

Discoverability Challenges and Collaboration Opportunities within the Scholarly Communications Ecosystem: A SAGE White Paper Update

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Abstract

The prominence of mainstream search engines and the rise of web-scale, pre-indexed discovery services present new challenges and opportunities for publishers, librarians, vendors, and researchers. With the aim of furthering collaborative conversations, SAGE commissioned a study of opportunities for improving academic discoverability with value chain experts in the scholarly communications ecosystem. Results were released in January 2012 as a white paper titled *Improving Discoverability of Scholarly Content in the Twentieth Century: Collaboration Opportunities for Librarians, Publishers, and Vendors*. Following the white paper, this article explores the implications for these findings through review of commissioned studies, research reports, journal articles, conference papers, and white papers published in the ensuing twelve months. Sidebars highlight especially promising cross-sector initiatives for enhancing researcher discoverability of the scholarly corpus at appropriate points in their workflow, including the NISO Open Discovery Initiative (ODI) and the Open Researcher and Contributor ID (ORCID). Concluding reflections highlight opportunities for librarians to contribute to cross-sector collaborations that support discovery of quality peer-reviewed content by improving navigation, discoverability, visibility, and usage of the scholarly corpus.

Keywords: Sage White Paper; Discoverability; NISO; ORCID.

Introduction

The lifecycle of academic works from idea through investigation, publication, discovery, access, and usage is supported by extensive collaboration across all segments of the scholarly communications ecosystem. However, transformational changes occurring worldwide within the knowledge creation and publication landscape have disturbed traditional divisions of labor and established codes of practice. Long-standing conventions and relationships among libraries, publishers, and vendors are now being revisited and renegotiated. In order to achieve discoverability possibilities unimaginable even a few years ago, cross-sector opportunities have received considerable attention from libraries and publishers in recent months, catalyzed by a common aim of significantly advancing researchers' capacity to locate relevant content in the scholarly corpus and generate academic progress and other creative activities.

SAGE was an early contributor to the current discussions on discoverability challenges and collaboration opportunities. In May 2011, the publisher commissioned a research study that produced a white paper, *Improving the Discoverability of Scholarly Content in the Twenty-First Century: Collaboration Opportunities for Librarians, Publishers, and Vendors*.¹ The study aimed to benefit publishers, vendors, and libraries as well as the researchers who produce and use the scholarly corpus. Using a semi-structured interview methodology, the four-person research team explored discoverability issues with fourteen cross-sector industry experts. The SAGE white paper, issued in January 2012, presents recommendations for cross-sector collaborations among scholarly communications "value chain"² contributors. These constituencies include 1) primary content publishers and their published authors, journal editors, and technology vendors; 2) secondary content publishers of abstracting and indexing (A&I) services and

their technology vendors; and 3) academic libraries and their campus communities and technology vendors. In this article, insights from scholarly literature, commissioned studies, international initiatives, and professional conferences will illuminate vital opportunities in the current fragmented discovery environment, with special attention to issues reported in the SAGE white paper.³ Concluding observations will identify promising cross-sector collaborations among libraries, publishers, and vendors that enhance visibility, discovery, and usage of the scholarly corpus, not only on the open web, but also within library services.

Ecosystem Disturbances and Disruptions

As suggested in a SAGE report by Brazier and Harris, "The research library community has been awaiting a 'sea change' in the world of scholarly communications for over a decade."⁴ Many academic librarians would say it has arrived at our shores. Libraries now navigate unrelenting turbulence in an information environment irreversibly altered since the advent of the Internet and migration to digital formats. Libraries are in competition with a new ecosystem of players that help users discover scholarly content, including search engines, social networks, and websites from scholarly societies, academic communities, publishers, and journals.⁵ As a consequence, libraries are no longer the primary starting point for research,⁶ nor even seen as necessarily integral to scholars' research workflow.⁷ The future of libraries and the roles of librarians are uncertain,⁸ as are the future roles of academic publishers, societies, authors, and readers.⁹

The magnitude of the sea change in the scholarly communications ecosystem has prompted recognition of a "new norm"¹⁰ that mirrors the new realities for information users and providers in larger society. The Pew Research Center's Internet & American Life Project has identified eight new realities within the emerging information landscape in the United States:

- 1)The world is full of networked individuals using networked information.
- 2)The 4 V's of information change are characterized by the physics principles of vol-

ume, velocity, vibrancy, and valence/relevance.

- 3)People are shifting information channels to consult upwards to six online platforms (for news) on a typical day.
- 4)People are not 'platform zealots' and, rather, move easily among and to platforms that they perceive to meet their needs, requirements, or expectations.
- 5)People increasingly expect portable (mobile) and participatory information exchanges.
- 6)People also increasingly expect that information exchange is personal and therefore customized.
- 7)Influence is migrating from organizations to networks and new "experts."
- 8)Social networks are more influential and are differently segmented and layered.¹¹

These realities produce new research workflows and discovery methods and challenge long-held assumptions about scholarly gatekeepers and evaluators, knowledge containers, social norms, and information architecture and policies,¹² along with the emergence of new business models and customer bases.¹³ In response, libraries, publishers, and vendors are leveraging new technologies while weathering turbulent conditions to satisfy--and even anticipate--the expectations and requirements of traditional market shares and new constituency groups.¹⁴

Ecosystem Accomplishments and Issues

The driving missions of academic publishing and librarianship have not changed. The shared goals remain: to further discovery, access, and usage of scholarly publications and advance knowledge creation and information exchange. Despite a rapidly evolving environment, librarians continue to manage systems for institutional collection, retrieval, preservation, and delivery of the scholarly corpus. Publishers continue to produce, promote, disseminate, and steward authors' work through formats findable by the world's scholars. Technology providers for publishers and libraries alike continue to create platforms and support strategies for delivery and management of electronic resources. Despite considerable *disequilibrium in this environment*, a number of accommodations to new realities are

progressing and shared visions are emerging on next steps for improved discoverability.

Academic publishers of primary (scholarly corpus) and secondary (A&I) content must use new techniques to fulfill traditional responsibilities to produce, promote, and disseminate authors' works. Publishers must partner with technology vendors to ensure optimal online discovery, access, and delivery of their products in formats findable both through the indexed web and through library discovery services. This requires effectively mapping products for a diverse array of library platforms and Internet search engines that enable discovery of information products and services. For instance, to ensure discoverability of products within library environments, publishers must deliver free bibliographic data (such as MARC records) at the point of purchase, without any assurance "that libraries will use this data in uniform ways, if - or at all."¹⁵ Furthermore, indexed web discovery relies on compliance with non-standard and changeable indexing rules from powerful search engine entities such as Google.¹⁶ All this must be done in addition to the upwards of 60 value-added services that publishers provide¹⁷ to produce and support authoritative scholarship within a scholarly communication lifecycle.

Demands of this kind require substantial investments in technology infrastructure and staff expertise. Moreover, publishers must initiate and maintain business relationships with an expanding ecosystem of technology vendors who can provide online hosting platforms, strategic discoverability solutions, and interactive user experiences. Despite these continuing cooperative relationships with technology vendors and library customers, the absence of interoperability standards and variations in practices compromise full discoverability potential.¹⁸

Secondary publishers of abstracting and indexing (A&I) content must also navigate accelerating uncertainties as they continue to provide high-quality metadata for use in discovery tools, oftentimes supplemented by abstracts and other data that constitute their core product lines. They, too, must provide e-content compatible with a variety of integrated library systems and, more recently, pre-indexed library discovery

services that offer "Google-like" user search experiences. These new discoverability opportunities occur amidst considerable uncertainty about if and how the A&I content will be presented and accessed in these discovery systems--and whether discovery services may overtake the market share traditionally held by A&I products.¹⁹ Other concerns arise: will A&I search results routinely include branded records, and can access via library subscriptions properly handle copyright protections and user authentication?²⁰

Libraries also face challenges prompted by new realities characterizing today's scholarly ecosystem. For instance, as libraries continue to manage and develop systems for collection, discovery, and delivery of the scholarly corpus customized to the needs of their particular constituencies, they must also partner with technology vendors to represent publishers' primary and secondary digital content through electronic resource management (ERM) systems, online public access catalogs (OPACs), and web-scale or federated search tools. Content integration into web-scale discovery services that offer, by Michael Kelley's description, "a Google-like interface that provides a fast, single point of entry to an institution's relevant and vetted scholarly content"²¹ requires significant modifications in complex workflows²² and enhancements in staff expertise.²³ The growing number of implementations of web-scale discovery services is a strong testament to cross-functional efforts to respond to evolving researcher workflows as libraries struggle to reestablish themselves as a compelling place to begin research.²⁴ Amidst considerable choices in the marketplace, however, the lack of standardization prohibits libraries from conducting thorough comparisons of tools, content, and providers,²⁵ and complicates both implementation and development efforts around these new research tools.

Although accommodation of changing researcher workflows has produced heightened collaborations across the industry, unresolved issues remain, requiring renegotiation and recommitment among value chain contributors in the scholarly ecosystem. In December 2011, in an effort to further collaborative initiatives of this kind, OCLC released a discussion document, *Libraries at Webscale*. It concluded that:

Big collaboration in the information ecosystem will come not only from broader collaboration across libraries, library groups, consortia, and cooperatives, but increasingly through new, innovative alliances and partnerships across the broader knowledge community--across researchers, publishers, commercial vendors, and mainstream providers such as Google, Amazon, and Facebook.²⁶

Forward-Looking Discoverability Collaboration

Search engine optimization (SEO) and library systems interoperability are common issues across sectors. Discoverability systems benefit from shared codes of behavior, standards, and practices that optimize online content visibility, discovery, access, and usage.²⁷ As demonstrated by the sidebars describing recent successful cross-sector initiatives, continued progress in effective and efficient discovery of scholarly content requires shared values and principles that can support cooperative and profitable partnerships. Collaboration necessarily involves a number of players: content publishers and their platform providers; libraries and their service providers; library consortia; library and publishing technology vendors of all kinds; and national and international researchers and authors.

In the publishing sector, such progress builds on considerable effort as publishers continually improve their mainstream and library search engine optimization strategies and as they forge active partnerships with librarians, researchers, and technologists. Monitoring performance of publications via numerous research tools requires constant vigilance, especially as technologies and business models advance at a rapid rate. In addition to promoting awareness of publications on the web, publishers deepen awareness of their products directly through libraries. Enhanced visibility requires accommodating various system requirements, including web-scale discovery services, despite concerns about "linking fairness," relevance rankings, or vendor neutrality.²⁸ Consequently, publishers of all sizes must develop scalable, often automated, con-

COUNTER and SUSHI

About COUNTER

"Launched in 2002, COUNTER (Counting Online Usage of Networked Electronic Resources) is an international initiative serving librarians, publishers, and intermediaries by setting standards that facilitate the recording and reporting of online usage statistics in a consistent and credible method that is compatible with library systems. The first COUNTER Code of Practice, covering online journals and databases, was published in 2003. COUNTER's coverage was extended further with the release of the Code of Practice for online books and reference works in 2006. The body of COUNTER-compliant usage statistics has steadily grown as more and more vendors have adopted the COUNTER Codes of Practice. [...] COUNTER has also worked with NISO on SUSHI (Standardized Usage [Statistics] Harvesting Initiative), to develop a protocol to facilitate the automated harvesting and consolidation of usage statistics from different vendors." In April 2012, the COUNTER Code of Practice for e-resources was released.

Source: <http://www.projectcounter.org/about.html>

About SUSHI

The COUNTER-SUSHI Implementation Profile released in August 2012 "defines a practical implementation structure to be used in the creation of reports and services related to harvesting COUNTER reports using the NISO SUSHI Protocol." (NISO RP-14-2012) For more information, go to:

<http://www.niso.org/workrooms/sushi/>

tent management systems in order to ensure they are able to support cost-effective, time-efficient, and accurate metadata deliveries.²⁹

Standards aimed at producing high-quality metadata are important to discoverability and have received significant attention of late in the scholarly ecosystem. Recent activity in this regard centers on addressing the uneven stand-

ODI

In January 2012, NISO convened a new Open Discovery Initiative (ODI) workgroup to define standards and best practices for pre-indexed library discovery services "based upon indexes derived from journals, ebooks and other electronic information of a scholarly nature. The content comes from a range of information providers and products--commercial, open access, institutional, etc. Given the growing interest and activity in the interactions between content providers and discovery services, the ODI is interested in recommending a more standard set of practices for the ways that content is represented in discovery services and for the interactions between the creators of these services and the content providers whose resources they represent" such as metadata exchanges for published material and library usage metrics.

Source: NISO "ODI Survey Report: Reflections and Perspectives on Discovery Services."

http://www.niso.org/apps/group_public/download.php/9977/NISO%20ODI%20Survey%20Report%20Final.pdf

ards that guide the format of product data (title, author, ISBN, etc.) and the enrichment of semantic elements (adding structure, expressing relationships, and eliminating ambiguity). For example, as the number of open-access publications proliferates, cross-sector stakeholders advocate for new standards to indicate the availability of these resources for end users in search results and elsewhere within the research workflow.³⁰ Another area where standards can enhance discoverability is versioning data, in particular bibliographic records and reference citation information. Improved versioning metadata requires heightened cooperation among publishers, indexers, aggregators, and other content providers. Since scholarly metadata is not the sole responsibility of any one representative in the community, high-quality and enriched metadata truly "takes a village" of cross-sector partners.

CrossRef

CrossRef, a not-for-profit association begun in 2000 by scholarly publishers, has the following mission:

CrossRef's general purpose is to promote the development and cooperative use of new and innovative technologies to speed and facilitate scholarly research. CrossRef's specific mandate is to be the citation linking backbone for all scholarly information in electronic form. CrossRef is a collaborative reference linking service that functions as a sort of digital switchboard. It holds no full text content, but rather effects linkages through CrossRef Digital Object Identifiers (CrossRef DOI), which are tagged to article metadata supplied by the participating publishers. The end result is an efficient, scalable linking system through which a researcher can click on a reference citation in a journal and access the cited article.

Source:

<http://www.crossref.org/01company/02history.html>

In April 2012, CrossRef initiated a pilot service, CrossMark, that addresses the problem of multiple versions of scholarly content. Articles exist in a variety of iterations throughout the publication lifecycle (author drafts, pre-print releases, corrected manuscripts, etc.) and are hosted across a variety of online locations (e.g., author websites, institutional repositories, government archives, aggregator collections, primary publisher websites, and more). This makes it difficult to locate the most recent authoritative version of a document, or to ascertain if the document has been updated, enhanced, corrected, withdrawn, or retracted. CrossMark aims to act as a "seal of approval" that informs researchers if there have been any updates and where the publisher-maintained paper is located, as well as other important non-bibliographic publication record information about the document.

For more information, go to:

<http://www.crossref.org/crossmark/>

For libraries, electronic resource management (ERM) systems and associated technologies such as OpenURL³¹ (citation linking) now increasingly support web-scale discovery services for local access through a single index. These advancements provide relevancy ranking of search results, facets for drilling deeply into search results, and format-agnostic access to content. Content can include open-access journal articles and authoritative websites, as well as catalog records that can trigger patron-driven e-book purchases. Furthermore, all this can occur by mobile access through apps or sites optimized for smartphones. This has been brought about largely by the “big four” discovery tools--Serials Solutions’ Summon, OCLC’s WorldCat Local, EBSCO’s Discovery Service (EDS), and Ex Libris’ Primo--partnering with growing numbers of publishers of primary and secondary content to produce centrally indexed content. As a consequence, libraries can now replicate the efficacy of Google’s simple interface, search speed, content breadth, and quality results, thereby finally addressing the vexing question, “If Google can do it, why can’t libraries?”

ORCID

ORCID (Open Researcher and Contributor ID) is an international, interdisciplinary, not-for-profit initiative that strives to solve the researcher name ambiguity problem. As such, the core mission of ORCID is to provide a registry of persistent unique identifiers for researchers and scholars. In October 2012, researchers began to register for a 16-digit ORCID number. Widespread adoption and usage by the research community at key workflow and dissemination points--manuscript submission, dataset deposition, grant applications, faculty profiles, patent applications, etc.--will support linkages across multiple datasets: clinical trials, publications, patents, datasets, grant awards. This central registry of researchers crosses disciplines, workplaces, sectors, and national boundaries, serving as a switchboard for researchers and publishers alike in tracking and managing the dissemination of research findings.

For more information, go to:
<http://about.orcid.org/about>

Despite these accomplishments, further collaboration among librarians, publishers, and vendors remains critically important to advancing our common purpose: to support the creation, discovery, delivery, and usage of the scholarly corpus. Toward that end, agreements in the recent past on common metadata standards, information organization, resource presentation, exchange protocols, and industry practices will expand researchers’ discoverability outcomes and further improve database interface design, interoperability, search algorithms, and web-scale discovery platforms. These agreements also promote increased understanding of cross-sector industry realities.³² In 2012, the most significant cross-sector collaborations include the NISO SUSHI Protocol,³³ NISO Open Discovery Initiative,³⁴ NISO ERM Data Standards and Best Practices discussion paper,³⁵ NFAIS Code of Practice draft,³⁶ COUNTER Code of Practice for E-Resources,³⁷ CrossMark,³⁸ and the Open Researcher and Contributor ID (ORCID).³⁹

These advancements illustrate the potential and the promise for discoverability through cross-sector collaboration, and demonstrate that enhanced collaboration throughout the value chain depends on renegotiated practices, standards, and relationships. In other words, the ecosystem will thrive by advancing forward-thinking relationships across the industry where a critical

NISO - ERM

In January 2012, the NISO ERM Data Standards and Best Practices Review Steering Committee released a white paper titled, *Making Good on the Promise of ERM: A Standards and Best Practices Discussion Paper*. The committee completed a thorough environmental scan and produced a gap analysis on link resolvers and knowledge bases; work, manifestations, and access points; cost and usage-related data; license terms; and data exchange using institutional identifiers. These elements influence ERM functionalities and interoperability. Read the full white paper at http://www.niso.org/apps/group_public/download.php/7946/Making_Good_on_the_Promise_of_ERM.pdf

NFAIS

In February 2012, the National Federation of Advanced Information Services (NFAIS) announced a draft *Code of Practice: Discovery Services* for review and comment. The document recognized that

discovery services have the potential to provide ease of information discovery, access, and use, benefitting . . . the global community of information seekers. However, the relative newness of these services has generated questions and concerns among information providers and librarians as to how these services meet expectations with regard to issues related to traditional search and retrieval services; e.g. usage reports, ranking algorithms, content coverage, updates, product identification, etc. Accordingly, [the Code of Practice] has been developed to assist those who choose to use this new distribution channel through the provision of guidelines that will help avoid the disruption of the delicate balance of interests involved.

Source:

<http://info.nfaais.org/info/codedraftintroduction.pdf>

balance is maintained between cooperation and competition that generates energy and motivates evolution. In a web-scale world, collaboration must both promote sharing and drive innovation to advance general ecosystem function and nourish the entire community.⁴⁰

Library Discoverability Implications

Despite considerable progress in cross-sector collaborations and the impressive goodwill of many ecosystem contributors, much work remains to be done. Since “we’re all in this together,”⁴¹ and we understand that new standards and practices for improved discovery offer a solid foundation for further improvements, librarians can now ask the question, “How can we support discovery of the quality vetted and peer reviewed content that libraries invest in

and scholars require at appropriate points in their workflow?”⁴² Ultimately, success will require multifaceted approaches in partnership with other ecosystem contributors. Given conversance with academic research and with teaching and learning activities, librarians are well positioned to work with academic publishers and campus constituencies on productivity and discoverability improvements that “enhance trust and value.”⁴³

Working together, “librarians and publishers can bring value to . . . learning, and new relevance to themselves, by inserting themselves into [researcher] . . . workflows.”⁴⁴ One way of accomplishing this is for libraries to partner with publishers in market research routines. Where libraries lack resources for user testing and publishers lack access to test participants, the scenario is ripe for cross-sector collaboration to produce greater knowledge of researcher behavior.⁴⁵ Relatedly, routine user testing and usage data analysis are now regularly employed to support website design development that aims to ensure library and mainstream search engine optimization for improved visibility--and usability--of scholarly content. However, results of these analyses are seldom shared. If results were routinely exchanged among libraries and publishers, as well as with platform and related technology providers, website design practices might evolve in ways that better mirror--and even anticipate--researchers’ evolving information-seeking needs.

Since, in the broadest sense, discoverability is intrinsically linked to visibility--which “involves placing information in locations where people will come across it in the work that they do”⁴⁶--publishers have initiated strategies for greater engagement with online content.⁴⁷ For instance, metadata enrichment to improve discovery during searching is increasingly augmented by “push” tools that recommend similar content to readers. Publishers use Facebook pages, subject portals, and blogs dedicated to individual publications to engage cohorts of scholars and authors within particular fields of study. They also provide widgets and application programming interfaces (API) to library websites so users have multiple points of entry to curated library scholarly content, whether licensed, owned, or open

access. Librarians could promote awareness of publishers' discovery strategies among their campus constituencies.

A variety of other approaches to advancing discovery would also benefit from cross-sector engagement. For instance, libraries have the opportunity to enhance institutional repositories, library search tools, and resource catalogues with linked data that connects researchers more quickly and efficiently to the full body of literature that will aid their work. Vendors, such as OCLC, encourage such engagement in the semantic web by enriching holdings data with links to other people, places, and materials found across the Internet.⁴⁸ And, in response to growing demand from mobile device owners, contributors across the value chain are developing mobile websites, applications, and related services to support on-the-go research.

Another way that librarians can help enhance visibility of authoritative, peer-reviewed content is by serving on publisher and vendor advisory boards and by encouraging their colleagues to do likewise. Librarians on advisory boards can contribute knowledge and perspective from their various roles as authors, editors, and researchers. These types of relationships serve to open communication channels across the community and increase future collaboration opportunities as value chain contributors aim to "develop strategies to remain relevant as the nature of information and information access changes."⁴⁹

For instance, academic publishers and academic librarians are beginning to develop enhanced research environments and applications--what might be called "intelligent tools"⁵⁰--to help scholars locate the content needed to advance their research and other creative activities. These new products and devices are typically driven by semantic technologies that have the potential to promote discovery as well as support researcher workflows through topical orientation, training, enabling exploration, and highlighting leading research. Two such examples are SAGE Research Methods and Literati by Credo.

The SAGE Research Methods (SRM) database contains content from SAGE reference books,

monographs, journal literature, videos about theoretical and practical topics, and qualitative and quantitative research design and analysis resources.⁵¹ In addition, a Methods Map offers a "visualization tool that maps the relationships between methods; it is similar in some ways to the taxonomy of a subject thesaurus, but in this context more akin to the hierarchies that qualitative researchers use to conceptualize research results. SRM provides a social media option for users to share content in a public list (as an instructor might do for a class), or to store items for future reference."⁵²

The other example, Literati by Credo, provides a suite of services related to information discovery, information literacy (including assessment), and literacy marketing.⁵³ Like SAGE, Credo welcomes active participation by librarians in co-creating both product and service. Building on the success of its earlier product, Credo Reference, which *Library Journal* designated as Best Overall Reference Database in 2011,⁵⁴ Literati by Credo offers an online discovery platform composed of topic pages, "mind maps," and search tools within an enriched working environment.

Other examples of building context through community include the next generation of citation management tools that integrate social networking technologies, as is the case with Mendeley, or build on open source software, as is the case with Zotero. New web-based and localized reference and document management tools offer online storage of papers and citations, sharing and collaboration tools, desktop and mobile applications, and article sales or rentals. Other tools such as Springer's "Papers" and Macmillan's "ReadCube" can be integrated with word processing software. In addition to bibliographic entries, these products provide full-text indexing of PDF documents and attach notes to citations.⁵⁵ The various functionalities of these research management systems streamline essential scholarly activities, freeing researchers to engage in core intellectual tasks and social networks that further collaboration and discovery.⁵⁶ Fortunately, "the time is ripe for innovation and collaboration."⁵⁷



Conclusion

The SAGE white paper released in early 2012 outlined the issues and opportunities related to discoverability of scholarly content and called for greater collaboration among librarians, publishers and vendors of various kinds. This article offers an update on developments over the past year or so since the white paper was released. The exciting new advances in cross-sector collaboration and product development bode well for the future. The innovations necessary to further optimize online search and discovery require technical, commercial, and behavioral accommodations, as demonstrated in the preceding examples of extensive cross-sector collaboration among all segments of the scholarly communications ecosystem. Ultimately, future academic progress depends on our ability to significantly improve the capacity of researchers to locate relevant publications during the conduct of their work. As the nature of the publishing industry, the defined purpose of libraries, and researcher workflows continue to evolve, it is ever more important that traditional relationships and business practices are revisited and renegotiated, strengthened and expanded.

Endnotes

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² "Value chain" is a concept popularized by Michael E. Porter in his book *Competitive Advantage: Creating and Sustaining Superior Performance* (New York: The Free Press, 1985). Although the term initially referred to a series of activities that create and build value, culminating in the total value delivered, the definition has evolved in recent decades. In the context of this paper, value chain refers to scholarly corpus [supply chains](#) and [distribution](#) networks. Coordinated interactions between supply and distribution channels create an extended global value chain, including suppliers and buyers.

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³⁰ Todd A. Carpenter, "As Hybrid Open Access Grows, the Scholarly Community Needs Article-level OA Metadata," *The Scholarly Kitchen* (blog), December 5, 2012, <http://scholarlykitchen.sspnet.org/2012/12/05/as-hybrid-open-access-grows-the-scholarly-community-needs-article-level-oa-metadata>

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