Research Workflow from CIBER, University College London, and Emerald.

RECURRING THEMES IN RESEARCH

One common thread from much of the available research is the challenge of finding new modes of collaboration in research. Articles and papers have long been a collaborative enterprise, especially in key areas of the sciences. Funding organizations are also encouraging institutions and scholars to collaborate. Universities are doing more extensive outreach to organizations, corporations, and public. Research has also become a more global, interdisciplinary enterprise. Collaboration is generally less advanced in most areas of the humanities than in the sciences. While a host of new technologies and tools are now available to enhance global collaboration among scholars, these tools have not been widely adopted. Much of the collaboration which is occurring is leveraging simple, easy-to-use tools such as email, Google Docs, and Skype.

Another important trend in research needs is the central role of data and data management in research. Of course, data has been critical for serving researcher needs for a long time. New applications are emerging and researchers aren't just crunching numbers. For example, data mining and data visualization play and important role in research within many disciplines. Scholars need more external data sources and they need support for selecting, accessing, and using these new sources. Researchers' own data also needs to be managed, archived, cataloged, and preserved. Of course, opening up data with tools to use it properly can offer important value to society. Developments in Genomics are a good illustration of the power of this**.** However,

calls for opening up more data are constrained by competitive concerns in some disciplines and legal/privacy considerations.

Journals continue to play an important, central role in the research process. Of course, assessment demands drive heavy reliance on journal citation metrics which are easily accessible. Faculty incentives also favor traditional channels for dissemination of findings and use of journal citation chains remains critical for research. There are important implications for humanities scholars since citation metrics do not offer comprehensive coverage for academic monographs. E-books could start to play a more important role in scholarship with e-delivery of chapters and an increase in accessibility via large indexes such as Web of Knowledge. However, it is also true that research increasingly requires an expanding range and diversity of source types to be effective, particularly within the humanities. Important formats that are in demand include video, audio, images, datasets, historical archives and collections, documents, manuscripts, and texts for mining.

Simple and fast access to content remains critical. Researchers looking for a few convenient, trusted tools with 24x7 access on any device. Researchers get frustrated with password barriers and view fast and easy access to full text as critical. Gateway services such as Google and large cross-discipline indexes play a critical role as a starting place. Easy-to-use mainstream technology tools are used to access and share information (Google and Docs, Twitter, YouTube, Skype) often in preference to more specialist or discipline-specific tools. Typically researchers want their research experience to like their experience with tools they use outside of work—like Yahoo, YouTube, Amazon, or Kayak. This critical need is an excellent area where publishers, technology providers and libraries can work together to enhance researchers' experiences.

While lots of insight is offered by existing research, institutional and departmental differences remain important. It is critical to understand trends in researcher needs at the institutional level. Tools such as LibQual +, Zoomerang, Survey Monkey, and ForeSee Results can be very useful in identifying user needs and harnessing the voice of users to surface issues and identify the highest impact oppor-

tunities. Focus groups and interviews also can play and important role in enhancing support for researchers.

Following are some questions which might be useful for focus groups and interviews:

- What key factors come into play for your research productivity reporting?
- How are requirements of funders changing in your field?
- How can the library help you to be more effective with your research?
- What types of information sources are most critical for your research and how do you access them today?
- Tell me about how you use datasets, multimedia, etc...?
- To what extent do you collaborate with other researchers?
- If so, what approaches and tools are you using to ensure that you can manage these collaborations effectively?
- How do you stay organized and manage your research efforts?

By keeping up with free and publicly available reports from reputable resources, libraries can better understand rapidly changing research needs across disciplines. Onsite research programs are also critical as researcher requirements look different within different types of institutions. Quantitative research should be supplemented with deeper qualitative information gathering to surface trends. As an example, faculty interviews can offer a window into the scope and nature of changes in technologies and funder requirements and their implications for research needs. Of course, the resources highlighted here offer only a foundation for enhancing research support. Additional tools, research and planning may be needed to maximize your library's efforts, especially if your research population is extremely diverse.

TRENDS IN THE SCIENCES (Audrey Powers - Collection Development and Research Librarian for College of the Arts, University of South Florida)

Within the sciences, critical trends that I am going to focus on relate to the need for content

integration, new models of access to content, and changes in the funding landscape.

NEED FOR CONTENT INTEGRATION
In order to optimize the user experience, librarians need to look beyond traditional content because information is more targeted. New tools are needed to present a variety of content and maintain the attention of the moving user; push the appropriate information into the user's workflow, i.e. audio should be available in a speech journal, video in a surgery journal. An interesting example of the potential for pushing information into the researcher's workflow is Vook, which publishes digital books that combine text, video, links to internet sites and social media into a single application that is available online and a mobile application.

Portals are also being developed that are focused on a particular aspect within a discipline in which content is repurposed (mini-sites). Content is being integrated from scholarly journals, traditional sources, and also from the society's meetings/conferences such as the American Society of Clinical Oncology "Cancer Portals". This clinical oncology society offers a suite of portals each focused on a particular type of cancer or mechanical engineering mini-site in which mechanical, bioengineering, energy, conservation are integrated. (Mark Johnson - HighWire Press)

NEW MODELS OF ACCESS
From a scientist's (physicist/forensic computer scientist) perspective:

"You often run into borrowed techniques accidentally. You talk about your problems with researchers from other fields and someone tells you that there's this clever technique that might be useful. This seems pretty inefficient.

The major problems in STM are filtering and access. A lot of journals aren't really accessible to the scientific community as a whole so people don't "see" things that are published there. On the other hand there are journals that are full of junk, are free, and are highly-accessible (arxiv.org)."
The *Need It Now* mentality has driven the need for *new models of access*. Librarians recognize that we have moved from the traditional *Just-In-Case* acqui-

sitions model to *Just-In-Time* models such as Patron-Driven Acquisitions (PDA), Print on demand (POD), and Demand-Driven Acquisitions (DDA) for acquiring books and journal articles.

These new access models have been accompanied by a variety of new usage based pricing models:

- Flexi subscription Option - Wiley
  Swap out for used titles, upgrade editions
- Evidence-based Selections - Elsevier
  Minimal upfront fee determined by % of total value of content for 12 months
- PPV (pay-per-view) or PPC (pay-per-click) - ShipIndex
  Apply Pay-per-use model to discovery services

A number of innovative tools and services are focusing on existing needs:

DeepDyve
Offers a rental model for scientific papers. It is based on a short-term rental of journal article access and is a search engine specializing in indexing and providing direct access to scientific articles. Their motto, "Research. Rent. Read" rents, not sells, access to articles.
Memberships offerings include:

- **Basic -** Pay as you go at $0.99 per article for a 24-hour rental
- **Silver -** A monthly subscription plan at $9.99 , which allows 20 articles at any one time with a 7-day rental
- **Gold -** A subscription plan of $19.99 allows unlimited rentals with no rental period
- A list of reputable publishers accessible via DeepDyve:
  - o Oxford University Press
  - o Sage
  - o Taylor & Francis
  - o Wiley-Blackwell
  - o PLoS
  - o HighWire hosted society publishers
  - o BioOne
  - o DeepDyve is also indexing open access repositories like the arXiv and PubMed Central

Get it Now
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IEEE Xplore
Early access to electronic preprints
Prepub reprints from ArXiv
Archive for electronic preprints in math, physics, astronomy computer science and quantitative biology
LibraryRenewal
Plans to improve access to digital content how, when and where you want it:

- Conduct research and create a variety of resources and presentations that explain and point towards new, effective solutions related to libraries and access to digital content
- Develop critical relationships through a program geared to key individuals and institutions working on legal, technological, and industry-specific issues related to access to digital content
- Build an organized grassroots movement designed to spread the word and raise issues at a local and regional level

Glue.Jar
Building a place for individuals and institutions to join together to liberate specific e-books and other types of digital content by paying rights holders to relicense their works under Creative Commons licenses.

- Book-lovers and libraries everywhere can join together to unglue books, making them freely available to the world
- Authors and publishers get the compensation they deserve
- Books that are out of print, not available as e-books, or otherwise hard to use will be available for everyone to read and share

Open Access Resources
Used for scholarly journals and books, this model challenges traditional publishing models. There has been rapid growth, but how can research be properly peer-reviewed while maintaining the same standards of quality originally enforced by tradi-

tional publishing models? Can librarians safely add all those journals to their catalog and recommend them to their patrons? The quality of the research being published is good. PLOS article numbers are increasing rapidly and impact factors are up.
Mendeley
A desktop and web program for managing and sharing research papers, discovering research data and collaborating online
Mendeley/PLoS API Binary Battle
Competition to build an app to make science more open. The objective is to build the best apps that make science more open using PLoS and/or Mendeley APIs (Application Programming Interface)

FUNDING TRENDS
As funding becomes more scarce agencies are trying to get more for their money so they are approaching research problems from many different angles.

INTERNATIONAL FUNDING OPPORTUNITIES INCREASING
Globalization of research has important implications for the US research enterprise, government agencies, academic institutions and companies that support and perform research.
International collaborations and partnerships provide unique opportunities to enhance research, but it also presents challenges in the recognition of differences in culture, national security and needs in education and training.

Funding is available to enhance collaboration across disciplines.

Projects and Initiatives
Examples include the VIVO project from Cornell, Faculty of 1000, COS Pivot, and Scholar Commons
For example, University of South Florida, Dance and Engineering
Rolling Dance/Mobility Chair Project - Development of new mobility chair which is hands-free and expands choreographic movement potential:

- Led by dance/artistic vision
- Has involved many collaborators
- Original funding was internal through an interdisciplinary grant.
- Received two external awards

- Received an internal grant for research with Veterans which supported a collaborative presentation at the International Association of Dance Medicine and Science with colleagues from physical therapy and helped fund the finalization of the prototype chair with company in California

Dance and Physical Therapy
Funded attendance at the International Dance Wellness Conference and creation of "Dance Wellness Program" Includes screenings, injury surveillance, injury prevention, and overall dancer health

Dance and Health
Florida Department of Health – funds provided to choreograph a teaching lesson on how to clean a hospital room
How can the library support enhancing research productivity and have an impact on the research process:

- Figure out how to insert yourself into researchers workflows
- Become valuable in the research process
- Provide ease of access to resources and services
- Do everything you can to GET IT NOW