

# Life Cycle Costs of Library Collections: Creation of Effective Performance and Cost Metrics for Library Resources

Stephen R. Lawrence, Lynn Silipigni Connaway,  
and Keith H. Brigham

An important issue for research librarians is the life cycle cost of acquiring and maintaining a collection. While purchase costs are easy to identify, associated acquisition, cataloging, circulation, and maintenance expenses are difficult to measure and attribute to specific collections. This paper develops a methodology to determine the life cycle costs of collections based on readily available statistical data collected annually by the Association of Research Libraries (ARL). ARL cost data (e.g., salaries and wages, materials expenditures, and operating expenses) for a specific library are allocated to collections (e.g., manuscripts, serials, and microforms) based on the size of the collection and its relative space requirements. By aggregating allocated costs, total life cycle costs for a collection can be estimated. Results of this research indicate that life cycle costs of collections are many multiples of their purchase costs. Results further suggest that the life cycle costs of monograph collections overwhelm the costs of other collections in research libraries—the cost structure of a research library is largely driven by its monograph collection. These results should prove useful in efforts to control costs and improve performance in research libraries.



This project investigates the life cycle costs associated with the acquisition and maintenance of various collections in research libraries. The objective is to develop effective performance and cost metrics for col-

lections in research libraries. Historically, research libraries have had no alternative but to acquire books and periodicals in a bound paper format. However, with the advent of digital technology, research libraries now can acquire material for addi-

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*Stephen R. Lawrence is Deming Professor of Entrepreneurship in the Graduate School of Business Administration at the University of Colorado at Boulder; e-mail: Stephen.Lawrence@Colorado.edu. Lynn Silipigni Connaway is Vice President, Research and Library Systems, at netLibrary, Inc.; e-mail: lynnc@netlibrary.com. Keith H. Brigham is Assistant Professor of Strategy at Texas Tech University; e-mail: KBrigham@bant2.ba.ttu.edu. This research was commissioned and sponsored by netLibrary under University of Colorado Contract #OCG4165B. The authors gratefully acknowledge the support and assistance of netLibrary and particularly thank Tim Schieve and Woody Palasek for their helpful information and encouragement. Faculty from the University of Colorado library also aided our research. CU Libraries Dean Jim Williams; Associate Deans Scott Seaman, Susan Anthes, and Janet Swan Hill; and Business Library Director Carol Krissman all provided helpful information, perspectives, and time.*

tion to collections in a variety of formats, including traditional bound paper, CD-ROM disk, or online delivery via Internet or database services. Currently, few data or little developed methodology exists for comparing the life cycle ownership costs of traditional or alternate media to guide libraries in making purchasing decisions. Thus, the purpose of this project is to review extant literature, collect data, and develop a methodology to allow libraries to effectively measure and compare the costs of acquiring content in alternative forms. This article seeks to:

- understand the total life cycle cost of ownership for library collections;
- develop metrics for measuring and comparing the life cycle costs of various library media;
- develop effective methods for quickly calculating performance and cost metrics.

To accomplish these objectives, the authors surveyed the library costing literature, conducted interviews with a number of knowledgeable library experts, acquired relevant data from the Association of Research Libraries (ARL) and industry sources, and developed an analytic tool to assist in the calculation of life cycle costs.

This research has provided an easily accessible and easy-to-use tool, the Library Interactive Costing Spreadsheet (LICS), which provides a method for research librarians to quickly evaluate the cost structure of their libraries compared with other ARL libraries. Application of the tool indicates that the life cycle cost of maintaining library collections is many multiples of their acquisition cost. Also, the research indicates that monograph collections are the overwhelming life cycle cost components for research libraries—costs in research libraries are largely driven by their monograph collections.

### Literature Review

The research questions for this study are:

- What is the total life cycle cost of a library book or monograph?
- What are the relative costs of various media?

- How do these relative costs compare across media?

These questions may seem straightforward, but the unique nature of libraries makes it difficult to uncover the answers to them. Cost management principles and techniques available for economic library management are among the weakest in the repertoire of library management.<sup>1</sup> Possible reasons for the relatively weak development of library costing systems include:<sup>2</sup>

- non-corporateness (no legal provisions or requirements);
- lack of motivation to develop costing systems (weak requirement for public accountability);
- lack of historical tradition (related to limited control over limited resources);
- lack of a definable product and performance measures;
- inherent complexity of the system.

Final delivery of service to the client is paramount; librarian and library sponsor are content if some reasonable level of service is accomplished within budgetary targets.

Stephen A. Roberts defined five types of cost studies in the library management literature:<sup>3</sup>

1. cost analysis;
2. cost distribution and/or cost allocation;
3. unit costing and timing;
4. cost-effectiveness;
5. cost benefit.

The first two—cost analysis and cost distribution—are methods for determining costs in libraries. The remaining three—unit costing, cost-effectiveness, and cost benefit—use the results of cost analysis and cost distribution to evaluate performance. Because the purpose of this study is to determine the life cycle costs of library media, the following discussion focuses principally on cost analysis and cost distribution.

### Cost Analysis Studies

Work measurement lies at the heart of cost analysis studies. It strives to measure the precise quantity of factors used (usually

labor) and the time devoted to particular functions and tasks.<sup>4</sup> This represents a bottom-up approach to determining costs by starting at the smallest identifiable and measurable activity and then relating it to a specific function or task. For example, Joan A. Maier used timed observations to calculate the walking rate (in feet per minute) of the average library employee.<sup>5</sup> This figure then was used to help determine the cost to catalog a volume. Work measurement also was used to determine the costs of different functions, including circulation and tracking overdue items.<sup>6,7</sup>

Estimation methods are often used when exact work measurement of labor is difficult or impractical. The use of factor inputs is allocated based on estimates derived from either observations of or discussions with knowledgeable staff members. Estimation methods, such as Roberts's, often provide relatively accurate estimates and may complement work measurement-based studies.<sup>8,9</sup> Although cost analysis studies provide detailed cost information for particular functions in specific libraries within a narrow time period, the generality of their results is limited. Roberts concluded that there was a "yawning gap in the library management literature" with respect to these early cost analysis studies.<sup>10</sup>

#### ***Cost Distribution and Allocation Studies***

Whereas cost analysis is a bottom-up approach to determine actual costs in a particular library function, cost distribution is a top-down method that provides similar information with less effort. Under cost distribution, actual total expenditures are allocated to various cost centers. Cost distribution often depends on budgetary data and is useful in supplementing normal budget control. An early study using a cost distribution method was conducted by Ferdinand F. Leimkuhler and Michael D. Cooper.<sup>11</sup> In this study, actual budget data from the General Library at the University of California-Berkeley were used to determine the cost of performing particular services. Through the allocation of budget data to different services, per unit

costs for circulation, holding, and acquisition were developed. More recently, Paul M. Gherman and Lynn S. Cochrane used the cost distribution method in their study of The Virginia Tech Libraries.<sup>12</sup> By allocating historical costs to cost centers, they determined unit costs for collection development, cataloging, retrieval from storage, and remote housing in storage. Although cost distribution studies may lack the precision of work measurement studies, they do offer valuable diagnostic and prognostic information.<sup>13</sup>

#### ***Other Library Costing Studies***

The remaining three types of library cost studies are more concerned with the relationship between costs and performance. They all rely on cost data gathered through either the cost analysis or the cost distribution method and attempt to establish performance implications. As performance aspects are beyond the purposes of this study, only a brief summary of each is provided.

#### ***Unit Costing and Timing***

Unit costing requires the use of work standards, or norms. These are derived from data provided by work measurement or cost distribution studies. Expected outputs based on these standards then can be compared with actual outputs. The variance between expected outputs and actual outputs can provide a simple measure of performance for a specific branch or service. Eileen G. Abels, Paul B. Kantor, and Tefko Saracevic applied functional cost analysis to reference services across libraries.<sup>14</sup> They found wide degrees of variation in unit costs, implying that there were still substantial challenges to understanding the cost basis of library services.

#### ***Cost-effectiveness***

In a cost-effectiveness analysis, the focus is on the level of output achieved or on satisfying certain goals. Cost-effectiveness and performance measurement are central topics in the library management debate.<sup>15</sup> The cost-effective library, one in which the highest level of performance

is achieved given limited levels of expenditure and resources, is the ultimate goal for library managers.<sup>16</sup>

### ***Cost-benefit Measures***

Cost-benefit analysis is a method for determining the social costs and benefits of an investment to decide whether the project should be undertaken. Within cost-benefit analysis, the concept of value is compared with costs. Karen Svenningsen developed a model that incorporates the economic value of information and cost and benefit concepts.<sup>17</sup> In many cases, interest in costing specific library functions was driven by increased availability of library information systems and automation and the consequent need to undertake cost-benefit analyses to justify the acquisition of new technologies.<sup>18</sup>

Perhaps because the promise of library cost studies has yet to be realized, the call for additional studies of library functions and services continues.<sup>19</sup> This may be attributed to the escalating costs of library resources and stagnant or declining library budgets. In addition, rapidly evolving information technologies and media options make it essential for librarians to understand their costs in order to make informed decisions about acquiring new technologies. As Martin M. Cummings concluded, "Analysis of costs in meaningful detail is essential to management, i.e., answering the question, 'Are there alternate, less costly ways to do the same thing?'"<sup>20</sup>

### **Methodology**

This article presents a new and unique method for determining library costs. Although this method could be categorized as a cost distribution study (following the top-down allocation method), it is novel in its approach. Whereas previous cost distribution studies have allocated expenses and resources to specific cost centers, this study allocates expenses and resources to different types of library media (monographs, serials, audio, etc.).<sup>21</sup> Through the creation of a costing spreadsheet that uses readily available ARL data and industry parameters, this study provides librarians

with a new method for ascertaining the costs of library collections.

### ***Sources of Data***

This study uses the easily accessible and available 1998 and 1999 data collected by the ARL and reported on its Web site ([www.arl.org](http://www.arl.org)). Every year, the ARL surveys its members (121 in 1999) to solicit statistics on a number of dimensions important to research libraries. A summary of the data types collected by the ARL is included in appendix A. The authors used ARL data from its 1998 and 1999 surveys and, consistent with these surveys, grouped library collections into ten categories:

- Monographs (books)
- Current Serials
- Microfilms
- Government Documents
- Manuscripts and Archives
- Cartographic Materials
- Graphic Materials
- Sound Recordings
- Video and Film
- Computer Files

In addition to ARL data, published data, statistics, and formulae relating to library design and construction were used.<sup>22</sup>

### ***Cost Categories***

Library expenses were estimated in six broad categories:

- Purchase Cost of Holdings
- Operating Expenses
- Wages and Salaries
- Building and Facilities
- Building Maintenance
- Fixtures and Equipment

Member libraries in the annual ARL surveys report expenses for the first three categories. In contrast, expenses for the second three categories must be estimated and derived from both external industry data and ARL survey data. The methodology used to allocate expenses to these categories is explained below.

### ***Allocation Methodology***

In any costing study, the allocation of expenses to the service or product of interest

is of fundamental importance. The principal allocation method used was the physical area occupied by various types of holdings. The area storage requirements of the various media were used to calculate a "book equivalent" factor for each media type that represents the fraction of space required by the media type relative to books and manuscripts. For example, the media type "government documents" has a book equivalent (BE) of 20 percent because "govdocs" takes only 20 percent of storage space per unit compared to books. The methodology used to allocate ARL-reported expenses for each of these categories is explained below.

A fundamental assumption of this study is that media BE figures are the primary drivers of costs in research libraries. BE estimates are used to allocate operating expenses, facility costs, maintenance expenses, asset inventories, and salary and wage expenses. The use of BE to allocate costs is based on a review of the library costing literature and on extensive discussions with professional librarians. The research confirms that the space consumed by a collection is an excellent first-order proxy for the costs associated with maintaining and circulating the collection. For example, a collection that occupies twice the space of another collection will generally require twice the labor and twice the assets (shelving, tables, etc.) and incur twice the expenses. Estimated space requirements for various categories of library media are shown in table 1.

### Holdings

Holdings data by collection type were taken directly from ARL survey statistics. The holdings statistics then were adjusted to BE holdings by applying the BE multiplier described above. Appendix B shows the median holding and BE-adjusted holdings by media category for the 121 libraries in the 1999 ARL survey.

### Purchase Expenses

The ARL collects statistics on total annual expenditures for monographs (EXPMONO) and serials (EXPSER) but aggregates purchases of other media types (EXPOTH). Estimates for expenditures of other media types (e.g., manuscripts, videos and film, etc.) were derived as follows: The growth of individual collections in a specific library were calculated by subtracting the 1999 size of the collection from its reported size in the 1998 ARL survey. In cases where the size of a collection declined, growth was set to zero. The relative size of the collection relative to other collections (excluding monographs and serials) then was used to allocate expenditures on other media. For example, if graphic materials were found to grow by 2,000 documents from 1998 to 1999, and this represented five percent of all nonbook and nonserials documents acquired by a library for that year, five percent of "other expenditures" (EXPOTH) would be allocated to graphic materials. Appendix B shows the median allocation percentages for other expenditures of the 121 libraries that participated in the 1999 ARL survey.

### Operating Expenses

Aggregate library operating expenses were taken as the sum of ARL expense categories:

- Operating Expenses (OPEXP)
- Miscellaneous Expenses (EXPMISC)

**TABLE 1**  
**BE Figures for Library Media Types**

Medium	Area Occupied (sq. ft. / 1,000)	Book Equivalent
Monographs (books)	100	100.0%
Current serials	67	67.0%
Microforms	0.17	0.17%
Government documents	20	20.0%
Manuscripts and archives	20	20.0%
Cartographic materials	20	20.0%
Graphic materials	2	2.0%
Sound recordings	20	20.0%
Video and film	143	143.0%
Computer files	0.20	0.2%

The aggregate operating expenses for a library then were allocated to collections using the BE-adjusted holding percentages for the library. Appendix B tabulates the median operating expenses by collection for ARL libraries in 1999.

**Wages and Salaries**

Total salaries and wages (TOTSAL) reported in ARL statistics again were allocated to library collections using BE-adjusted holding percentages. Median library wages and salaries by collection are listed in appendix B.

**Building and Facilities**

The ARL survey does not collect data on the actual size of facilities occupied by its member libraries nor does it solicit the replacement cost of these facilities. The facility size of individual libraries was estimated from Metcalf, in which necessary space requirements for libraries of various sizes were listed.<sup>23</sup>

Table 2 is almost perfectly estimated ( $R^2 = 99.9\%$ ) using the regression equation:  $\text{Area} = 5,750 + 0.148 * \text{VOLS}$  where VOLS is the total number of volumes in a library as reported in the ARL survey. This equation was used to estimate library facility sizes measured in square feet. Facility costs then were calculated using national estimates for the replacement cost (per square foot) of public buildings. Because buildings have an expected life far longer than one year, amortized annual replacement costs were calculated assuming a facility life expectancy of fifty years. This annual amortized replacement cost then was allocated to a collection using its relative BE-adjusted size.

**TABLE 2**  
**Space Requirements**  
**of Monographs**

Volumes	Sq. ft.
100,000	20,000
250,000	45,000
500,000	80,000
1,000,000	150,000
2,700,000	405,000

**Facility Maintenance**

The ARL survey does not collect information on the ongoing maintenance costs necessary to maintain library facilities. Ongoing facility maintenance expenses were estimated using the library space requirements derived above and multiplied by a national estimate for the annual maintenance cost (per square foot) of public buildings. As usual, maintenance costs were allocated to collections using BE statistics.

**Fixtures and Equipment**

The fixtures and equipment expense category includes shelving, tables and chairs, computer terminals, equipment, and any other physical items used in a library. The ARL does not collect statistics on fixtures and equipment, so equipment requirements had to be estimated by library. This was accomplished by multiplying estimated library facility size (measured in square feet) by a national estimate for fixture and equipment assets (cost per square foot) in public buildings. Because the life of these assets is typically greater than one year, their cost must be amortized over their expected lives. The expected life of various types of furnishings and equipment varies greatly by type and use, so an aggregate uniform expected life estimate is possible and necessary. For the purposes of this study, the authors estimated the average expected life for library fixtures and equipment to be ten years. Amortized annual replacement costs of library fixture and equipment assets were allocated to collections by their relative BE size.

**Life Cycle Cost Calculations**

The unit life cycle costs of maintaining library collections were found by determining the annual cost of maintaining an entire collection and then dividing it by the number of bibliographic units in the collection, providing the annual cost of maintaining a single unit in the collection. To obtain a life cycle cost estimate, two calculation methods were used—total costs and discounted costs.

### Total Costs

The total life cycle cost of owning a unit in a collection was calculated by simply multiplying the annual cost of maintaining a unit in a collection by its expected physical life and adding the unit's purchase cost. This calculation requires that the expected physical life of various library media be estimated. In research libraries, "physical life" is defined as the time period between the acquisition of a new document and its eventual reconditioning, restoration, or replacement. It should be noted that physical life is different from useful life. A document's useful life is the time until its content is obsolete; its physical life is the time until the document no longer functions materially. Because research libraries typically retain collections in perpetuity, the focus here is on the physical life of library media. The authors used the estimates of expected physical life displayed in table 3. The total cost of a bibliographic unit represents an aggregation of all direct and indirect costs over the expected life span of the unit.

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**The research indicates that the purchase price of acquiring a collection is a small fraction of the life cycle cost of maintaining it.**

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### Discounted Costs

Discounted cost calculations take into account the time value of money (i.e., a dollar expended today is dearer than a dollar expended twenty years from now). Discounted cost calculations require the estimation of a "discount rate" to adjust the value of future expenditures. A discount rate of 7.5 percent, the long-term average interest rate delivered by municipal and state bonds, was used for the calculations. The assumption is that most research libraries are supported by government and university agencies that can obtain funds at this rate. In the case of a library supported by an endowment, the discount rate represents the "opportunity cost" of money—in other words, the return the endowment could earn alternatively if invested conservatively.

**TABLE 3**  
**Expected Life of Library Media**

Medium	Expected Physical Life (years)
Manuscripts (books)	50
Current serials	50
Microforms	25
Government documents	50
Manuscripts and archives	100
Cartographic materials	50
Graphic materials	20
Sound recordings	15
Video and film	10
Computer files	5

*Adapted from Metcalf 1986*

The discounted life cycle cost of library media was calculated by dividing annual ongoing expenses by the discount rate and then adding the average purchase cost of a unit in the collection. It should be noted that this calculation does not require an estimate of the life expectancy of library media. Instead, the authors assumed that the annual expense of maintaining a unit in a collection is incurred in perpetuity. That is, if it currently costs \$10 per year to maintain a book in a particular library, this cost will be incurred for all time into the future. Although it may appear unreasonable to assume that a book will last forever and that its maintenance costs will be assumed forever, the discounted cost of maintaining the book at the end of its expected life fifty years from now is only:  $\$10.00 \times 0.075^{50} = \$0.20$  which is a relatively small amount. Thus, discounted cost estimates provide an alternative perspective on the life cycle cost of owning library media that takes into account the time value of money.

### Results

Data from the 1998 and 1999 ARL surveys were used to calculate the life cycle costs of library collections using the allocation methodology described above. Details of these calculations are tabulated in appen-

dix B, and the median estimated life cycle costs for various media in ARL libraries are summarized in table 4.

Discounted life cycle costs are generally less than total costs because future dollars for the former are heavily discounted. However, this relationship is not true for video, film, and computer files because of their relatively short life expectancy. Table 4 also includes comparison life cycle cost data using 1998 ARL data. The close congruence between the life cycle costs between the two years provides evidence that life cycle cost estimates are consistent across time.

**Life Cycle Costs of Library Collections**

The data in table 3 clearly indicate that, on average, the purchase price of library media is a small fraction of the life cycle ownership costs of library collections. For example, the results of this project demonstrate that the expected cost of owning a monograph is more than seven times the monograph's purchase price. This has important financial implications for libraries that are building their collections: the initial cost of populating a collection is a small fraction of the ongoing cost of maintaining one.

**TABLE 4**  
**Median Life Cycle Cost Summaries Using 1998 and 1999 ARL Data**

1999 ARL data				
Medium	Discounted Life Cycle Cost (per unit)	Total Life Cycle Cost (per unit)	Purchase Cost (per unit)	Total Cost / Purchase Cost (per unit)
Monographs (books)	\$ 119.56	\$ 343.03	\$ 47.78	718 %
Current serials	643.91	801.78	590.97	134
Microforms	0.27	0.45	0.11	256
Government documents	14.13	55.40	0.00	311
Manuscripts and archives	20.26	126.79	4.46	1,130
Cartographic materials	26.78	73.82	11.05	247
Graphic materials	1.65	2.91	0.06	216
Sound recordings	22.64	24.77	6.80	219
Video and film	128.95	107.50	15.70	307
Computer files	0.17	0.07	0.01	331
1998 ARL data				
Medium	Discounted Life Cycle Cost (per unit)	Total Life Cycle Cost (per unit)	Purchase Cost (per unit)	Total Cost / Purchase Cost (per unit)
Monographs (books)	\$ 121.28	\$ 340.17	\$ 47.90	742 %
Current serials	594.50	731.20	541.87	139
Microforms	0.26	0.42	0.10	284
Government documents	14.25	56.69	0.00	300
Manuscripts and archives	18.59	126.09	3.11	1,251
Cartographic materials	28.44	74.58	13.00	227
Graphic materials	1.64	2.89	0.09	185
Sound recordings	20.85	22.58	5.36	203
Video and film	122.60	105.02	10.85	290
Computer files	0.28	0.13	0.01	384



**TABLE 5**  
**Relative Cost of Collections**

Medium	Book Equivalent	Reported Holdings	BE Holdings	Relative BE Holdings
Monographs (books)	100.0%	2,716,117	2,716,117	95.1 %
Current serials	67.0%	22,172	14,855	0.5
Microforms	0.17%	3,700,071	7,400	0.3
Government documents	20.0%	282,321	56,464	2.0
Manuscripts and archives	20.0%	12,941	2,588	0.1
Cartographic materials	20.0%	179,190	35,838	1.3
Graphic materials	2.0%	149,171	2,983	0.1
Sound recordings	20.0%	31,251	6,250	0.2
Video and film	143.0%	8,464	12,094	0.4
Computer files	0.2%	3,919	8	0.0

### *Relative Life Cycle Costs*

Another important question answered by this study is, What are the relative costs of maintaining different library collections? Table 5 demonstrates that monographs are overwhelmingly the largest source or driver of library costs, consuming 95 percent of library life cycle expenditures. This result indicates that if research libraries want to control their costs, they must work to control and reduce the life cycle costs of maintaining their monograph collections.

### **Summary and Conclusions**

This study used easily accessible and widely distributed survey data from the ARL to estimate the life cycle costs of library collections. The research indicates that the purchase price of acquiring a collection is a small fraction of the life cycle cost of maintaining it. Although this result may be intuitively obvious to those familiar with library operations, it is believed that this is the first study to rigorously measure the life cycle cost of library collections and to quantify the relationship between a collection's purchase cost and its subsequent maintenance costs.

A second contribution of this research was to measure the relative cost impact of various library collections among ARL research libraries. The results demonstrate that monographs dominate the cost structure of a research library, consuming approximately 95 percent of library

resources. For research libraries that want to control expenses over time, the control of monographs is essential. Although the initial acquisition expense for some collections may rival that of monographs, the life cycle cost of maintaining monographs dwarfs that of other collections.

### **Further Research**

Because electronic books (eBooks) are becoming more prevalent in libraries, they may be one method for controlling the costs of acquiring and maintaining hard-copy monographs. The next step is to determine eBook life cycle costs and to compare them with hard-copy book life cycle costs.

The BE costs identified in this study can be used to calculate the costs of eBooks. eBook access fees will be included as miscellaneous expenses and added to the total operating expenses. Printer paper and telecommunications costs also will be added to the total operating expenses. The purchase and maintenance costs of computer terminals and printers will be included in the fixtures and equipment cost category. The space allocations for computer workstations and printers will be calculated in the building and facilities cost category.

A formula will need to be developed to calculate a percentage of all expenses associated with computer workstations and printers for eBook access because this equipment also is used to access the online public access catalog, electronic

journals, databases, and the Internet. Moreover, a percentage of the telecommunications costs will need to be allocated to the staff's use of electronic resources for their work associated with acquisitions, collection development, cataloging, circulation, interlibrary loan, and reference services. As computer equipment and telecommunications costs become more affordable and microwave technology becomes more accessible, the costs associated with acquiring, accessing, and maintaining eBook collections may be less

than the costs of maintaining hard-copy monograph collections. The determination of eBook life cycle costs and a comparison of these costs to the hard-copy life cycle books costs is the next logical step in calculating and identifying library material life cycle costs.

*Note: A copy of the analysis tool, the Library Interactive Costing Spreadsheet (LICS), used in this study is available online from <http://bus.colorado.edu/faculty/lawrence/LICS>.*

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**APPENDIX A**  
**ARL Survey Data**

The table below summarizes data that is collected annually by the Association of Research Libraries from its members. Variables in boldface type represent data used in this study. More extensive descriptions of the data can be found on the ARL Web site at address <http://www.arl.org/stats/arlstat/98doc.html>.

Library Characteristics	
YEAR	Survey of year
INSTNO	Library number
INAM	Library name
TYPE	Type of library
REGION	Geographic region
MEMBYR	Year library joined ARL
LAW	Law library included?
MED	Medical library included?
EXCH	Canadian exchange rate
Collections	
<b>VOLS</b>	Volumes held
VOLSADG	Volumes added gross
<b>VOLSADN</b>	Volumes added net
<b>MONO</b>	Monographs purchased
SERPUR	Current serials purchased
SERNPUR	Current serials not purchased
<b>CURSER</b>	Total current serials
<b>MICROF</b>	Microforms
<b>GOVDOCS</b>	Government documents
<b>MSS</b>	Manuscripts and archives
<b>MAPS</b>	Cartographic materials
<b>GRAPHIC</b>	Graphic materials
<b>AUDIO</b>	Audio materials
<b>VIDEO</b>	Video and film
<b>COMPFIL</b>	Computer files
Service Activities	
ILLTOT	Total lending
ILBTOT	Total borrowing
GRPPRES	Group presentations
PRESPTCP	Presentation participants
REFTRANS	Reference transactions
INITCIRC	Initial circulations
TOTCIRC	Total circulations
Personnel	
PRFSTF	Professional staff
NPRFSTF	Support staff
STUDAST	Student assistants
TOTSTFX	Total staff and students (PRFSTF+NPRFSTF+STUDAST)

**APPENDIX A**  
**ARL Survey Data (continued)**

Expenditures	
<b>EXPMONO</b>	Expenditures for monographs
<b>EXPSEER</b>	Expenditures for current serials
<b>EXPOTH</b>	Expenditures for other materials
<b>EXPMISC</b>	Expenditures for non-materials
<b>EXPLM</b>	Total expenditures for materials
<b>EXPBND</b>	Expenditures for binding
SALPRF	Professional salaries
SALNPRF	Non-professional salaries
SALSTUD	Student assistant wages
<b>TOTSAL</b>	Total salaries and wages (SALPRF+SALNPRF+SALSTUD)
<b>OPEXP</b>	Other operating expenses
TOTEXP	Total expenditures (EXPLAM_EXPBND+TOTSAL+OPEXP)
TOTSTU	Total full-time student enrollment
GRADSTU	Total graduate school enrollment
University Data	
PHDAWD	Ph.D. degrees awarded
PHDFLD	Ph.D. fields
FAC	Instructional faculty

**APPENDIX B**  
**Median Life Cycle Cost Estimates (1999 ARL Statistics)**

<b>Library Collection</b>	<b>Monographs</b>	<b>Serials</b>	<b>Microforms</b>	<b>GovDocs</b>	<b>Manuscripts</b>	<b>Maps</b>	<b>Graphics</b>	<b>Audio</b>	<b>Video</b>	<b>CompFiles</b>
Reported Holdings	2,772,663	22,913	3,944,886	283,661	13,507	183,706	166,932	32,484	9,175	4,509
Book Equivalent Holdings	2,772,663	15,352	7,890	56,732	2,701	36,741	3,339	6,497	13,111	9
Relative BE Holdings (percent)	95.1%	0.5%	0.3%	1.9%	0.1%	1.3%	0.1%	0.2%	0.4%	0.0%
<b>Unit Cost</b>	<b>\$ 47.78</b>	<b>\$ 590.97</b>	<b>\$0.11</b>	<b>\$0.00</b>	<b>\$4.46</b>	<b>\$11.05</b>	<b>\$0.06</b>	<b>\$6.80</b>	<b>\$15.70</b>	<b>\$0.01</b>
<b>Total Life Cycle Costs</b>	<b>Monographs</b>	<b>Serials</b>	<b>Microforms</b>	<b>GovDocs</b>	<b>Manuscripts</b>	<b>Maps</b>	<b>Graphics</b>	<b>Audio</b>	<b>Video</b>	<b>CompFiles</b>
Operating Expenses	39.08	26.18	0.04	8.19	15.59	7.77	0.32	2.37	11.41	0.01
Wages & Salaries	113.68	76.16	0.11	22.55	45.81	22.33	0.95	6.95	33.28	0.02
Buildings & Facilities	35.88	24.04	0.04	7.05	14.32	7.18	0.29	2.15	10.26	0.01
Facility Maintenance	71.77	48.08	0.07	14.10	28.64	14.36	0.57	4.31	20.52	0.01
Fixtures & Equipment	35.88	24.04	0.04	7.05	14.32	7.18	0.29	2.15	10.26	0.01
Total Ongoing Expenses	\$299.74	\$200.83	\$0.34	\$55.40	\$122.33	\$62.76	\$2.84	\$17.97	\$91.80	\$0.06
<b>Total Life Cycle Costs</b>	<b>\$343.03</b>	<b>\$801.78</b>	<b>\$0.45</b>	<b>\$55.40</b>	<b>\$126.79</b>	<b>\$73.82</b>	<b>\$2.91</b>	<b>\$24.77</b>	<b>\$107.50</b>	<b>\$0.07</b>
Life Cycle Cost / Unit Cost	718%	134%	256%	311%	1130%	247%	216%	219%	307%	331%
<b>Discounted Life Cycle Costs</b>	<b>Monographs</b>	<b>Serials</b>	<b>Microforms</b>	<b>GovDocs</b>	<b>Manuscripts</b>	<b>Maps</b>	<b>Graphics</b>	<b>Audio</b>	<b>Video</b>	<b>CompFiles</b>
Operating Expenses	7.51	6.98	0.02	2.18	2.08	2.07	0.21	2.10	15.22	0.02
Wages & Salaries	10.12	20.31	0.06	6.01	6.11	5.95	0.64	6.17	44.37	0.06
Buildings & Facilities	27.94	6.41	0.02	1.88	1.91	1.92	0.19	1.92	13.68	0.02
Facility Maintenance	8.74	12.82	0.04	3.76	3.82	3.83	0.38	3.83	27.35	0.04
Fixtures & Equipment	17.48	6.41	0.02	1.88	1.91	1.92	0.19	1.92	13.68	0.02
Total Ongoing Expenses	\$71.78	\$52.94	\$0.16	\$14.13	\$15.80	\$15.72	\$1.58	\$15.85	\$113.25	\$0.16
<b>Discounted Life Cycle Costs</b>	<b>\$119.56</b>	<b>\$643.91</b>	<b>\$0.27</b>	<b>\$14.13</b>	<b>\$20.26</b>	<b>\$26.78</b>	<b>\$1.65</b>	<b>\$22.64</b>	<b>\$128.95</b>	<b>\$0.17</b>
Discounted LC Cost / Unit Cost	265%	109%	183%	176%	237%	139%	178%	206%	376%	716%