The Future of Academic Library Materials Expenditures: A Thought Experiment

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Introduction

For several decades academic library materials budgets have been increasing. ARL statistics show a 322% increase in Library Materials expenditures between 1986 and 2012 versus a 109% increase in the CPI.[1] Data from the National Center for Educational Statistics shows growth in a way that is less precise, but still shows an increase of 133% increase in expenditures on information resources from a national total of $1,197,292,834 to $2,790,039,494 between 1992 and 2012. The percentage of total library expenditures used for information resources increased from 32.8% in 1992 to 39.8% in 2012.[2]

These increase were required primarily because of the increase in the cost of journals, especially science, technology, and medical journals published by for-profit companies. As measured by the *Bowker Annual* and it's successor the *Library and Book Trade Almanac*, the prices for U.S periodicals excluding

Russian translations rose 805.3% from an average price of $54.97 in 1984 to an average price of $497.63 in 2010. The average price of Chemistry and Physics journals rose 1,045.5% from $228.90 in 1984 to an average of $2,622.14 in 2010 and journals in Medicine, in Psychology, and in Zoology increased at nearly the same rate. Using a somewhat different group of titles the average prices across all fields rose 25.2% in four years from $843.46 in 2010 to $1,051.73 in 2014.[3]

The pressure of ever increasing journal prices has been one of the great challenges of past several decades for academic libraries. I would like to propose that the bad old days are over. I believe there are a set of strategies that academic libraries can follow that will allow them to maintain consistent or expanding levels of service without having to increase expenditures on materials. That is I think it is likely possible to maintain materials budgets at current levels in real dollars and to provide users with the books and articles they need even in the face of continued price increases at the levels we are use to seeing.

What Has Changed?

I believe there are four changes that make new strategies for materials expenditures possible.

1. Patron Driven Acquisition (PDA) for books, both print and e-books, works and can provide the books that are need at a lower cost than traditional approaches to collection building.
2. Article purchasing rather than subscriptions for journals can be cost effective in many cases.
3. Gold Open Access (OA) journals will continue to grow and become the business model of choice for a large portion of scholarly journal publishing. As a result libraries will be able to decrease the number of subscriptions they need.

4. The growth in open content and open discovery tools on the Web, such as Wikipedia and Google Scholar, will reduce the need for paid database content.

It is worth looking at each in some detail.

Patron Driven Acquisition (PDA) for Books

PDA models for the acquisition of e-books have been in existence since about 2000. For many years it has been understood that libraries purchase large numbers of books that are never used. In 1979 the Kent study at the University of Pittsburgh showed that about 40% of the books acquired in a given year had not circulated after six years and that since most use can expect to occurr in the years immediately following acquisition of the item, it was unlikely that many of the unused titles would ever be used in the future.[4] In the pre-Internet world this apparent waste made some sense. Even for expert and experienced librarians predicting which books would ultimately be used is an art at best and more often a guessing game. But given that many academic books went quickly out of print and the used book market was expensive and slow it made good sense to purchase just-in-case. What made sense in the print world is not sensible in the digital world. E-books, like all digital content, can be delivered instantaneously, so purchasing before a user wants a book can only be justified if the price is discounted sufficiently to offset the posibility that the book will go unused. Except for big subscription packages this is rarely the case. While print books cannot be delivered instantaneously, they can, in many cases, be delivered very quickly. I have sometimes joked that my library should load the bibliographic records for all of the books Amazon sells into our catalog with a location code that says “remote storage facility, allow 48 hours for delivery.” There would of course be no real remote storage facility, we would simply order the book if and when a request came, and in most cases we would be able to deliver the book within 48 hours.

The Bucknell University library moved to an exclusively patron-driven purchase model for books and significantly decreased the amount of money spent, which between 2012 and 2014 declined from slightly less than $600,000 to just over $100,000, without any notable decline in circulations. The result was "a vibrant collection that receives significant use."[5]

The Bucknell experience makes it clear that it is possible to significantly reduce expenditures on books by using a PDA model for most book purchase and reduce expenditures by up to 75% without impacting service.

Article Purchasing Rather Than Subscriptions for Journals

As noted above price increases for journal subscription continue to increase at rates well above the rate of inflation. It is unrealistic to expect this trend to abate. But there has been an important change that libraries can exploit. In the print world the journal and issues and volumes mattered. The article was always the unit of scholarship, but the journal issue was the container in which it was delivered and the volume was what you paid for. In the digital world the article is being unbound from the volume and the issue, and in some ways from the journal. This follows the trend established by music. Price points for individual articles from services like the Copyright Clearance Center's Get It Now service are about $25 per article and the CCC guarantees delivery in several hours. Science Direct (Elsevier) charges between $15 and $40 per article or chapter and access is immediate.[6] It is easy to imagine that libraries could build systems that connect with their link resolvers with these services and purchase articles in ways that would appear to the user to be no different from subscription access. In essence creating a PDA model for journal articles. As with any purchase-on-demand arrangement, the library accepts some financial risk in the event of heavier than expected use, none-the-less it seems hard to imagine that there are not some savings to be had. I also suspect that the ability of publishers to

increase the prices of articles will be more constrained than pricing for subscriptions. Some significant portion of individual article sales are to individuals who are likely to be more price sensitive than libraries have been, especially if the purchase is done with their own money. Even when the library pays there would seem to be a price point at which researchers would be appalled by the cost and look for alternative ways of getting a copy of the required article, like e-mailing the author or looking for a preprint in an institutional repository.

Gold Open Access (OA) Journals Will Continue to Grow

I have argued that Gold OA is a disruptive business model as defined by the business theorist Clayton Christensen and that it will become to dominant business model, accounting for 90% of for scholarly journal publishing, between 2020 and 2025.[7] This prediction, which was made based on 2009 data, seems to be on track.[8] There is considerable debate and no small amount of skepticism about this prediction, but there is little doubt that Gold OA is growing. Also growing this Green OA as institutions and funding agencies increasingly insist that journal articles produced by the faculty of a university or those receiving grant support from a funder be deposited in an institutional or disciplinary repository. The impact of Green OA on library collecting policy is unclear, though one can easily imagine that it could reduce demand for the acquisition of the commercial versions of some articles. The impact of Gold OA though is clear; libraries don't need to acquire this content, as it is freely available to everyone. As increasing numbers of scholarly articles are available in OA forms this should mean that libraries do not have to purchase as many subscription journals. It may also mean that publishers have an incentive to hold down price increases so that libraries have less of an incentive to cancel subscriptions, though I will believe this when I see it.

The Increase in Open Web Content and Discovery Tools

This is probably the most difficult of the four areas to quantify, but it is clearly the case that there is an increasing amount of quality content and good discovery tools available for free on the Web. Wikipedia and Google Scholar are the obvious examples. Data.gov and the Digital Public Library of America are portals to large and growing bodies of content. TED, NPR, the BBC, the World Bank and many others host large stores of free quality content. Google Books and the HathiTrust have made millions of public domain books available. JSTOR makes its journal content, published prior to 1923 in the United States and prior to 1870 elsewhere, freely available. It is hard to know how or when libraries will be able to substitute this content for content that they now purchase. Government and international organization data, like that from the World Bank are clear substitutes. TED, NPR, and the BBC are sources most libraries did not acquire in the past so they are not clear substitutes, but might replace newspaper or other purchased news content. While it is hard to predict how libraries will be able to reduce purchased content as a result of this growing body of high quality Web-based content, it is inevitable that opportunities will arise.

The Thought Experiment

The thought experiment that follows will attempt to show what would happen if a library were to take advantage of the three trends, or opportunities, described above and changed their collecting practice. We will do this by modeling a hypothetical library materials budget, making some assumptions about price increases and how purchasing strategies can change in light of the three trends. We will look at this over a ten-year time frame (2015 to 2024).

The Hypothetical Materials Budget

Our hypothetical budget will begin as shown in the table below. We will assume that print and e-books are purchased from the same bucket of funds and will not concern ourselves with what will inevitably be and increase in the purchase of e-books and the purchase of fewer print books. For the purpose our experiment we will assume cost for both formats behave in the same way. What is included in the databases category is somewhat nebulous, but would include reference tools, aggregations of content such as EBSCO, ProQuest, JSTOR or MUSE, statistical compilations, etc. Journals includes journal subscriptions directly from publishers either individual titles or packages.

Materials Fund in 2015		
	Expenditures	% of Total
Books (print and e-books)	$450,000	15.0%
Journals	$1,740,000	58.0%
Document Delivery	$60,000	2.0%
Databases	$750,000	25.0%
Total Costs	$3,000,000	100.0%

Price Increases

We will assume that price increase are as follows:

Books – 3.0% per year

Journals – 8% per year

Articles (purchased individually) – 5% per year

Databases – 5% per year

Implementing Strategy 1 – Moving to a PDA Model for Book Purchases

For the purposes of our experiment we will assume that by moving to a PDA model for book purchasing over three years our hypothetical library can reduce the amount spent on books by 20% in each of these years. This is a notably less dramatic implementation than was done at Bucknell. We will assume that the cost of an average book in 2015 is $50.00. The results of this change in the strategy for book purchasing are shown in the table below.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Book Costs	$450,000	$370,800	$305,539	$251,764	$259,317	$267,097	$275,110	$283,363	$291,864	$300,620
Cost per book	$50.00	$51.50	$53.05	$54.64	$56.28	$57.96	$59.70	$61.49	$63.34	$65.24
Books Purchased	9,000	7,200	5,760	4,608	4,608	4,608	4,608	4,608	4,608	4,608

Over the decade the expenditures drop by 33.2%, or about $150,000 even as book prices increase by 30.5%. After the initial change in purchasing strategy the number of books purchased per year remains the same just a bit less than 50% of the number purchased before the change.

If we were to be more aggressive and reduce the amount spent on books by 25% in each next three years, which would be close to the Bucknell experience, the results would be as shown in the table below.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Book Costs	$450,000	$347,625	$268,540	$207,447	$213,671	$220,081	$226,683	$233,484	$240,488	$247,703
Cost per book	$50.00	$51.50	$53.05	$54.64	$56.28	$57.96	$59.70	$61.49	$63.34	$65.24
Books Purchased	9,000	6,750	5,063	3,797	3,797	3,797	3,797	3,797	3,797	3,797

The expenditures on books at the end of the ten-year period would have declined by 45.0% and the number of books purchased would have declined by 57.8%. For our model we will assume the first implementation of this strategy.

Implementing Strategy 2 – Purchasing individual articles as an Alternative to Journal Subscriptions

While there are clearly situations where the level of use of a particular journal title makes a subscription the most economical choice, there are also likely to be journals in many library collections where the required uses can be provided by purchasing individual articles. Establishing this is at the most basic level quite simple. If the number of uses multiplied by the cost of to purchase individual articles is less than the subscription cost, then individual article purchase is the more economical means of providing users with the articles they need. So, for example if a journal title is expected to have 100 uses per year and the cost of purchasing individual articles is $25 per article, then the total cost would be expected to be $2,500 annually. If the subscription to the title is $3,000, then $500 can be saved and the title should be cancelled and articles purchased separately. If, on the other hand, the subscription is $1,200, it should be kept. There are two other considerations. The first is the uncertainty of use. It may be wise to error on the side of keeping a subscription if the use varies by year or if the breakeven is close to the subscription cost. The other consideration is that in most cases a library is entitled to access to the backfiles of a title it has paid for as part of a subscription even it the subscription is cancelled. This means that the only articles that will need to be purchased will be those published after the cancellation goes into effect. Initially this will be only a few issues. The gap will widen over time and more articles will need to be purchased, but this factor reduces the risk of this strategy in the short run.

To model the implementation of this strategy we will assume that the number of journals subscribed to was reduced by 10% in 2016, 2018, and 2020 and that each time subscriptions were cut the document delivery budget was increased by 30%. We are assuming the cost of a separately purchased article is $25 in 2015. The results are shown in the table below.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Journal Costs	$1,740,000	$1,691,280	$1,826,582	$1,775,438	$1,917,473	$1,863,784	$2,012,887	$2,173,918	$2,347,831	$2,535,657
Cost per Subscription	$1,000	$1,080	$1,166	$1,260	$1,360	$1,469	$1,587	$1,714	$1,851	$1,999
Journal Subscriptions	1,740	1,566	1,566	1,409	1,409	1,268	1,268	1,268	1,268	1,268
Document Delivery Costs	$60,000	$81,900	$85,995	$117,383	$123,252	$168,239	$176,651	$185,484	$194,758	$204,496
Cost per Article	$25.00	$26.25	$27.56	$28.94	$30.39	$31.91	$33.50	$35.18	$36.94	$38.78
Articles Purchased	2,400	3,120	3,120	4,056	4,056	5,273	5,273	5,273	5,273	5,273
Total Cost	$1,800,000	$1,773,180	$1,912,577	$1,892,821	$2,040,725	$2,032,023	$2,189,538	$2,359,402	$2,542,589	$2,740,153

The costs of journals increased 45.7% and the cost of document delivery increased by 240.8% with the total cost of providing journal articles increased $940,154 or 52,2%. The number of subscriptions declines by 27.1% and the number of articles purchased increases 119.7%.

This might not seem like it would be worth the effort, but despite the fact that costs are not contained to the extent we might hope, it does make a big difference. If this strategy was not implemented the result over the decade would have been quite different. The total cost of providing articles would have risen to $3,571,348 or nearly double what it was at the beginning of the period. Thus implementing this strategy would mean the cost of articles would be $831,195 less and the total amount saved over the ten years would have been $4,678,284, which is not chump change.

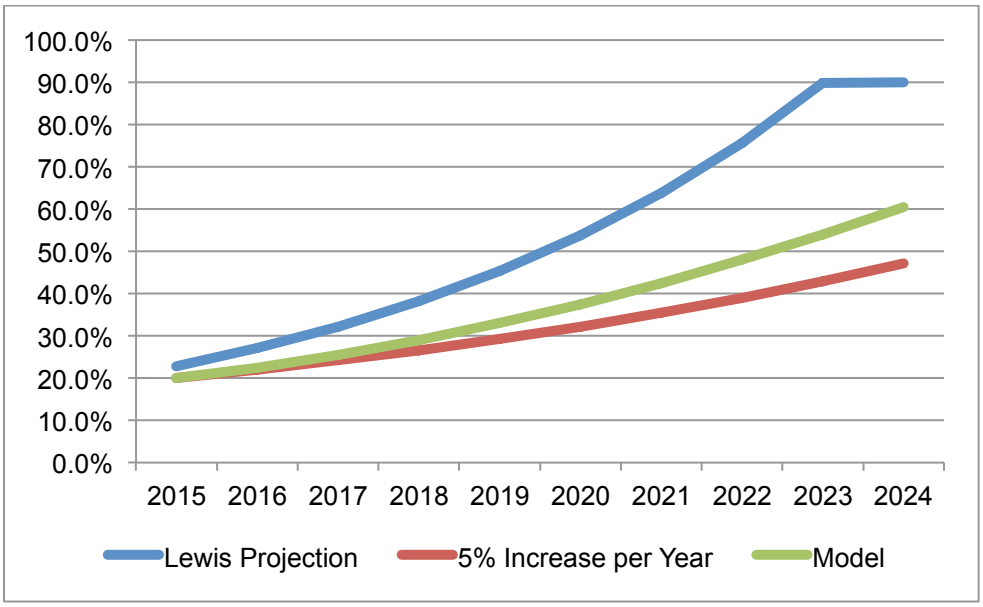
Implementing Strategy 3 – Replacing Subscriptions with Open Access

It is unclear how a library will be able to build a strategy to reduce expenditures on journal subscriptions based on the growth of Gold OA, but it should be the case that some reduction is possible. There are two issues that need to be considered. The first is what rate of substitution can we expect. The second is how can a library reduce its collection of subscription journals based on the growth of Gold OA.

Let's look at the first issue. My most recent prediction for the rate of substitution is shown in the first line of the table below. I have assumed that the Gold OA substitution stops at 90%. If we assume a 5% straight-line increase beginning with Gold OA having 20% penetration we get the figures in the second line of the table below. For the purposes of our model, I will use an intermediate assumption. The assumption assumes a Gold OA penetration in 2015 of 20% and adds an increasing percentage to than as follows to that base 2.5% in 2016, 3.0% in 2017, 3.5% in 2018, etc.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Lewis Projection	22.8%	27.1%	32.1%	38.2%	45.3%	53.8%	63.8%	75.7%	89.9%	90.0%
5% Increase per Year	20.0%	22.0%	24.2%	26.6%	29.3%	32.2%	35.4%	39.0%	42.9%	47.2%
Model	20.0%	22.5%	25.5%	29.0%	33.0%	37.5%	42.5%	48.0%	54.0%	60.5%

These different assumptions are shown in the following graph.



The second issue that we need to resolve is how can a library take advantage of the increasing substitution of Gold OA for subscriptions. It might be argued that libraries will need to keep many of their existing subscriptions even as Gold OA expands because the new Gold OA titles are not really substitutes, but rather new and different. This will certainly be true to some extent. For the purposes of our model we will first assume that our hypothetical library will be able to capture half of the savings represented by the increase in Gold OA. The results are shown in the table below.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Journal Costs	$1,740,000	$1,849,838	$1,959,157	$2,066,187	$2,168,624	$2,263,461	$2,346,756	$2,413,281	$2,455,978	$2,465,054
Cost per Subscription	$1,000	$1,080	$1,166	$1,260	$1,360	$1,469	$1,587	$1,714	$1,851	$1,999
Journal Subscriptions	1,740	1,713	1,680	1,640	1,594	1,540	1,479	1,408	1,327	1,233

If half of the substitution of Gold OA for subscriptions can be captured, then journal cost rise 41.7% and the number of journals subscribed to decreases by 507 or 29.1%.

Combining strategies 2 and 3

If both strategies for mitigating journal cost increase are employed, the results are shown in the chart below.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total Cost	$1,740,000	$1,664,854	$1,763,241	$1,673,612	$1,756,585	$1,650,063	$1,710,785	$1,759,282	$1,790,408	$1,797,025
Cost per Subscription	$1,000	$1,080	$1,166	$1,260	$1,360	$1,469	$1,587	$1,714	$1,851	$1,999
Journal Subscriptions	1,740	1,542	1,512	1,329	1,291	1,123	1,078	1,027	967	899

The combination of the two strategies means that journal costs increase only $57,025 or 3.3% over the decade. The number of journals subscribed to decreases by 841 or 48.3%.

Strategy 4 – Databases and Free Web Content

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024

As noted above it is difficult to anticipate how free content on the web will substitute for the variety of database content purchased by libraries. It is though easy to imagine that many libraries will soon find that the money they spend on some resources will no longer be justified given the free alternatives. For the purpose of this exercise we will assume that the database portion of the budget can be reduced by 2% each year because of the substitution of free content for content that would previously have been purchased. The result would be as shown in the table below.

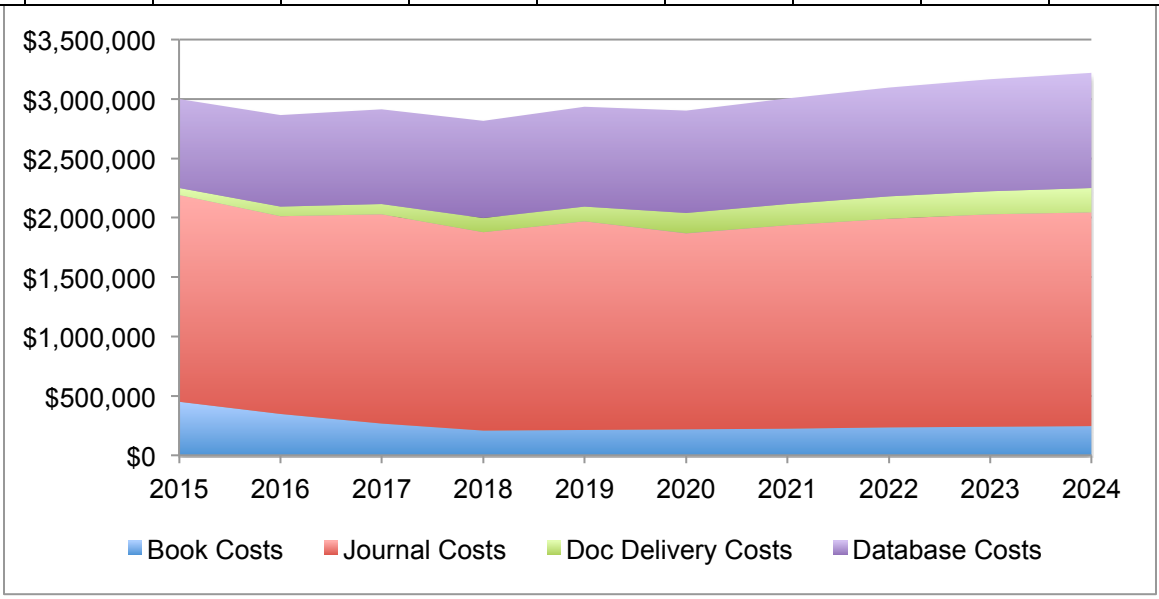
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Database Costs	$750,000	$771,750	$794,131	$817,161	$840,858	$865,243	$890,335	$916,155	$942,723	$970,062

Over the decade costs of databases would increase by $220,062, or 29.3%.

Overall Effect of Instituting these Four Strategies

The overall effect of implementing the four strategies laid out in this model is shown in the table and the graph below.

Book Costs	$450,000	$347,625	$268,540	$207,447	$213,671	$220,081	$226,683	$233,484	$240,488	$247,703
Journal Costs	$1,740,000	$1,664,854	$1,763,241	$1,673,612	$1,756,585	$1,650,063	$1,710,785	$1,759,282	$1,790,408	$1,797,025
Doc Delivery Costs	$60,000	$81,900	$85,995	$117,383	$123,252	$168,239	$176,651	$185,484	$194,758	$204,496
Database Costs	$750,000	$771,750	$794,131	$817,161	$840,858	$865,243	$890,335	$916,155	$942,723	$970,062
Total Costs	$3,000,000	$2,866,129	$2,911,907	$2,815,603	$2,934,367	$2,903,626	$3,004,455	$3,094,405	$3,168,378	$3,219,286
% Change		-4.5%	1.6%	-3.3%	4.2%	-1.0%	3.5%	3.0%	2.4%	1.6%



The overall result over the decade of the model would be a $219,286, or 7.3% increase in the cost of materials for our hypothetical library. It is interesting to note that cost of providing books and journals is $776 less at the end of the decade than it was at the beginning. For much of the decade the costs are below what they were at the beginning. In fact, the total expenditures over the decade are $29,9118,155. If the library were able to maintain its beginning $3,000,000 budget and bank the savings from year to year, at the end of the decade the library would have had $81,845 left in the bank.

Two more aggressive variations on this strategy would allow our hypothetical to have expenditures at the end of the decade that are about the same as they were at the beginning. If the library were able to reduce its databases by 5% per year, that is keeping a constant dollar expenditure for databases throughout the decade, it would have a total expenditure of $2,982,516, or 0.6% below the initial $3,000,000. Alternatively, if the library were able to capture 70% of the

substitution of Gold OA rather than only 50%, then it would end the decade with a materials expenditure of $2,980,771, or again 0.6% below where it began the decade.

Conclusion

For a long time academic libraries have face relentless price increases especially for journals and more recently for databases. For a long time there was little that libraries could do besides belt tightening and begging their campuses for more money. Recent developments are driven by the digitization of content. These include the ability to purchase content only when there is an actual need, the development of open access publishing, and the development on increasing quantities of quality free content on the web of all types. These developments mean that strategies exist, or can be easily imagined, that will provide libraries with the opportunity to provide their users with the content they require without continued unreasonable increases in expenditures.

These strategies are not necessarily easy. Explaining to the campus, especially faculty, how they will work so that service is not harmed and the cost savings they will bring will be important.

As libraries begin implementing these strategies there will be impacts on publishers. These may have unfortunate consequences for those publishers that do not adapt to the new reality.

While there will be challenges, academic libraries have entered a new era where they have the ability to drive change and influence their environment in ways that were impossible even a few years ago.

Notes

The spreadsheet with the model is “Thought Experiment Model 4-15.”

[1] “Graph 4: Expenditure Trends in ARL Libraries, 1986-2012,” *Statistical Trends*, Washington, DC: Association of Research Libraries. Available at: http://www.arl.org/focus-areas/statistics-assessment/statistical-trends#.VRWKl1zj-Uw

[2] See various years of "Academic Libraries” in the Library Statistics Program, National Center for Educational Statistics. Available at: http://nces.ed.gov/pubsearch/getpubcats.asp?sid=041#050

[3] See: *Library and Book Trade Almanac (formerly the Bowker Annual).* Medford, NJ: Information Today, 56th edition, 2011 page 463 and 59th edition 2014 pages 426-427.

[4] Allen Kent, et. al. *Use of Library Materials: The University of Pittsburgh Study*. New York, NY: Marcel Dekker, Inc., 1979.

[5] Param Bedi and Jason Snyder, “Making a Difference: Moving Your Organization from Transactional to Transformational,” *Educause Review* 50(2): March/April 2015. Available at: http://www.educause.edu/ero/article/making-difference-moving-your-organization-transactional-transformational

[6] See the Science Direct website at: http://www.elsevier.com/online-tools/sciencedirect/articles#pay-per-view

[7] David W. Lewis, "The Inevitability of Open Access," *College & Research Libraries* 73(5):493-506 September 2012. Available at: http://crl.acrl.org/content/73/5/493.full.pdf+html

[8] David W. Lewis, "The Inevitability of Open Access: Update One," August 2013. Available at: https://scholarworks.iupui.edu/handle/1805/3471

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