Academic Research Library Support of Sponsored Research in the United States

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Abstract

Academic research libraries support their educational institutions' missions to conduct research, including sponsored (funded) research. In the United States, colleges and universities have performed cost analysis studies, typically employing user surveys, for at least thirty-five years to quantify the extent to which their libraries support sponsored research. The United States government allows educational institutions to seek reimbursement for library expenses related to funded research via the institution's indirect cost rate. This has given American academic institutions an incentive to measure the extent to which their academic libraries support sponsored research. This paper reports on the results of statistically valid studies conducted between 1982 and 2001 at 153 libraries incorporating responses from approximately 150,000 academic library users to measure academic research library support of sponsored (funded) research in the United States.

Introduction

Academic research libraries support their institution's multi-faceted mission, including the school's educational, research, public service and, in some cases, patient care programs. In recognition of academic libraries' support of the sponsored research enterprise, the United States Government has federal regulations in place that permit educational institutions to perform a cost analysis study which results in an equitable distribution of the costs libraries incur to support an institution's major functions. U.S. Office of Management and Budget (OMB) Circular A-21 (the Circular) sets forth the principles by which educational institutions and their libraries can quantify and seek reimbursement for costs incurred in support of sponsored research.

Section E.2.d.(3) of OMB Circular A-21 allows an institution to perform a cost analysis study. A cost analysis study, in seeking to achieve an equitable distribution of library costs, may take into consideration weighting factors, population, or space occupied, if appropriate. The explicit requirements incumbent on an institution performing a cost analysis study are that the study must:

> …be appropriately documented in sufficient detail for subsequent review by the cognizant federal agency; distribute the costs to the related cost objectives in accordance with the relative benefits

derived; be statistically sound; be performed specifically at the institution at which the results are to be used; be reviewed periodically, but not less frequently than every two years, updated if necessary, and used consistently; state and explain any assumptions made in the study; and be fully justified. (United States. Office of Management and Budget, 2000)

The Standard Methodology

In the absence of a cost analysis study, OMB Circular A-21 Section F.8. prescribes that library expenses shall be allocated (to the institution's major functions) first on the basis of primary categories of users, including students, professional employees, and other users. Federal negotiators often refer to this allocation method (see Figure 1) as "the standard methodology."

FIGURE 1
Library Standard (FTE) Allocation Methodology
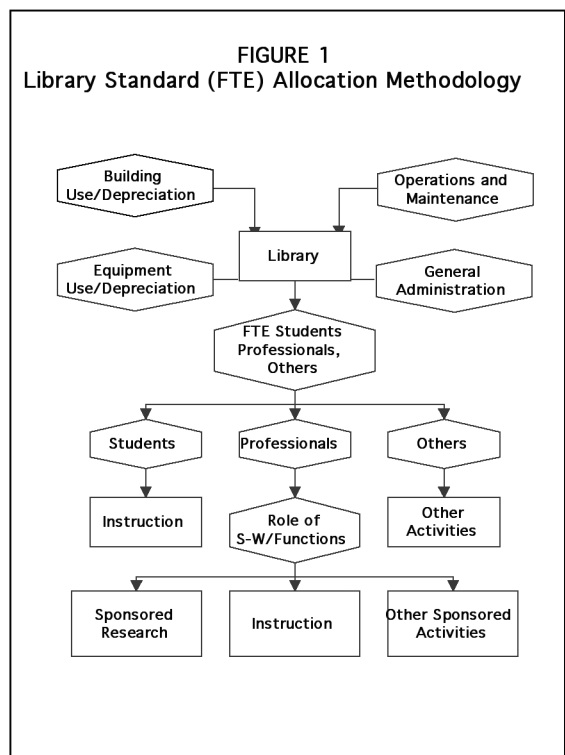
Section F.8. defines the student category as full-time equivalent (FTE) students enrolled at the institution, regardless of whether they earn credits toward a degree or certificate. Under the standard methodology, using a straight full-time equivalent count, the institution's student category is assigned to the instruction

function. The second category of users, professional employees, consists of the full-time equivalent of all faculty members and other professional employees. Expenses incurred for professional employees are assigned to the institution's major functions in proportion to the salaries and wages of all faculty members and other professional employees applicable to those functions. Finally, the other users category, defined as all other users of library facilities, is assigned to the other institutional activities function.

OMB Circular A-21, Section F.8. fails to address several key issues. It does not adequately define "professional employees" and its student and employee counts are based on potential library users on campus as opposed to actual library users. The Circular's reference to other users as "all other users of library facilities" fails to recognize that, unless a library identifies every individual utilizing library facilities, the institution cannot quantify this category of users. Section F.8. also fails to articulate how graduate research assistants should be distributed to the student and professional employee full-time-equivalent categories.

The standard methodology assumes that each individual FTE requires or receives the same level of support from expenditures for library facilities, materials and services. Librarians know this assumption to be false, both intuitively and empirically. Allocating the cost of a highly specialized, extremely expensive research journal to undergraduate students and doctoral-level researchers equally based on full-time-equivalent head counts is inaccurate. The allocation of library facilities costs using the standard method is also inherently an inequitable cost assignment relative to the benefits derived by library users because the library building is generally assumed to be used most intensively by students. (Schulz, 1983)

The standard methodology provides an educational institution with a relatively easy summary allocation of library costs. It fails, however, to account for the variation in library services, collections, and facilities and their accompanying costs as well as the differential usage of the library by diverse library users. The standard methodology is an abbreviated cost allocation approach for calculating academic library support for sponsored research that fails to address the complexities of academic research library operations and its benefits to actual users.

Early Academic Efforts to Measure Research Usage

There were at least several early pioneering efforts to measure research use of libraries, including noteworthy studies at Stanford University in 1964, the University of Pennsylvania in 1967 and Columbia University in 1969. The Columbia study included a special user survey and twelve types of surveys to sample 1300 randomly selected faculty members, senior research staff, administrative staff, research technicians and assistants, and graduate assistants from a total student and faculty population of 24,000. Ellis Mount and Paul Fasana articulated the classic problem historically facing academic libraries as they attempt to quantify the cost of providing research services: "…the library counted the number of items purchased and processed, but little was known about how or by whom these materials were used." (Mount and Fasana, 1972)

A similar sentiment was reported in an article on a study conducted at Purdue University:

Satisfactory methods for allocating library costs between research and instruction in conventional academic libraries have not been developed. When faculty members or graduate students borrow materials from the library, the only way of determining how the material is to be used is to ask. (Drake, 1975)

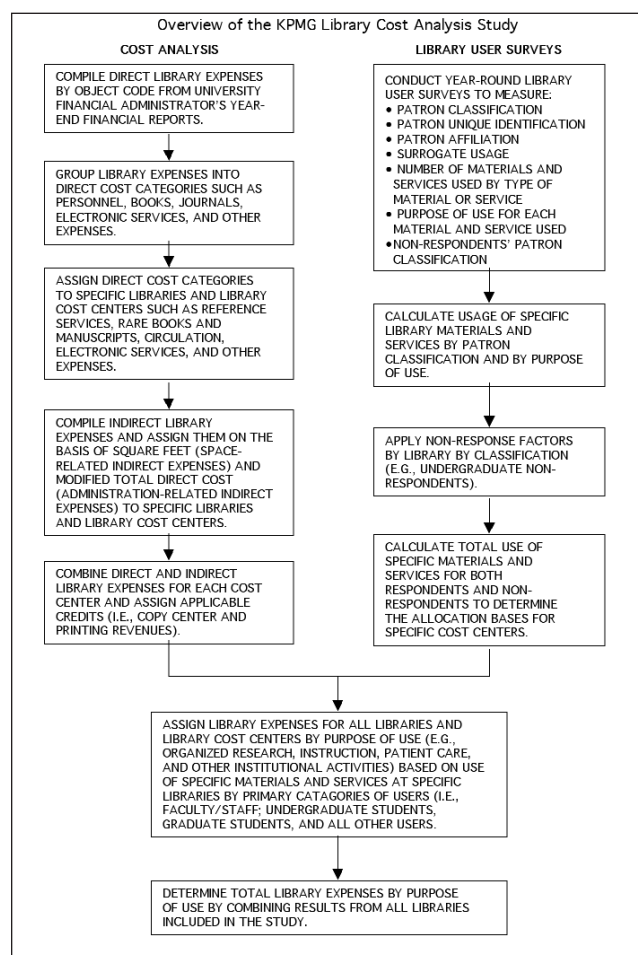## The KPMG Library Cost Analysis Study Methodology

KPMG (then known as Peat, Marwick, Mitchell) began conducting library cost analysis studies in 1982. The KPMG study, utilizing a consistent approach over time, has since been performed forty-six times in 153 libraries at thirty-one educational institutions. The KPMG study, developed by the author and Greg Baroni, currently the Principal-in-Charge of KPMG LLC Consulting's Higher Education Consulting Practice, evolved from a methodology developed in 1977 by Baroni and Linda Crismond, then Assistant University Librarian at the University of Southern California. The KPMG study has proven itself to be consistent with other reported reliable techniques for interrelating academic libraries' costs and services. (See, for example, Kantor, 1985)

In 1990, KPMG contracted with two statisticians, C. Mitchell Dayton and N.J. Scheers, to determine appropriate sample sizes for different types of research libraries when estimating sponsored research use with a 95% confidence level and a standard error rate of 5% or less. Dayton and Scheers reported that five components of the standard error had to be estimated to calculate sample size accurately when determining the ratio estimator for sponsored research: the ratio estimator itself (research use/total use); the coefficient of variation for research use; the coefficient of variation for total use; the correlation between research use and total use, and the standard error of the ratio estimator. Moreover, Dayton and Scheers determined that 96% of the variance in the standard error for actual library user survey data derived from sample size, the ratio estimator, and the coefficient of variation for research use.

For use in future studies, Dayton and Scheers compiled sample size tables for library user surveys to estimate sponsored research use as a proportion of total library use for libraries ranging from 5% to 70% sponsored research with standard errors of the ratio at .02, .03, and .05. At a library where 10% of total usage sup-

ports sponsored research, for example, a sample size of 719 respondents typically yields a confidence level of 95% and a standard error of plus or minus two percent. For a library with 30% sponsored research usage, a sample size of 1625 typically yields a confidence level of 95% and a standard error of plus or minus three percent. (Dayton and Scheers, 1990)

The basic library cost analysis study methodology employed by KPMG has been published previously (Franklin, 1989) and presented at cost accounting workshops. An overview is depicted graphically in Figure 2.

Overview of the KPMG Library Cost Analysis Study

COST ANALYSIS

COMPILE DIRECT LIBRARY EXPENSES BY OBJECT CODE FROM UNIVERSITY FINANCIAL ADMINISTRATOR'S YEAR-END FINANCIAL REPORTS.

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GROUP LIBRARY EXPENSES INTO DIRECT COST CATEGORIES SUCH AS PERSONNEL, BOOKS, JOURNALS, ELECTRONIC SERVICES, AND OTHER EXPENSES.

↓

ASSIGN DIRECT COST CATEGORIES TO SPECIFIC LIBRARIES AND LIBRARY COST CENTERS SUCH AS REFERENCE SERVICES, RARE BOOKS AND MANUSCRIPTS, CIRCULATION, ELECTRONIC SERVICES, AND OTHER EXPENSES.

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COMPILE INDIRECT LIBRARY EXPENSES AND ASSIGN THEM ON THE BASIS OF SQUARE FEET (SPACE-RELATED INDIRECT EXPENSES) AND MODIFIED TOTAL DIRECT COST (ADMINISTRATION-RELATED INDIRECT EXPENSES) TO SPECIFIC LIBRARIES AND LIBRARY COST CENTERS.

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COMBINE DIRECT AND INDIRECT LIBRARY EXPENSES FOR EACH COST CENTER AND ASSIGN APPLICABLE CREDITS (I.E., COPY CENTER AND PRINTING REVENUES).

LIBRARY USER SURVEYS

CONDUCT YEAR-ROUND LIBRARY USER SURVEYS TO MEASURE:
• PATRON CLASSIFICATION
• PATRON UNIQUE IDENTIFICATION
• PATRON AFFILIATION
• SURROGATE USAGE
• NUMBER OF MATERIALS AND SERVICES USED BY TYPE OF MATERIAL OR SERVICE
• PURPOSE OF USE FOR EACH MATERIAL AND SERVICE USED
• NON-RESPONDENTS' PATRON CLASSIFICATION

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CALCULATE USAGE OF SPECIFIC LIBRARY MATERIALS AND SERVICES BY PATRON CLASSIFICATION AND BY PURPOSE OF USE.

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APPLY NON-RESPONSE FACTORS BY LIBRARY BY CLASSIFICATION (E.G., UNDERGRADUATE NON-RESPONDENTS).

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CALCULATE TOTAL USE OF SPECIFIC MATERIALS AND SERVICES FOR BOTH RESPONDENTS AND NON-RESPONDENTS TO DETERMINE THE ALLOCATION BASES FOR SPECIFIC COST CENTERS.

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ASSIGN LIBRARY EXPENSES FOR ALL LIBRARIES AND LIBRARY COST CENTERS BY PURPOSE OF USE (E.G., ORGANIZED RESEARCH, INSTRUCTION, PATIENT CARE, AND OTHER INSTITUTIONAL ACTIVITIES) BASED ON USE OF SPECIFIC MATERIALS AND SERVICES AT SPECIFIC LIBRARIES BY PRIMARY CATAGORIES OF USERS (I.E., FACULTY/STAFF; UNDERGRADUATE STUDENTS, GRADUATE STUDENTS, AND ALL OTHER USERS.

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DETERMINE TOTAL LIBRARY EXPENSES BY PURPOSE OF USE BY COMBINING RESULTS FROM ALL LIBRARIES INCLUDED IN THE STUDY.

As Figure 2 depicts, a surveyed library's direct and indirect expenses are assigned to cost centers that correspond to the library's principal activities. Once the library's total costs are analyzed and assigned to the appropriate cost center they are assigned to functions such as sponsored research, instruction, and other activities using the results of library user surveys.

The purpose of the user surveys is to estimate the percentage of total library use associated with sponsored research for each of the library's major activities. Each cost center identified has a corresponding allocation base with usage data collected from the library user surveys (e.g., circulation costs are allocated based on circulation usage reported during the user surveys).

The surveys involve the selection of a random sample of time periods for conducting each survey, distri-

bution and collection of the survey forms at the library and an estimation of the proportion of library activities which are attributable to sponsored research. When conducting the library user surveys, a time sampling procedure is used in which all library users are surveyed for a specified number of time periods during the year. A random sample of two-hour time periods using a monthly stratification is then selected. The actual date and time periods within each month are determined randomly using a random number generator.

For any given randomly selected two-hour time period, a census of library users is conducted. The procedure involves distributing the survey forms as users arrive at the library and at the same time, surveyors request information concerning user category (e.g., undergraduate student, graduate student, faculty/staff, other). Completed forms are collected from users as they leave the library. A non-response rate is calculated for each user category so that non-respondent use can also be estimated and factored into the allocation base.

The library user survey is based on the random moments sampling technique. User survey forms are distributed to all persons entering the Library during randomly scheduled two-hour survey intervals and users are asked to return their completed survey forms as they leave the library.

Concurrent with the in-house survey being conducted, remote library users are also surveyed as they access electronic services purchased by the library. During the same randomly selected two-hour survey periods throughout the year that in-house surveys are conducted, library users are presented with a brief survey screen when they select one of the electronic databases or full-text products offered by the library. Users indicate their classification (e.g., undergraduate student), affiliation (e.g., College of Arts and Sciences), location (e.g., at home), and purpose of use (e.g., sponsored research) from a set of drop-down menus.

Findings

The thirty-one institutions where the KPMG library cost analysis study has been conducted include twenty-five of the one hundred largest recipients of science and engineering research development in the United States. (National Science Foundation, 2000)

The thirty-one research universities studied represent nineteen public institutions and twelve private universities. The universities are also geographically diverse: four from northeastern states; seven from mid-Atlantic states; seven from southeastern states; five from the mid-west; six from the southwest; and two from the far west.

Data collected at the thirty-one schools demonstrates that the proportion of sponsored research use to total library use varies considerably by type of library. Table 1 summarizes the average percentage of sponsored research use as a percentage of total library use at three groups and twelve distinct types of libraries.

Table 1: Sponsored Research Usage by Type of Library

Main and Medical Libraries (n=number of libraries)	Mean Value, Sponsored Research Usage	Median Value, Sponsored Research Usage	High Value/ Low Value	Standard Deviation
Main Libraries (Undergraduate, Graduate, or Undergraduate/Graduate Combined) (n=31)	11.5%	10.9%	20.8%/3.5%	4.54
Medical and Health Sciences Libraries (n=36)	25.3%	25.9%	38.7%/11.2%	5.85
Math/Physics/Astronomy Libraries (n=22)	34.9%	37.0%	49.0%/14.7%	9.39
Engineering Libraries (n=15)	24.3%	22.4%	60.7%/8.8%	12.26
Earth Sciences/Geology/ Oceanography Libraries (n=15)	28.1%	25.5%	44.3%/21.9%	9.50
Chemistry/Pharmacy/Chemistry and Pharmacy Libraries (n=14)	40.2%	33.3%	62.1%/30.3%	11.66
Veterinary Libraries (n=4)	16.2%	17.5%	28.0%/15.9%	9.41
Biology Libraries (n=4)	25.2%	22.6%	30.3%/22.2%	3.63
Law Libraries (n=4)	11.9%	11.6%	14.5%/9.6%	2.03
Social Work Libraries (n=4)	19.1%	19.8%	26.5%/9.1%	6.33
Education Libraries (n=2)	14.1%	14.1%	15.6%/12.6%	1.50
Business Libraries (n=2)	6.3%	6.3%	10.4%/2.3%	4.08

Table 1 also illustrates that there is considerable variation in sponsored research usage at even the same type of library. The high and low values for sponsored research usage are disparate and the standard deviations are high at virtually every type of library studied. These findings underscore the diverse characteristics of both individual libraries and the academic communities they serve.

The data collected from library user surveys also permits an analysis of how specific materials and services at different types of libraries support sponsored research (see Tables 2-4). The survey forms generally differentiated between library collections used in the library, library materials checked out, and library services used (e.g., reference, interlibrary loan, bibliographic instruction). Within each type of library, research usage was generally comparable for library materials used in-house, library materials checked out, and library services used. The veterinary libraries were an exception.

When specific materials and services were analyzed for their support of sponsored research, the interlibrary loan service showed the greatest proportional support for sponsored research at all types of libraries except education libraries, where a larger percentage of owned journal use supported sponsored research. Journal use was almost invariably second highest after interlibrary loan use in its percentage of use related to sponsored research at all other types of libraries.

Electronic services use supporting sponsored research generally mirrored the same level of support exhibited by the general use of library materials and services at almost all types of libraries. The exceptions were the veterinary science and biology libraries surveyed. At veterinary libraries, an average of 41.4% of electronic services use supported sponsored research, compared to 22.5% for library materials used in house, 12.7% for library materials checked out, and 28.9% for library services used. At biology libraries, an average of 33.1% of electronic services use supported sponsored research, compared to 26.3% for library materials used in house, 21.5% for library materials checked out, and 22.4% for library services used.

Table 2: Research Use of Specific Library Materials and Services

Main and Medical Libraries (n=number of libraries)	General Materials & Services			Specific Materials & Services		
	Library Materials Used In-House	Library Materials Checked Out	Library Services Used	Electronic Services Use	Journals Use	Interlibrary Loan Use
Main (n=31)						
Mean	12.1%	12.0%	12.8%	11.8%	13.1%	22.7%
Median	12.1%	11.7%	13.1%	12.3%	12.7%	21.3%
High/Low	20.3%/4.3%	22.9%/3.5%	21.5%/3.9%	17.7%/4.7%	24.9%/4.5%	46.5%/3.2%
Std Deviation	4.57	5.17	4.77	4.22	5.39	10.66
Medical (n=36)						
Mean	25.9%	25.2%	25.3%	25.9%	31.2%	33.6%
Median	26.7%	25%	25.9%	23%	31.3%	32.8%
High/Low	35.1%/10.4%	39.9%/7.9%	46.2%/10.9%	47.3%/13.7%	42.9%/11%	59.1%/7.1%
Std Deviation	5.67	8.17	7.85	8.12	6.56	12.24

Table 3: Research Use of Specific Library Materials and Services

Science Libraries (n=number of libraries)	General Materials & Services			Specific Materials & Services		
	Library Materials Used In-House	Library Materials Checked Out	Library Services Used	Electronic Services Use	Journals Use	Interlibrary Loan Use
Earth Sciences (n=15)						
Mean	27.4%	28.5%	23.3%	32.2%	34.0%	36.7%
Median	25.6%	30%	23.9%	27.7%	30.1%	33.3%
High/Low	43.8%/8.5%	48.4%/3.3%	36.5%/2.6%	50%/5.3%	55.8%/15.9%	63.6%/18.2%
Std Deviation	10.17	12.59	12.89	18.52	11.91	18.61
Math/Physics (n=22)						
Mean	31.8%	29.6%	26.3%	22.6%	40.1%	38.8%
Median	31.8%	26.2%	26.9%	25%	43.1%	37.5%
High/Low	49.1%/15.5%	51.9%/11.2%	50%/12.2%	41.7%/8.6%	62.6%/13.1%	71.4%/5.6%
Std Deviation	9.95	13.78	9.82	9.67	13.51	30.42
Engineering (n=15)						
Mean	24%	27.4%	25.1%	25.1%	28.6%	28.8%
Median	22.9%	26.8%	20.6%	19.0%	26.1%	28.8%
High/Low	56.9%/11.2%	71.9%/7.6%	72.7%/10.3%	72.7%/9.3%	56.3%/14.5%	50%/3.2%
Std Deviation	11	15.9	16.18	17.84	10.45	16.87
Chemistry (n=14)						
Mean	42.8%	45.7%	40.1%	32.8%	48.8%	49.4%
Median	40.8%	41.4%	35.6%	37.9%	51.4%	50%
High/Low	63.9%/25%	68.1%/24.0%	60%/19.5%	56.4%/8.3%	72.9%/29.4%	92.3%/9.5%
Std Deviation	12.15	13.44	12.37	14.16	12.67	37.55

Table 3: Research Use of Specific Library Materials and Services continued

Veterinary (n=4)						
Mean	22.5%	12.7%	28.9%	41.4%	28.9%	57.14%
Median	25.3%	11.5%	31.9%	41.4%	28.9%	57.14%
High/Low	27.7%/14.4%	20%/6.7%	38.3%/16.7%	50.9%/31.9%	38.4%/19.4%	n.a.
Std Deviation	5.81	5.51	9.06	9.52	9.48	n.a.
Biology (n=4)						
Mean	26.3%	21.5%	22.4%	33.1%	35.6%	38.1%
Median	26.3%	20.7%	17.6%	33.1%	35.6%	38.1%
High/Low	29.6%/22.9%	38.3%/6.3%	50%/4.4%	50%/16.3%	42.2%/29.3%	61.9%/14.3%
Std Deviation	2.5	11.38	16.89	16.87	5.7	23.81

Table 4: Research Use of Specific Library Materials and Services

	General Materials & Services			Specific Materials & Services		
Social Science Libraries (n=number of libraries)	**Library Materials Used In-House**	**Library Materials Checked Out**	**Library Services Used**	**Electronic Services Use**	**Journals Use**	**Interlibrary Loan Use**
Social Work (n=4)						
Mean	16.0%	21.4%	23.0%	17.8%	16.4%	64.8%
Median	21.7%	11.3%	21.9%	20.3%	17.1%	78.6%
High/Low	22.7%/8%	36.1%/5.9%	28.5%/17.1%	25.7%/1.9%	25.6%/8.9%	100%/15.8%
Std Deviation	6.3%	13.0	4.12	9.42	6.0%	35.75
Law (n=3)						
Mean	10.2%	11.4%	10.5%	13%	7%	20%
Median	10.7%	7.6%	9.3%	11.4%	6.3%	20%
High/Low	19.6%/0.5%	25.2%/1.2%	19.2%/3.1%	25%/2.6%	13.8%/0.9%	n.a.
Std Deviation	7.81	10.15	6.6	9.22	5.32	n.a.
Education (n=2)						
Mean	15.7%	14.2%	10.3%	14.4%	21.2%	16.67
Median	15.7%	14.2%	10.3%	14.4%	21.2%	16.67
High/Low	18.2%/13.2%	16.5%/11.9%	10.8%/9.8%	16.9%/11.8%	28.8%/13.6%	n.a.
Std Deviation	2.5	2.3	0.5	2.52	7.58	n.a.
Business (n=2)						
Mean	5.6%	9.8%	7.0%	8.7%	7.5%	n.a.
Median	5.6%	9.8%	7.0%	8.7%	7.5%	n.a.
High/Low	9.6%/1.6%	11.6%/8%	11.9%/2.2%	12.8%/4.6%	7.6%/7.4%	n.a.
Std Deviation	4.00	1.79	4.87	4.08	0.08	n.a.

Conclusion

Academic research libraries vary in their support of sponsored research, one of an academic research university's primary missions. Science libraries, medical libraries, and engineering libraries services and collections exhibit the most support for sponsored research, but there is substantial variation among similar types of libraries (e.g., biology libraries) at different universities. Journals and interlibrary loan/document delivery are consistently the most highly used collection and service in support of sponsored research. In most cases, electronic services use approximates traditional services in its level of use to support sponsored research, but there are several notable exceptions, including biology libraries and veterinary science libraries, where electronic services appear to support sponsored researchers' work more intensively than traditional collection and service offerings.

The data gathered while performing library cost analysis studies during the last twenty years reveals considerable information about academic library support for sponsored research at major research universities. One university has conducted the KPMG study six times during the last fourteen years. Its results demonstrate that library support of sponsored research has been relatively consistent at that institution for a significant period of time (see Table 5).

Table 5: Longitudinal Research Use at One Academic Research Main Library 1988–2001

Year of Library Cost Study	Sponsored Research Use as a Percentage of Total Library Use
1988	9.4%
1990	11.4%
1992	9.8%
1995	10.2%
1998	10.4%
2001	10.6%

At an institutional level, three variables were analyzed to determine their relationships in determining a university's spending patterns in relation to its library's support of sponsored research. The three variables considered were: total research and development funding at the university; total library expenditures, and library expenditures in support of sponsored research as a percentage of total library expenditures.

The author found a high correlation between total research and development funding at an educational institution and total library expenditures at research universities. Little or no relationship was determined, however, between total library expenditures and library expenditures in support of sponsored research as a percentage of total library expenditures. Little or no correlation was also found between an institution's research and development funding and library expenditures in support of sponsored research as a percentage of total library expenditures.

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