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University Investment in the Library, Phase II: An International Study of the Library's Value to the Grants Process

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Executive Summary

Academic libraries must find ways to measure and demonstrate the value of their collections and services to all of their stakeholders. Academic library collections (both print and electronic) and library services provide value in many ways, including value to research, teaching, and student development. Return on investment (ROI) is one way to quantify the value of the library. This study examines the ROI of the library in one functional area—ROI in all stages of the grants process. This project expands and tests a case study conducted with the University of Illinois at Urbana-Champaign (Luther, 2008) which developed a methodology for calculating the library's ROI to the university through grants received. This new study expands that methodology to 8 institutions in 8 countries to see if the methods are widely applicable in academic research libraries worldwide. Both quantitative and qualitative data were collected, including surveys of faculty, interviews with university administrators, and data on grant proposals, grant income, and the library budget.

The results demonstrate the value of the library to the institution in improving grant proposal and report writing and in helping to attract grant income. Library e-collections especially play a vital role in all aspects of grants, from proposal writing to final reports. The study across countries also shows how some specific factors within an institution (such as subject focus) or factors within a country (such as sources for grants funding) can influence the ROI for grants income. This report continues the ongoing discussion of ROI and academic libraries. Expansion of this research to include other aspects of ROI will be conducted under sponsorship by the Institute of Museum and Library Services (IMLS). The study, *Value, Outcomes, and Return on Investment of Academic Libraries* ("Lib-Value," grant number LG-06-09-0152-09), is a 3 year project which began in December 2009 and is being led by principal investigators Carol Tenopir and Paula Kaufman.

Key findings:

1. For every monetary unit invested in academic libraries, the parent institutions received a return on investment of between 15.54:1 to 0.64:1 in research grant income. In 6 of the 8 countries, the ROI for grants is more than 1:1. ROI for grants varies according to the goals of the institution (e.g., research-intensive vs. teaching-focused, or emphasis on science/technology/medicine vs. emphasis on social sciences and humanities) and the availability of competitive funding sources. This ROI was calculated using the entire library budget. If the portion of the library budget that is just related to e-collections is used, the ROI rates range from 155:1 to 6.4:1.
2. In two North American universities, regression analysis using 10 years of data shows that an increase in the library budget is correlated with an increase in grant funding.
3. Faculty survey respondents cite averages of 7.5 to 41.2 books or articles in each grant proposal they write, 14.9 to 26.5 in each final grant report, and 22.0 to 42.2 for each article they write. The amount of reading, and therefore value, goes far beyond what is cited. For each article or book cited, respondents report reading between 18.0 to 40.2 other books or articles. Faculty members who receive grant funding cite more and read more on average than those who receive no funding.
4. At least three-fourths of survey respondents in all institutions and over 90% in 5 of the 7 institutions state it is "important," "very important," or "essential" to cite references to journal articles or books in their grant proposals.
5. Most respondents access at least half of the articles and books they cite in grant proposals, reports, and publications from their institutional library e-resource collections.
6. Survey respondents report that they spend at least 3.5 hours per week finding and accessing articles, and at least 9.8 hours reading articles. This investment in time shows that articles are important to them.

University administrators said in interviews at each institution that their long-term goals include attracting and retaining productive faculty, fostering innovative research, facilitating interdisciplinary collaboration, and raising the university's prestige. Comments and data from the faculty surveys indicate that, in addition to helping generate grant income, the library also serves these administrator goals.

Return on investment in the grants process is one important and convenient way to quantify the value of the academic library, but it underestimates the total value of the library. The time invested by faculty in finding and using scholarly literature is an indication of the value of collections to both teaching and research. Time savings and improved efficiency made possible by library collections are another component of value. Qualitative comments by faculty and administrators demonstrate in terms of ROI the importance of electronic access to the core functions of the faculty and the institution. ROI calculations should be expanded beyond grant income to include the value of all key library products and services that support the mission of the institution.

Introduction

In an era of decreasing resources and increasing calls for accountability, academic libraries all over the world face the challenge of demonstrating and quantifying their value to their funders and to all of their stakeholders. Academic librarians must make a compelling case for the library's value to the institution in order to secure the financial resources necessary to effectively serve the university and research community. As institutional leaders weigh competing priorities and allocate limited resources, they need concrete evidence of how the library supports the institution's strategic goals. In addition, they need evidence that helps them weigh the value of new directions. As librarians and administrators make budgeting decisions, librarians may be asked to prioritize their products and services to focus on those that are the most effective in serving the institutional mission with increased financial challenges.

For insight into exactly how academic libraries can support institutional strategic goals, a case study conducted at the University of Illinois at Urbana-Champaign (UIUC) included interviews with top-level administrators about their priorities and values (Luther, 2008). Administrators want faculty to make substantive research contributions by focusing on new intellectual directions. This is the first step in developing the university to better meet current institutional needs: significant research improves the intellectual climate and research reputation of the university; this reputation helps the university attract and retain productive faculty; and a productive faculty helps the university attract funding and improve its reputation. Administrators believe they can help faculty make research contributions by strengthening interdisciplinary work, finding resources, building connections, and increasing the efficiency and impact of research. These administrative priorities led investigators for the UIUC case study to develop an ROI model that focuses on the library's role in faculty research productivity and grant funding.

Return on investment is a quantitative measure of the value returned to the institution for each dollar invested in the library. The pilot study at UIUC established a model for measuring the library's ROI (Luther, 2008). The model compares the university's expenditure on the library to the income received by the university from research grant proposals that cite library resources. The study investigators collected 10 years of data on grant proposals, awards, expenditures, and library budgets, as well as information about the numbers of faculty, principal investigators, and articles published. Researchers then conducted a survey of faculty members to 1) determine the role of library resources in producing grant proposals and grant reports, and to 2) obtain qualitative statements of the value of the library to faculty members' work. The ROI in terms of dollars awarded to grant recipients who used the UIUC library to prepare their grants was found to be \$4.38 for every \$1.00 invested in the library, using the total library budget.

Although this model for calculating ROI does not attempt to measure the library's total value in the functional areas of teaching, research, and learning, it does provide a way to quantify one of the library's contributions to the institution's income-generating functions and to demonstrate the economic value of investment in the library.

This report applies the ROI model established in the UIUC case study to 8 additional institutions in 8 countries. Academic institutions were from North America, Western Europe, Asia-Pacific, and Africa. Brief profiles of the participating institutions reveal some similarities and differences:

- "University 1" is a public research-intensive university in North America, with approximately 1,550 faculty, 21,100 undergraduate students, and 5,600 graduate students.
- "University 2" is a Western European research institute, with approximately 200 research centers throughout the nation, about one-third of which are joint centers with universities. The institute has about 3,200 full-time researchers and 3,800 pre- or postdoctoral researchers.
- "University 3" is a public university in Asia, with over 12,300 undergraduates, 9,900 postgraduate students, 1,000 full-time teaching faculty, and 660 full-time research faculty.
- "University 4" is an Asian science and engineering research university, with approximately 450 full-time faculty, 3,600 undergraduates, and 5,500 graduate students.
- "University 5" is an independent North American research university, with over 2,500 full-time faculty, 30,800 undergraduates, and 4,600 graduate students.
- "University 6" is a public university in Africa, with more than 1,000 academic staff members and over 50,000 students, including more than 27,700 full-time undergraduate students, 10,400 full- or part-time postgraduate students, and 14,000 distance education students.

- "University 7" is a private university in Asia, with about 2,100 full-time faculty, over 45,000 undergraduates, and 8,600 graduate students.
- "University 8" is a public university in Oceania, with over 2,800 academic staff and 21,300 students. (Survey data for this university is not available, so only the ROI value is reported in the results section but not other results.)
- "University 9" is the University of Illinois at Urbana-Champaign, at which the original case study was conducted. The ROI calculation for UIUC is discussed in this report for comparison.

Related Research

Several methods for estimating the financial value of libraries have emerged in recent studies. Much of the progress in library valuation methodologies has been made in public libraries. Like academic libraries, public libraries increasingly need to demonstrate their value to their funders in quantifiable terms. The Americans for Libraries Council conducted an extensive review of public library valuation methods and identified 3 popular methodologies: cost/benefit analysis, contingent valuation, and secondary impact analysis. Public libraries have also adapted some valuation techniques from the business and nonprofit sectors, including Social Return on Investment (SROI), an expanded type of cost/benefit analysis that estimates the financial value of the library's social, cultural, and environmental effects (Imholz & Arns, 2007).

A contingent-valuation method was used to calculate the ROI of public libraries in Florida. This method estimates the library's value by considering what would be lost in terms of access to materials and services, revenue for contractors and vendors, and the cost of alternative sources of information and services if the library ceased to exist. By comparing the financial value that would be lost if the libraries no longer existed to the state's total investment in its libraries, researchers calculated a return on investment of \$6.54 for every dollar invested in Florida public libraries (Griffiths, King, Tomer, Lynch, & Harrington, 2004). A similar contingent-valuation method was used to calculate the ROI of 8 Colorado public libraries; the ROI for most libraries in Colorado was about 5:1 (Library Research Service, 2007).

Using a more conservative method of ROI calculation than that of the Florida or Colorado studies, researchers in Ohio found that for every dollar invested in 4 Southwestern Ohio public library systems, the public receives \$3.81 in quantifiable benefits (Levin, Driscoll, & Fleeter, 2006). This study focused only on quantifiable benefits—such as the value of circulating materials, reference services, computer use and training, and outreach services—and excluded benefits that are more difficult to quantify, such as the economic impact of the library's small business resources and career development training.

Some studies have expanded ROI to academic libraries. In examining the use and outcomes of University of Pittsburgh library print and electronic collections, King, Aerni, Brody, Herbison, and Knapp (2004a) found that if all journal article readings by faculty are taken into account, the current reader purchase cost (value) of using sources other than the library journal collection is \$13.48 million. At the same time, the investment by the University of Pittsburgh in its library collection is \$3.43 million (King et al., 2004b). The net benefit of the collection is thus \$10.05 million (\$13.48 minus \$3.43 million), so the ROI for the university library is 2.9:1 (\$10.05/\$3.43 million) (Tenopir & King, 2007).

Another academic library study (Mezick, 2007) demonstrated that library expenditures and professional staff had a significant positive effect on student retention. Analysis from publicly available online data from the National Center for Education Statistics found that the top-ranked colleges (based on the 2004 *U.S. News & World Report* ranking) exhibited higher expenditures, greater book numbers, and higher staff numbers per student (Jones, 2007).

Most of the previous ROI models focus primarily on cost savings rather than income generation. Prior to 2008, no known methodology offered a way to measure an academic library's role in generating grant income for the university. Consequently, researchers adapted an ROI methodology from corporate libraries to the academic library environment to determine the ROI of the UIUC library (Luther, 2008). This report applies and extends a revised version of the ROI model established in the UIUC case study to 8 additional academic libraries to see if the ROI model is more widely applicable to a range of institutions worldwide.

ROI Model

ORIGINAL MODEL FROM CORPORATE LIBRARIES

The ROI model used in this report was adapted from a model developed for corporate libraries to calculate revenue generated when the library was used (Strouse, 2003). The corporate library revenue model is based on 3 variables:

- x = percent of survey respondents who generated revenue using the library
- y = percent of instances when library use generated revenue
- z = the median revenue generated with each library use

These variables are multiplied to derive a value for the revenue generated by each library use (denoted as “xx”).

ADAPTED MODEL FOR ACADEMIC LIBRARIES USED IN UIUC CASE STUDY

This model was adapted for the academic environment by researchers in the UIUC case study (Luther, 2008). The adapted model is based on these variables:

- x = percent of faculty who secure grants using citations from library collections in their proposals
- y = percent of grant proposals that are successful
- z = the average grant income
- xx = the average grant income generated using resources from the library’s collections

The UIUC case study researchers then extended the model to determine the return on investment of the total library budget in terms of grant income, as shown in the chart below.

| Corporate Library Model | Adapted Model for Academic Library |
|--|---|
| x% of respondents report generating revenue with library support | x% of faculty with grants that used citations |
| X | X |
| y% of instances when library was used and revenue was generated | y% grant proposal success rate when library resources were used |
| X | X |
| \$z median revenue generated | \$z average grant income |
| = | = |
| \$xx average revenue generated per library use | \$xx average grant income generated when library resources were used |
| [no extension] | $\begin{aligned} & X \text{ number of grants expended} \\ & \div \text{ library budget} \\ & = \text{ grant income for each \$1 invested in library (ROI value)} \end{aligned}$ |

Presented as an equation, the ROI model used in the UIUC case study looks like this:

$$\left(\frac{\text{Percentage of faculty who use citations in grant proposals who are also PIs:}}{\left(\frac{\text{number of PIs} \times \% \text{ of faculty who use citations in grant proposals}}{\text{number of tenure system faculty}} \right)} \times \frac{\text{Percentage of proposals that are successful and use citations obtained through library:}}{\left(\frac{\text{number of grant awards} \times \% \text{ of faculty who say citations are important to grant awards}}{\text{number of grant proposals} \times \% \text{ of proposals that include citations obtained through library}} \right)} \right) \times \frac{\text{average size of grant} \times \text{number of grants expended in one year}}{\text{total library budget}}$$

REVISIONS TO THE UIUC MODEL

This study uses a revised version of the ROI model used in the UIUC case study. The revised model omits this portion of the equation:

$$\left(\frac{\text{number of PIs} \times \% \text{ of faculty who use citations in grant proposals}}{\text{number of tenure system faculty}} \right)$$

This part of the model was intended to calculate the percentage of faculty using citations in their grant proposals. However, it actually calculates the percentage of faculty who use citations and who are also principal investigators. The percentage of faculty who are principal investigators has no bearing on the library's ROI. In its simplest form, return on investment is:

$$\frac{\text{income}}{\text{expenditure}}$$

In this context, that means:

$$\frac{\text{grant funding received with the library's help}}{\text{library budget}}$$

A faculty survey was used to determine how much of the institution's total grant funding is attributable to the library, based on 3 factors:

- what percentage of faculty use citations in their proposals
- whether faculty access cited articles obtained through the library or through the institution's e-resources portal
- whether faculty consider citations important to the grant award process

The amount of grant funding received with the library's help is the same, regardless of what percentage of the institution's faculty are principal investigators. The original ROI formula for UIUC yielded an ROI of 4.38:1. The reformulation for UIUC increases that ratio to 5.60:1.

The revised ROI model used in this study looks like this:

$$\left(\frac{\text{number of grant awards} \times \% \text{ of faculty who say citations are important to grant awards}}{\text{number of grant proposals} \times \% \text{ of proposals that include citations obtained through library}} \right) \times \frac{\text{average size of grant} \times \text{number of grants expended in one year}}{\text{total library budget}}$$

Data Sources

Both quantitative and qualitative data were collected to allow calculation of ROI and to provide a broader picture of the value of the library. Methods used included a survey of faculty, interviews with administrators, and collection of financial, budget, and grants data. Data collected included:

- a survey of faculty, with questions about their use of library resources in grant proposals, reports, and articles for publication; time spent using resources; and other questions about their citing and reading patterns
- open-ended questions to faculty about the role of e-resources in their grants and research
- interviews with institution-level administrators about the institutional goals and their perspectives on the library's value to the institution
- 10 years of institution-wide data on the number of grant proposals submitted, the income received from grants (also referred to as grants expenditures), and the total library budget

Quantitative information from the survey, including the percentage of faculty who cite library resources in their grant proposals, the number of proposals submitted, and the number of grants received, plus university data on grant proposals, grants received, grant expenditures, and total library budget are used together to calculate the ROI of the library in grants income.

Results

ROI CALCULATION

The grants ROI for the 9 institutional libraries (including UIUC) was calculated based on the following formula:

$$\frac{\left(\frac{\text{number of grant awards} \times \% \text{ of faculty who say citations are important to grant awards}}{\text{number of grant proposals} \times \% \text{ of proposals that include citations obtained through a library}} \right) \times \text{average size of grant} \times \text{number of grants expended in one year}}{\text{total library budget}}$$

Key Finding 1

For every monetary unit invested in the libraries, the institutions received a return in grants income ranging from 15.54:1 for a research institute to 0.64:1 for comprehensive teaching and research institutions.

The ROI values for the 9 institution libraries are shown on this and the next page:

| University | ROI Value |
|--------------|----------------------|
| University 1 | 3.44:1 |
| University 2 | 15.54:1 |
| University 3 | 1.90:1 |
| University 4 | 13.16:1 ¹ |
| University 5 | 0.75:1 |
| University 6 | 1.31:1 |
| University 7 | 0.64:1 |
| University 8 | 1.43:1 ² |
| University 9 | 5.60:1 ³ |

Table 1a: ROI values in 9 libraries

There are several possible explanations for the variation in ROI values. The highest ROI values come from institutions with a purely research mission or with a concentration in science and technology. The middle ROI values are from research-oriented institutions that cover all disciplines and include both research and teaching, or which are located in countries or environments where seeking externally funded competitive grants is a priority and funds are available. Lower ROI values are from universities that are either comprehensive liberal arts institutions with a mix of research and teaching, institutions which have more limited opportunities for grants, those which rely on government funding instead of competitive grant funding, or those for which only a subset of total institutional data was available. Both the national environment and the mission and goals of the institution that houses a library influence the ROI from grants, making it difficult to compare ROI values across different institutions.

To help in understanding how the ROI was calculated, Table 1b shows the values for each element of the grants ROI formula for each of the 8 new institutions.

Table 1b: ROI elements for 8 institutions

| | Univ. 1 | Univ. 2 | Univ. 3 | Univ. 4 | Univ. 5 | Univ. 6 | Univ. 7 | Univ. 8 |
|---|------------|------------|-------------|---------|---------|------------|---------|------------|
| Number of grant awards | 1147 | 713 | 208 | 1176 | 235 | 1810 | 208 | 301 |
| Percentage of faculty who say citations are important to grant awards | 95.5% | 94.9% | 92.6% | 95.1% | 98.5% | 94.4% | 80.4% | 95.85% |
| Number of grant proposals | 1987 | 1023 | 3517† | 2940* | 485 | 3850 | 768 | 902 |
| Percentage of proposals that include citations obtained through library | 94.5% | 99.8% | 83.6% | 90.0% | 100.0% | 95.7% | 83.6% | 95.53% |
| Average size of grant | 101596 | 134416 | 780,174 | # | # | 123731 | # | 139537 |
| Number of grants expended in one year | 1128 | 2210 | 1266 | 1176 | 639 | 1810 | 791 | 435 |
| Total library budget | 19,429,400 | 12,671,725 | 192,634,000 | # | # | 79,096,878 | # | 14,192,000 |
| ROI | 3.44:1 | 15.54:1 | 1.90:1 | 13.16:1 | 0.75:1 | 1.31:1 | 0.64:1 | 1.43:1 |

* Using approximation of 40% acceptance

† Using approximation of 36% acceptance

Numbers withheld at the request of the participating institutions

Note: Average size of grant and Total library budget values are expressed in local currencies

| University | ROI Value |
|--------------|-----------------------|
| University 1 | 34.41:1 |
| University 2 | 155.37:1 |
| University 3 | 19.00:1 |
| University 4 | 131.65:1 ¹ |
| University 5 | 7.50:1 |
| University 6 | 13.13:1 |
| University 7 | 6.37:1 |
| University 8 | 14.40:1 ² |
| University 9 | 56.05:1 ³ |

Table 1c: ROI values in 9 libraries, calculated on the portion of the library budget attributable to the collection

The formula used to calculate ROI in this study used the total budget for the library. A more refined estimation of grants ROI might be arrived at by considering only the library budget or costs for electronic collections. An extensive analysis of the University of Pittsburgh library found that the portion of the total library costs attributable to e-collections was about 10% (King et al., 2004b). This analysis took into account not only the cost of the collection itself, but also the staff time and cost of support services, including collection development, licensing/interaction, acquisitions, receipt processing, and cataloging. It is beyond the scope of this project to perform that sort of in-depth cost analysis of each of the libraries in this study. If we assume, however, that these libraries have a similar budget allocation for e-collections as the University of Pittsburgh library, the ROI would be much higher, as represented in Table 1c.

¹ Due to some missing information, the ROI value for University 4 was calculated based on some approximation of the data.

² There is no survey data for University 8, so the ROI was calculated by averaging 4 similar universities' values.

³ The original formula yielded an ROI value for UIUC of 4.38:1. This is UIUC's recalculated ROI value.

REGRESSION ANALYSIS

Regression analyses were performed for all 8 study participants on longitudinal data collected from up to 10 years of university-wide data on the number of grant proposals submitted, the number of grant dollars received, and the total library budget. The data was analyzed based on regression equations shown in Table 2 below.

Table 2: Regression Equations used in this study

| | Equation Used* |
|-----------------------------------|--|
| Log normal regression | $\log(\text{Grant Income}_i) = \beta_0 + \beta_1 \log(\text{library budget}_i) + \beta_2 \log(\text{number of principal investigators}_i) + \epsilon$ |
| Instrumental variables regression | $\log(\text{Grant Income}_i) = \beta_0 + \beta_1 \log(\text{library budget}_i) + \epsilon$ <p>where $\log(\text{library budget}_{i,t}) = \gamma_0 + \gamma_1 \log(\text{library budget}_{i,t-1}) + \gamma_2 \log(\text{number of faculty}_i) + \epsilon'$</p> |
| Log-log (t-1) regression | $\log(\text{Grant Income}_{i,t}) = \beta_0 + \beta_1 \log(\text{library budget for the previous year}) + \beta_2 \log(\text{number of principal investigators in the previous year}) + \epsilon$ |
| Per capita (faculty) regression | $\text{Grant Income/number of faculty} = \beta_0 + \beta_1 (\text{library budget /number of faculty}) + \beta_2 (\text{number of principal investigators/number of faculty}) + \epsilon$ |

*where β is the coefficients and ϵ is the error term

Although findings from regression analysis are not statistically significant for other universities, results from 2 North American universities ("University 1" and "University 5") show a correlation between library funding and grant income. Four equations were used to test for a relationship between the library budget and grant income. For University 1, the log-normal regression shows that a 1% increase in the library budget is correlated with a 1.07% increase in grant funding. For University 5, the log-normal regression shows that, over 10 years, a 1% increase in the library budget is correlated with a 1.21% increase in grant funding.

Key Finding 2

In two North American universities, regression analysis of 10 years of data shows that an increase in the library budget is correlated with an increase in grant funding.

⁴The regression analysis was provided by Dr. Bruce Kingma (School of Information Studies, Syracuse University).

The instrumental variables regression adjusts for the endogeneity of the library budget variable. In other words, the equation accounts for the fact that the library budget is affected by another variable in the model: the number of faculty. This regression shows that a 1% increase in library funding is correlated with a 1% increase in grant funding in the same year for University 1 and a 1.71% increase for University 5. The log-log regression tests whether there may be a time lag in the impact of the library budget on grant income; that is, it tests whether the library budget and number of principal investigators in one year affects grant income in the next year. This regression shows that a 1% increase in library funding is correlated with a 0.8% increase in grant funding in the next year for University 1. For University 5, a 1% increase in library funding is correlated with a .92% increase in grant funding in the next year.

The per capita faculty regression adjusts for size effects by measuring the library budget's impact on grant income per faculty member, rather than for the entire university. The per capita regression shows that an increase in the library budget of a monetary unit of 1.00 per faculty member is correlated with an increase in grant income of 6.55 per faculty member for University 1 and 3.29 per faculty member for University 5.

The same set of regression equations were also used to test for a correlation between library funding and the number of grants received, but no statistically significant relationship was found for either of these universities.

Interviews with Administrators

To better understand the institutional research mission and the ways in which the library supports that mission, executives and administrators at each institution were interviewed about their values and goals and their views about how the library contributes to those values and goals.

Interviews were held in 2008 with university leaders and administrators at each of the 8 universities. Interviewees answered questions about their institutional research mission, their goals to help achieve that mission, and what they perceived as the contribution of the library to the grants process. They were also asked to describe the form and format of institutional research data on grant proposals, library budgets, and funding, as well as to provide up to 10 years of research and budget data.

EXECUTIVES' VALUES AND GOALS

Administrators at the 8 institutions shared many similar goals and perceptions of the value of the library, yet there were striking differences as well:

- Interviewees at all institutions emphasized the library's contribution to the institutional goals, with key drivers such as prestige of the research institution and internationalization of the institution.
- Institutional goals (or key drivers) at all institutions centered on research productivity, productive faculty, high quality students, high quality instruction, and international relevance.
- The goal of expanding grant funding is not common to all participating universities because the funding process at participating institutions varies greatly in accordance with administrative procedures in each country. Despite the differences, all institutions in this study are heavily focused on the institutional research impact, an impact measured by faculty productivity and increases in grant funding or budgets.
- Along with increasing research impact, some participating institutions are in the process of building international reputations by following enhanced international standards to add greater value to their institutions.
- In the meeting of institutional goals, the library provides strategic support and contributes to making the institution move from a teaching-only focus to a research focus, and from being a local to being an international player. The library is seen as one of the drivers in the reputation-building process, helping to attract research-productive faculty and diverse students.
- A well-supported library promotes seamless integration of library services with institutional research activities. One of the executives remarked that "the better the service, the less noticeable [the libraries] are."
- Having a strong library not only supports institutional goals, but also creates a collaborative and supportive environment that improves research and provides new outlets for research. One interviewee remarked that publication of research works is and will be regarded as social return on investment.

Faculty Survey

Faculty members in 7 of the 8 institutions were surveyed in 2008 about their use of library resources in grant proposals and reports. All instructional and research faculty were invited to participate via an e-mail from each participating institution's library director with an embedded link to the questionnaire, which was housed on a University of Tennessee server. A generic version of the anonymous Web-based questionnaire is reproduced in the appendix to this report. The University of Tennessee Institutional Review Board granted permission (under "Form A exemptions from IRB reviews") for the survey.

The response rate ranged from 8.4% to 32.9%. Respondents to the faculty survey were asked to provide both their subject discipline and their academic rank at the university.

FUNDED AND NONFUNDED RESPONDENTS

More than half of respondents in 4 of the 7 universities indicated that they did not receive any research grants as Principal Investigator (PI) or Co-Principal Investigator (Co-PI) in 2007. In Universities 2, 4, and 5 a majority of respondents did receive funding (Table 3 below).

Table 3: Percent of respondents who did or did not receive grants in 7 institutions

| University | Funded | Nonfunded |
|----------------------|--------|-----------|
| University 1 (n=282) | 41% | 59% |
| University 2 (n=574) | 69% | 31% |
| University 3 (n=217) | 30% | 70% |
| University 4 (n=84) | 77% | 23% |
| University 5 (n=197) | 70% | 30% |
| University 6 (n=132) | 37% | 63% |
| University 7 (n=534) | 46% | 54% |
| Total (n=2020) | 53% | 47% |

SURVEY ANALYSIS

While the value of the library is not limited to principal investigators, this report focuses on the library's role in generating grant income for the university. In order to form a better profile of the library's importance to the grant award process, 2 sets of descriptive statistics are presented for each faculty survey question. Responses for the whole group, including for those who received no grant funding, are marked "All Respondents" in table headers. Responses for the percentage of faculty who did receive grant funding are marked "Funded Respondents." This means that "Funded Respondents" is a subset of "All Respondents."

The faculty survey examined 4 topics, and analysis is presented in the context of those topics:

- the number and monetary value of research grants submitted and received
- use of library resources in citations for grant proposals, final reports, and articles for publication
- faculty perceptions of the importance of citations in the grant awards process
- faculty perceptions of the importance of electronic access to journal articles and books

RESEARCH GRANTS SUBMITTED AND RECEIVED

Number of proposals submitted

Some of the differences across institutions can be seen in the average number of proposals or grants received by faculty members. For all respondents who answered the question “As principal investigator (PI) or co-principal investigator (Co-PI), how many proposals for externally funded research grants did you submit in 2007?” the average number of proposals submitted ranged from 0.68 to 2.75. For just those respondents who had submitted at least one proposal, the number of proposals submitted per respondent ranged from an average of 1.44 to 3.43 (Table 4).

Table 4: Number of proposals for externally funded research grants submitted by respondents in 2007, in 7 institutions (where S.D. stands for “standard deviation” and S.E. stands for “standard error” throughout)

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|------|------|------|--------------------|------|------|------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 282 | 1.43 | 2.34 | 0.14 | 115 | 2.99 | 2.91 | 0.27 |
| University 2 | 574 | 1.11 | 1.34 | 0.06 | 392 | 1.44 | 1.38 | 0.07 |
| University 3 | 218 | 0.68 | 1.24 | 0.08 | 67 | 1.81 | 1.64 | 0.20 |
| University 4 | 84 | 2.75 | 2.39 | 0.26 | 65 | 3.43 | 2.26 | 0.28 |
| University 5 | 197 | 1.42 | 1.53 | 0.11 | 137 | 1.86 | 1.58 | 0.14 |
| University 6 | 132 | 0.96 | 1.69 | 0.15 | 49 | 2.20 | 2.09 | 0.30 |
| University 7 | 534 | 1.16 | 1.54 | 0.07 | 246 | 2.04 | 1.76 | 0.11 |
| Total | 2021 | 1.21 | 1.69 | 0.04 | 1071 | 1.98 | 1.91 | 0.06 |

Number of grants received

All respondents who answered the question “During 2007, for how many externally funded research grants were you the PI or Co-PI?” reported that they participated on average in 0.51 to 2.33 research grants in 2007. For those who received funding, the average number of research grants ranged from 1.66 to 3.02 per respondent (Table 5).

Table 5: Number of externally funded research grants for which the respondent was PI or Co-PI in 2007, in 7 institutions⁵

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|------|------|------|--------------------|------|------|------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 282 | 0.96 | 1.82 | 0.11 | 115 | 2.35 | 2.20 | 0.21 |
| University 2 | 574 | 1.36 | 1.49 | 0.06 | 395 | 1.98 | 1.42 | 0.07 |
| University 3 | 217 | 0.51 | 1.04 | 0.07 | 66 | 1.68 | 1.27 | 0.16 |
| University 4 | 84 | 2.33 | 2.07 | 0.23 | 65 | 3.02 | 1.87 | 0.23 |
| University 5 | 197 | 1.45 | 1.64 | 0.12 | 137 | 2.08 | 1.59 | 0.14 |
| University 6 | 132 | 0.73 | 1.39 | 0.12 | 49 | 1.98 | 1.66 | 0.24 |
| University 7 | 533 | 0.77 | 1.05 | 0.05 | 247 | 1.66 | 0.96 | 0.06 |
| Total | 2019 | 1.06 | 1.49 | 0.03 | 1074 | 2.00 | 1.52 | 0.05 |

⁵ Because proposals submitted in 2007 (Table 3) may not be funded until 2008 or later, the numbers in Tables 3 and 4 do not relate directly to each other. Proposals for grants funded in 2007 (Table 4) may have been written at any time in the past.

USE OF LIBRARY RESOURCES FOR CITATIONS

The number of citations of books or articles included by faculty members in each of their grant proposals, final reports, or articles for publication ranges widely across the 7 institutions, but with one exception exceeds 10 citations per paper on average. The lowest reported number of citations comes from an Asian university with a focus in arts, humanities, law, education, and social sciences.

References cited in proposals

The average number of citations included in a grant proposal is higher among funded faculty than in the group as a whole. On average, in 6 of the 7 institutions, funded respondents include at least 15 citations in each of their proposals (Table 6).

Table 6: Responses to the question "How many references to articles and/or books do you cite in a grant proposal?" in 7 institutions

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|-------|-------|------|--------------------|-------|-------|------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 227 | 34.20 | 40.50 | 2.70 | 109 | 46.00 | 47.30 | 4.50 |
| University 2 | 502 | 30.64 | 23.30 | 1.04 | 374 | 32.78 | 24.00 | 1.24 |
| University 3 | 173 | 18.87 | 30.31 | 2.30 | 57 | 30.37 | 40.73 | 5.40 |
| University 4 | 71 | 18.25 | 15.23 | 1.74 | 65 | 17.95 | 15.55 | 1.99 |
| University 5 | 182 | 41.16 | 38.40 | 2.85 | 132 | 45.22 | 42.66 | 3.71 |
| University 6 | 108 | 12.59 | 18.44 | 1.77 | 45 | 15.07 | 11.79 | 1.76 |
| University 7 | 432 | 7.52 | 8.42 | 0.41 | 215 | 9.65 | 9.37 | 0.64 |
| Total | 1695 | 23.47 | 28.59 | 0.69 | 997 | 29.03 | 31.70 | 1.01 |

References cited in final grant reports

Respondents were asked to estimate on average how many articles or books they cited in previous final grant reports. Respondents estimate they cite on average at least 14 articles or books in their final grant reports, with funded respondents citing at least 18 (Table 7).

Table 7: Responses to the question "How many references to articles and/or books do you cite in a final grant report?" in 7 institutions

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|-------|-------|------|--------------------|-------|-------|------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 209 | 22.20 | 27.90 | 1.90 | 107 | 24.00 | 28.90 | 2.80 |
| University 2 | 496 | 21.81 | 22.35 | 1.00 | 370 | 22.36 | 23.27 | 1.21 |
| University 3 | 169 | 17.28 | 33.20 | 2.55 | 54 | 18.46 | 23.88 | 3.25 |
| University 4 | 75 | 21.63 | 20.98 | 2.42 | 60 | 20.87 | 15.43 | 1.99 |
| University 5 | 159 | 26.54 | 29.05 | 2.30 | 115 | 28.70 | 31.99 | 2.98 |
| University 6 | 106 | 19.02 | 41.04 | 3.99 | 45 | 23.64 | 34.48 | 5.14 |
| University 7 | 414 | 14.93 | 23.59 | 1.16 | 210 | 19.53 | 28.24 | 1.95 |
| Total | 1628 | 19.92 | 27.04 | 0.67 | 961 | 22.43 | 26.54 | 0.86 |

References cited in articles for publication

Respondents report that they cite at least 22 articles or books in each article they submit for publication. The average number of citations per article was similar among funded respondents and all respondents (Table 8).

Table 8: Responses to the question "How many references to articles and/or books do you cite in an article for publication?" in 7 institutions

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|-------|-------|------|--------------------|-------|-------|------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 258 | 32.30 | 23.70 | 1.50 | 111 | 33.30 | 17.90 | 1.70 |
| University 2 | 512 | 32.40 | 14.80 | 0.65 | 374 | 33.05 | 13.99 | 0.72 |
| University 3 | 176 | 22.02 | 26.18 | 1.97 | 57 | 28.79 | 17.83 | 2.36 |
| University 4 | 78 | 23.88 | 12.81 | 1.45 | 62 | 23.68 | 12.99 | 1.65 |
| University 5 | 185 | 42.19 | 33.06 | 2.43 | 131 | 43.58 | 34.06 | 2.98 |
| University 6 | 118 | 30.29 | 50.34 | 4.63 | 46 | 32.11 | 30.19 | 4.45 |
| University 7 | 435 | 22.10 | 41.13 | 1.97 | 215 | 21.76 | 18.97 | 1.29 |
| Total | 1762 | 29.32 | 31.02 | 0.74 | 996 | 31.15 | 21.28 | 0.67 |

Articles read for each article cited

Citations of books and journal articles in grant proposals, final reports, and articles for publication are only one indicator of the total impact of library resources on faculty productivity. Faculty members' actual use of library resources for writing grant proposals, reports, and articles is even higher than their number of citations would indicate. On average, for every one article or book a faculty member cites, she or he reads at least 18 other articles or books (Table 9).

Table 9: Responses to the question "In 2007, on average for each article and/or book cited in a grant proposal, grant report, and/or article for publication, approximately how many other articles and/or books did you read?" in 7 institutions

| | All Respondents | | | | Funded Respondents | | | |
|--------------|-----------------|-------|-------|------|--------------------|-------|-------|-------|
| | n | Mean | S.D. | S.E. | n | Mean | S.D. | S.E. |
| University 1 | 247 | 18.00 | 32.70 | 2.10 | 106 | 18.70 | 41.20 | 4.00 |
| University 2 | 484 | 26.87 | 48.61 | 2.21 | 350 | 28.70 | 52.46 | 2.80 |
| University 3 | 173 | 25.44 | 64.28 | 4.89 | 57 | 15.82 | 28.91 | 3.83 |
| University 4 | 72 | 40.22 | 80.19 | 9.45 | 59 | 42.64 | 87.24 | 11.36 |
| University 5 | 176 | 24.33 | 69.78 | 5.26 | 124 | 25.72 | 79.47 | 7.14 |
| University 6 | 114 | 18.90 | 29.57 | 2.77 | 46 | 17.37 | 23.55 | 3.47 |
| University 7 | 425 | 24.06 | 73.38 | 3.56 | 211 | 25.40 | 74.00 | 5.10 |
| Total | 1691 | 24.47 | 58.81 | 1.43 | 953 | 24.96 | 52.94 | 1.72 |

Key Finding 3

Respondents cite an average range of 7.5 to 41.2 books or articles in each grant proposal they write, 14.9 to 26.5 in each final grant report, and 22.0 to 42.2 for each article they write. For every article a respondent cites, s/he reads 18.0 to 40.2 other articles.

IMPORTANCE OF CITATIONS

Across all institutions, a strong majority of all respondents consider it “essential,” “very important,” or “important” to include references to journal articles and/or books in their grant proposals (Table 10).

Table 10: Responses to the question "Based on your understanding of the awards process for external research grants, how important is it to include references to journal articles and/or books in grant proposals?" in 7 institutions and for all respondents

| | All Respondents | | | | | | |
|--------------|-----------------|-----------|----------------|-----------|--------------------|---------------|--------|
| | | Essential | Very Important | Important | Somewhat Important | Not Important | Total |
| University 1 | Count | 190 | 47 | 21 | 6 | 6 | 270 |
| | % | 70.4% | 17.4% | 7.8% | 2.2% | 2.2% | 100% |
| University 2 | Count | 266 | 151 | 93 | 25 | 3 | 538 |
| | % | 49.4% | 28.1% | 17.3% | 4.6% | 0.6% | 100% |
| University 3 | Count | 95 | 53 | 39 | 12 | 3 | 202 |
| | % | 47.0% | 26.2% | 19.3% | 5.9% | 1.5% | 99.9%* |
| University 4 | Count | 18 | 20 | 24 | 15 | 4 | 81 |
| | % | 22.2% | 24.7% | 29.6% | 18.5% | 4.9% | 99.9%* |
| University 5 | Count | 153 | 28 | 9 | 3 | 0 | 193 |
| | % | 79.3% | 14.5% | 4.7% | 1.5% | 0% | 100% |
| University 6 | Count | 79 | 28 | 11 | 5 | 2 | 125 |
| | % | 63.2% | 22.4% | 8.8% | 4.0% | 1.6% | 100% |
| University 7 | Count | 169 | 113 | 123 | 73 | 26 | 504 |
| | % | 33.5% | 22.4% | 24.4% | 14.5% | 5.2% | 100% |
| Total | Count | 970 | 440 | 320 | 139 | 44 | 1913 |
| | % | 50.7% | 23.0% | 16.7% | 7.3% | 2.3% | 100% |

* Total does not equal 100% due to rounding

Funded respondents rate the importance of citations even higher than does the group as a whole (Table 11).

Table 11: Responses to the question "Based on your understanding of the awards process for external research grants, how important is it to include references to journal articles and/or books in grant proposals?" in 7 institutions and for funded respondents

| | Funded Respondents | | | | | | Total |
|--------------|--------------------|-----------|----------------|-----------|--------------------|---------------|--------|
| | | Essential | Very Important | Important | Somewhat Important | Not Important | |
| University 1 | Count | 88 | 14 | 6 | 2 | 1 | 111 |
| | % | 79.3% | 12.6% | 5.4% | 1.8% | 0.9% | 100% |
| University 2 | Count | 194 | 112 | 53 | 18 | 1 | 378 |
| | % | 51.3% | 29.6% | 14.0% | 4.8% | 0.3% | 100% |
| University 3 | Count | 34 | 10 | 10 | 4 | 0 | 58 |
| | % | 58.6% | 17.2% | 17.2% | 6.9% | 0% | 99.9%* |
| University 4 | Count | 13 | 11 | 21 | 15 | 3 | 63 |
| | % | 20.6% | 17.5% | 33.3% | 23.8% | 4.8% | 100% |
| University 5 | Count | 108 | 18 | 8 | 1 | 0 | 135 |
| | % | 80.0% | 13.3% | 5.9% | 0.7% | 0% | 99.9%* |
| University 6 | Count | 33 | 9 | 2 | 2 | 1 | 47 |
| | % | 70.2% | 19.1% | 4.3% | 4.3% | 2.1% | 100% |
| University 7 | Count | 101 | 51 | 46 | 33 | 9 | 240 |
| | % | 42.1% | 21.2% | 19.2% | 13.8% | 3.7% | 100% |
| Total | Count | 571 | 225 | 146 | 75 | 15 | 1032 |
| | % | 55.3% | 21.8% | 14.1% | 7.3% | 1.5% | 100% |

* Total does not equal 100% due to rounding

Key Finding 4

At least three-fourths of respondents in all institutions and over 90% in 5 of the 7 institutions say it is "important," "very important," or "essential" to the grant awards process to cite references to journal articles or books in their grant proposals.

IMPORTANCE OF ELECTRONIC ACCESS

Percentage of references accessed electronically

Nearly all respondents indicate that they rely heavily on electronic access to scholarly literature. In 6 of the 7 universities, more than half of respondents say they access at least 50% of the articles and books they cite through the university computer network or the university library (Table 12). Clearly, the library e-collection is important to the proposal and writing process of faculty members.

Table 12: Responses to the question "Approximately what percentage of the journals and/or books that you cite in grant proposals, grant reports, and/or articles for publication were originally accessed electronically while on the university computer network and/or via the university library?," in 7 institutions and for all respondents

| | All Respondents | | | | | | | Total |
|--------------|-----------------|-------|--------|---------|---------|---------|-------|--------|
| | | 0 % | 1-24 % | 25-49 % | 50-74 % | 75-99 % | 100 % | |
| University 1 | Count | 14 | 32 | 28 | 44 | 120 | 16 | 254 |
| | % | 5.5% | 12.6% | 11.0% | 17.3% | 47.2% | 6.3% | 99.9%* |
| University 2 | Count | 1 | 26 | 30 | 115 | 298 | 44 | 514 |
| | % | 0.2% | 5.0% | 5.8% | 22.4% | 58.0% | 8.6% | 100% |
| University 3 | Count | 18 | 20 | 25 | 32 | 72 | 13 | 180 |
| | % | 10.0% | 11.1% | 13.9% | 17.8% | 40.0% | 7.2% | 100% |
| University 4 | Count | 0 | 12 | 13 | 11 | 32 | 8 | 76 |
| | % | 0% | 15.8% | 17.1% | 14.5% | 42.1% | 10.5% | 100% |
| University 5 | Count | 4 | 24 | 21 | 37 | 85 | 17 | 188 |
| | % | 2.1% | 12.8% | 11.2% | 19.7% | 45.2% | 9.0% | 100% |
| University 6 | Count | 5 | 10 | 10 | 26 | 50 | 15 | 116 |
| | % | 4.3% | 8.6% | 8.6% | 22.4% | 43.1% | 12.9% | 99.9%* |
| University 7 | Count | 75 | 107 | 59 | 64 | 130 | 21 | 456 |
| | % | 16.4% | 23.5% | 12.9% | 14.0% | 28.5% | 4.6% | 99.9%* |
| Total | Count | 117 | 231 | 186 | 329 | 787 | 134 | 1784 |
| | % | 6.6% | 12.9% | 10.4% | 18.4% | 44.1% | 7.5% | 99.9%* |

*Total does not equal 100% due to rounding

Funded faculty members report even more use of electronic resources than does the group as a whole (Table 13).

Table 13: Responses to the question "Approximately what percentage of the journals and/or books that you cite in grant proposals, grant reports, and/or articles for publication were originally accessed electronically while on the university computer network and/or via the university library?" in 7 institutions and for funded respondents

| | Funded Respondents | | | | | | | |
|--------------|--------------------|-------|--------|---------|---------|---------|-------|--------|
| | | 0 % | 1-24 % | 25-49 % | 50-74 % | 75-99 % | 100 % | Total |
| University 1 | Count | 3 | 8 | 8 | 26 | 57 | 8 | 110 |
| | % | 2.7% | 7.3% | 7.3% | 23.6% | 51.8% | 7.3% | 100% |
| University 2 | Count | 0 | 19 | 24 | 80 | 218 | 34 | 375 |
| | % | 0% | 5.1% | 6.4% | 21.3% | 58.1% | 9.1% | 100% |
| University 3 | Count | 0 | 3 | 8 | 8 | 35 | 3 | 57 |
| | % | 0% | 5.3% | 14.0% | 14.0% | 61.4% | 5.3% | 100% |
| University 4 | Count | 0 | 9 | 9 | 8 | 27 | 8 | 61 |
| | % | 0% | 14.7% | 14.7% | 13.1% | 44.3% | 13.1% | 99.9%* |
| University 5 | Count | 1 | 19 | 12 | 21 | 63 | 15 | 131 |
| | % | 0.8% | 14.5% | 9.2% | 16.0% | 48.1% | 11.4% | 100% |
| University 6 | Count | 0 | 2 | 3 | 7 | 26 | 8 | 46 |
| | % | 0% | 4.4% | 6.5% | 15.2% | 56.5% | 17.4% | 100% |
| University 7 | Count | 27 | 52 | 26 | 39 | 69 | 13 | 226 |
| | % | 11.9% | 23.0% | 11.5% | 17.3% | 30.5% | 5.8% | 100% |
| Total | Count | 31 | 112 | 90 | 189 | 495 | 89 | 1006 |
| | % | 3.1% | 11.1% | 8.9% | 18.8% | 49.2% | 8.8% | 99.9%* |

*Total does not equal 100% due to rounding

Key Finding 5

Most respondents ($\geq 70\%$) access at least half of the articles and books they cite in grant proposals, reports, and publications from their institutional library e-resources.

TIME SPENT FINDING, ACCESSING, AND READING ARTICLES AND BOOKS

Time spent finding and reading scholarly literature demonstrates or implies the value of that literature to the reader. Respondents report that they spend at least 3.5 hours per week finding and accessing articles, and at least 9.8 hours reading articles (Figure 1). If we assume this is representative of a typical week over 10 months (or 44 weeks) of the academic year, faculty members spend on average about 585 hours each per year finding and reading books and articles. They invest this time because it is important to their scholarly endeavors.

Figure 1: Responses to the question "In 2007, approximately how much time in hours did you spend in an average week on each of the following activities – finding/accessing and reading articles and books?" in 7 institutions and for all respondents



Key Finding 6

Respondents report that they spend at least 3.5 hours per week finding and accessing articles and books, and at least 9.8 hours reading articles/books.

FACULTY COMMENTS

Respondents discussed the importance of electronic resources to their work in their responses to this open-ended survey question: "How has access to electronic resources available over the university network changed the way you work?" The responses addressed the impact of electronic resources on 1) efficiency and productivity, 2) preparation of grant proposals and publications, and 3) how resources help improve research and teaching. The comments are grouped under these three common themes.

Efficiency and Productivity

Faculty respondents say that access to electronic resources helps them work more efficiently and increases their productivity by providing faster access to articles and books and more efficient searching of the literature.

“Electronic access to library resources...is essential. The task of finding the most pertinent articles on a new topic used to take a full afternoon. The same work can now be completed in 15 to 30 minutes.” (University 1)

“It has saved me plenty of time, since there is no need to get to the library and make copies each time. Besides, I can have remote access to the electronic journals from home, which allows me to work on weekends.” (University 2)

“I guess that on average the online access saves me more than 10 hours per week.” (University 2)

“The convenience of desk-top delivery has improved my efficiency and, dare I say it, my ability to be a better researcher and teacher.” (University 3)

“With the current workload, I could not continue with research without the convenience of access [to e-resources] from my own computer.” (University 6)

“It mainly saves me a lot of time which can be used for more extensive reading.” (University 6)

“Access [to e-resources] has made collecting research resources infinitely more efficient; and [has] facilitated interdisciplinary research.” (University 1)

Preparation of Grant Proposals and Publications

Faculty members believe that electronic access to resources improves their preparation of grant proposals and articles for publication.

“Electronic access greatly improved and simplified work for publication, preparation of proposals, and research work with students.” (University 1)

“It has made my life much simpler and allowed me to follow the most recent developments much more quickly.” (University 2)

“It has helped me open or discard lines of research at the very beginning by knowing what other researchers have published or are soon going to publish...” (University 2)

“A sure way to kill a proposal is not to give proper credit or to not update new developments.” (University 9)

“I almost entirely rely on this access to gain information required. The electronic resources indeed facilitate my preparation of grants and manuscripts for publication. I would say that I would be lost without it.” (University 3)

“We now do all our searches electronically. We definitely do more detailed literature searches before submitting proposals or starting research.” (University 6)

“[Electronic access] is essential for scientific writing.” (University 6)

Improving Research and Teaching

Electronic access improves faculty members' research and teaching by allowing them to explore a wider range and greater volume of scholarly literature. This, in turn, helps them to gain a broader understanding of their field of inquiry, making their research and teaching more innovative, current, and thorough. In addition, respondents also comment that electronic access makes it much easier to share articles with their students, fellow researchers, and colleagues. Several faculty members commented that electronic access is simply a necessity.

“You have access to many more articles, and although you do not read them completely, you are more aware of what is going on in the field.” (University 2)

“[E-access allows me] to update knowledge especially from areas of research that otherwise remain practically ignored.” (University 2)

“I read and cite a wider range of material, especially outside [of] my discipline, and I feel more confident that I am engaging with the relevant literature.” (University 5)

“Having access to a much, much wider range of English-language resources than before is ... a huge change for the better ... I have always crossed disciplinary boundaries in my own research, but this is much easier to do with access to electronic resources.” (University 7)

“... The growing amount of materials and resources available has become an invaluable resource. I could not do the kind of research or teaching I do without these resources.” (University 7)

“... [S]uch access has become an essential research tool.” (University 7)

“Electronic access has been very useful to my work, as it widens considerably the scope of my readings. It also saves me a lot of time since I [can] access them anywhere (at home and abroad). In other words, I [can] do my research anytime and anywhere that has Internet access.” (University 3)

“Being able to easily access articles of the most current and/or best practice in my field of education/teaching has promoted in-depth student participation in class discussions and research.” (University 6)

Limitations

In some institutions, the percentage of faculty members from each academic discipline who responded to the survey may not be representative of the actual percentage of faculty in that university, which may skew faculty survey results. A small part of the ROI calculation is based on survey responses, although most of the ROI calculation is based on data provided by university administration. Unrepresentative survey responses may have some effect on the ROI value. For example, in University 5, 64.2% of the total faculty members are from life sciences whereas only 21.9% of the respondents to the survey are life sciences faculty. Since life sciences typically have more opportunities for external funding and higher average grant amounts, their perspectives and answers on the survey may differ from social sciences faculty members, who responded to the survey in disproportionately high numbers. The comparison between the percentage of participating faculty and the percentage of actual faculty in University 5 is shown in Table 14.

Table 14: Comparison of participating faculty and actual faculty in University 5

| University 5 | Population | Respondents |
|--|------------|-------------|
| Physical Sciences (called Science and Engineering) | 8.8% | 10.0% |
| Life Sciences, Health and Medicine | 64.2% | 21.9% |
| Social Sciences (called: Civil Law, Common Law, Education, Management, and Social Science) | 17.3% | 40.0% |
| Arts and Humanities | 9.7% | 28.1% |

Conclusion

This study demonstrates one method of quantifying the academic library's value. The research grant income that is generated using the library's collections is a good place to start the process of demonstrating ROI of academic libraries. This research also studies how the library contributes to administrators' long-term goals, including raising the university's prestige, attracting and retaining productive faculty, and fostering innovative research and interdisciplinary collaboration. Data from faculty, administrators, and budget offices at 8 institutions in 8 countries show that:

- Faculty use library resources to support their scholarship, research, and teaching.
- The vast majority of faculty use library resources to help prepare their grant proposals, articles, and reports, and they consider these resources an important part of the grants process.
- For every monetary unit invested in the library, the institution receives a return on investment in grants income alone that ranges from at least 15.54:1 to 0.64:1, depending on the focus of the institution and external funding opportunities in the country and using the total library budget.
- E-resources help faculty be more efficient and productive and increase their interdisciplinary and international perspectives.
- Institutional leaders rely on the library to help recruit, evaluate, and retain productive faculty, undergraduate, and postgraduate students, and to bolster their institutions' international reputations.

This measure of return on investment is based solely on the contribution of the library's resources to the institutional research grants income. This is one of many ways in which the library generates value for the university. The next phase of this research will examine how to quantify other ways in which the library creates value through its contributions to teaching, student engagement, and the university's overall stature. Differences between individual institutions and countries need to be taken into account when considering this research. This is a beginning step to an important way of thinking about academic libraries and their role in the institutions they serve.

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APPENDIX: FACULTY SURVEY

1. Please indicate the broad subject areas that best describe the primary department with which you are affiliated at [Name of Institution].

- Physical Sciences (e.g., Engineering, Physics, etc.)
- Life Sciences (e.g., Biology, etc.)
- Social Sciences (e.g., Political Sciences, Sociology, etc., and including Business, Education, and Law)
- Health Sciences (e.g., Medicine, Nursing, Public Health, etc.)
- Arts & Humanities
- Other (please specify): _____

2. Please indicate your current position at [Name of Institution].

- Professor (or equivalent)
- Associate Professor (or equivalent)
- Assistant Professor (or equivalent)
- Faculty Administrator/Other

3. As principal investigator (PI) or co-principal investigator (Co-PI), how many proposals for externally funded research grants did you submit in 2007? Please specify the number; if none, please enter 0.

4. During 2007, for how many externally funded research grants were you the PI or Co-PI? Please specify the number; if none, please enter 0.

5. What was the approximate total monetary value in local currency of the research grants that you received as PI or Co-PI over the last 5 years? Please specify the number; if none, please enter 0.

6. Based on your understanding of the awards process for external research grants, how important is it to include references to journal articles and/or books in grant proposals?

- Essential
- Very important
- Important
- Somewhat important
- Not important

On average, how many references to articles and/or books do you cite in each of the following? If none, please enter 0.

7. In a grant proposal: _____

8. In a final grant report: _____

9. In an article for publication: _____

10. Approximately what percent of the journals and/or books that you cite in grant proposals, grant reports, and/or articles for publication were originally accessed electronically while on the university computer network and/or via the university library's web site?

- 0
- 1-24%
- 25-49%
- 50-74%
- 75-99%
- 100%
- Do not know/unsure

11. In 2007, on average for each article and/or book cited in a grant proposal, grant report, and/or article for publication, approximately how many others did you read? If none, please enter 0.

In 2007, approximately how much time in hours did you spend in an average week on each of the following activities? If none, please enter 0.

12. Finding and/or accessing needed articles and/or books? _____

13. Reading articles and/or books? _____

14. How has access to electronic resources available over the university computer network and/or from the university library web site changed the way you work? Please comment.

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Carol Tenopir is a Chancellor's Professor at the School of Information Sciences at the University of Tennessee, Knoxville and the Director of Research for the College of Communication and Information, as well as Director of the Center for Information and Communication Studies. Her areas of teaching and research include: information access and retrieval, electronic publishing, the information industry, online resources, and the impact of technology on reference librarians and scientists. She is the author of five books, has published over 200 journal articles, is a frequent speaker at professional conferences, and since 1983 has written the "Online Databases" column for *Library Journal*. Dr. Tenopir holds a Ph.D. degree in Library and Information Science from the University of Illinois. Her Center was recently awarded a National Leadership Grants for Libraries from the Institute of Museum and Library Services (IMLS) to address academic librarians' growing need to demonstrate the return on investment (ROI) and value of the library to the institution. The continued study of ROI will help guide library management in the redirection of library funds to important products and services for the future.

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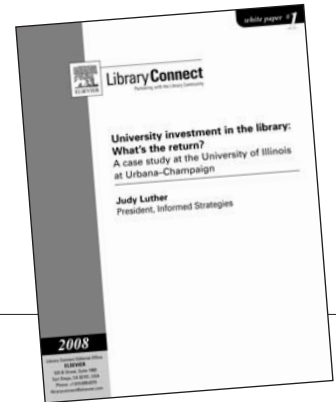
Amy Love is a recent graduate school graduate of, and Andrea Baer a current graduate student of, the School of Information Sciences at the University of Tennessee, Knoxville. Joseph Park and Lei Wu are Ph.D. students in the College of Communication and Information, University of Tennessee, Knoxville. Regina Mays is the project manager for the IMLS-funded Lib-Value project which expands the study of the ROI and value of academic libraries, and which is based at the Center for Information and Communication Studies at the University of Tennessee, Knoxville.

Bruce Kingma is the Associate Provost for Entrepreneurship and Innovation and a professor in the School of Information Studies (iSchool) at Syracuse University. Dr. Kingma received a Ph.D. degree in economics from the University of Rochester and a B.S. degree in economics with honors from the University of Chicago.

Donald W. King is an adjunct professor at the University of Tennessee, School of Information Sciences. He has held previous positions as a research professor at the University of North Carolina at Chapel Hill's School of Information and Library Sciences and with the School of Information Sciences at the University of Pittsburgh. He is the founder and former President of King Research, Inc. Mr. King holds a M.S. in Statistics from the University of Wyoming and is a fellow of the American Statistical Association.

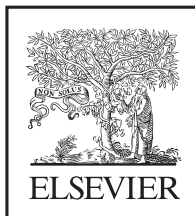
The 2008 Elsevier white paper "University investment in the library: What's the return?" by Judy Luther, President of Informed Strategies, details the original case study done with the University of Illinois at Urbana–Champaign that established the ROI model for grants.

Visit www.elsevier.com/libraryconnect for this white paper, as well as the many other Library Connect and Connect publications.



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