A Case for Continued Strategic Investments by Research Libraries to Advance Research and Learning

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Mary Lee Kennedy, Executive Director,
Association of Research Libraries

Clifford Lynch, Executive Director,
Coalition for Networked Information

ASSOCIATION OF RESEARCH LIBRARIES

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Coalition for Networked Information

The internet emerged from the research and higher education community and changed the world. Research libraries were right there. Thirty years of strategic investment by research libraries, in partnership with the organizations that have led the internet's development, has positioned higher education institutions to effectively (though, to be sure, imperfectly) sustain their instructional and research missions through the current pandemic, and to support a massive, unprecedented, international, emergency research effort to address COVID-19. To fully appreciate the scale and scope of these investments, one need only imagine that the pandemic had occurred in 1990 and envision the impact on students and on researchers.

Here we reflect on six major strategic directions where research libraries have made—and must continue to make—sustained investments to ensure researchers and scholars can teach and make breakthrough innovations, even in the face of crises like pandemics. Each strategic direction includes examples of mature and early-stage infrastructure investments, recognizing that research libraries are continually fine-tuning where to make the most impactful investments to advance research and learning. The six major strategic directions serve as a reminder of the central role of research libraries in the research enterprise. We make no pretense of being comprehensive.

The six strategic directions of research library investment are:

1. **Reduce barriers to information access and use in order to increase the opportunity to create new knowledge by shifting the culture of scholarship towards open science and open education.** Research libraries have done this by:
   - Creating and sustaining investment in global and national infrastructures to provide access to open scholarly information through partnerships (such as Confederation of Open Access Repositories, Global Sustainability Coalition for Open Science Services, Invest in Open Infrastructure, and OER Commons)
   - Making major investments in all forms of open access scholarly publishing, including journals (such as through BioOne and

PLOS), monographs (such as through Knowledge Unlatched, Open Humanities Press, and TOME), and research data (such as through Dataverse)

- Creating, curating, organizing, and promoting massive collections of open educational resources particularly at a time focused on education affordability
- Creating and contributing to open repositories for depositing research outputs, including underlying data and code (such as PubMed)
- Negotiating licensing agreements with commercial vendors to significantly increase barrier-free access to information (such as transformative agreements)
- Leading (with the scholarly community) the adoption of open metadata standards and infrastructure (such as findable, accessible, interoperable, and reusable (FAIR) data) and persistent identifiers (such as digital object identifiers and ORCID IDs)

2. **Ensure the ongoing organization of research practices, workflows, outputs, and preservation of scholarly assets.** This investment is particularly critical given the shift from print to digital distribution of scholarly journal publishing, and increasingly scholarly monographs. It is also critical in research data management and the curation of social publishing. This strategic direction is exemplified by:
   - The development of the standards and practices to describe, document, and annotate the cultural and scientific record, and to represent it in machine-manipulatable ways (such as International Image Interoperability Framework, linked open data, Text Encoding Initiative, and web annotation)
   - Infrastructure for digital preservation, and migration to digital formats (such as International Internet Preservation Consortium, Internet Archive, LOCKSS/CLOCKSS, and Portico)

- Establishing globally accessible preprint server systems and practices (such as arXiv, bioRxiv, medRxiv, and others), complemented by a worldwide constellation of institutional repositories that massively speed up scholarly communication and global participation in leading edge-science
- Massively investing (through research grants) in research data stewardship by promoting data and code to first-class research outputs
- Developing and codifying research data management, including creating best practices for machine-actionable data-management plans
- Documenting a wide range of social movements, political events, and disasters (such as COVID-19 and major natural disasters), including experience as captured in social media, news, blogs, scholarly articles, and videos

3. **Digitize as much as possible of the cultural and scientific record that provides essential evidence for scholarship so that it can be shared worldwide and preserved.** This is exemplified by:
   - Massive digitization of and access to cultural heritage in partnership with for-profit and nonprofit organizations (such as Google, Microsoft, Digital Public Library of America, Europeana, HathiTrust, and JSTOR)
   - Collective investments of many millions of US dollars in the digitization of, access to, and preservation of unique materials from research libraries, archives, and museums
   - Rescuing information from geographic regions in turmoil (such as Digital Library of Afghanistan, Digital Library of the Middle East, Endangered Archives Programme, and Modern Endangered Archives Program)
   - Digitizing journal back files (such as those of JSTOR and commercial publishers), thereby paving the way for publishers to offer e-journals

4. **Establish and partner with organizations to support the above strategic directions, to advance the new digital environment.** Examples include organizations that are:
   - Singularly focused on thought leadership and the application and implications of digital shifts (such as California Digital Library, Coalition for Networked Information, Digital Library Federation, and EDUCAUSE)
   - Founded with the specific goal of developing open access public and institutional policies (such as Open Access 2020 and SPARC)
   - Developing, codifying, and creating communities of research data policy and management experts (such as Canadian Research Knowledge Network, Data Curation Network, Digital Curation Centre, and Research Data Alliance)
5. **Build and nurture vital alliances and partnerships within and beyond the research and higher education community in order to collectively advance research.** Key partnerships include:
   - University presses (such as the Association of University Presses)
   - Academic computing (such as EDUCAUSE and Internet2)
   - Scholarly societies (such as American Council of Learned Societies and Social Science Research Council) and individual disciplinary societies
   - Higher education advocates (such as American Council on Education, Association of American Universities, Association of Public and Land-grant Universities, and U15 Group of Canadian Research Universities)
   - National agencies (such as Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, US National Endowment for the Humanities, US National Institutes of Health, and US National Science Foundation)

- National and international organizations (such as cOAlition S, International Science Council, and US National Academies of Sciences, Engineering, and Medicine)

6. **Develop (and where necessary, invent) the necessary skills and expertise to support students and researchers in this evolving environment.** These skills and areas of expertise range from intellectual and legislative leadership in copyright and fair use/fair dealing, to identifying and educating on information bias in algorithms, to using and educating on newly emerging arenas, such as machine-learning applications in computational collections, virtual reality in digital humanities, data science in bioinformatics, and the science of science in understanding the behavioral and ethical uses of information.

Research libraries fully emerged as digital organizations with the internet, and, with it, transformed at scale. They continue to evolve in symbiosis with scholarly practices in order to shape the information ecosystem in which scholars and students achieve their aspirations. With the increasing need to develop sustainable infrastructure, research libraries remain focused on local and global communities of scholars and students so that, at times as disruptive as today, libraries can continue to provide their expertise and their services. This is only possible given the strategic investments they have made, and must continue to make for the future.