

*Is cost benefit analysis applicable to journal use in special libraries?**

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Abstract: This paper describes the concept of cost-benefit analysis in libraries, citing early uses. The need for cost-benefit analysis in libraries is shown, as are difficulties in applying the technique in libraries. Although many cost minimising efforts have been made by libraries, "utility" measures were found to be intangible and inappropriate, and so a serious threat to the integrity of the cost-benefit analysis. A systematic random sample of journals subscribed by ISRO Satellite Centre Library was subjected to a simplified cost-benefit analysis. "Cost per use" of a journal appears to be useful ratio for assessing journals subscribed to by a library. The sample study of cost-benefit analysis of journals indicates that such a study does not answer all questions, but provides an additional dimension over and above what appears in a simple use study to an understanding of journal usage. The conclusion is drawn that many non-economic factors dominate the decision to subscribe to a journal. It is felt that a cost-benefit analysis can increase the awareness of librarians, administrators and others concerning costs and use patterns, but cannot be truly effective without the help of intuitive value judgment.

Keywords: Journal subscription, cost benefit analysis, journal usage, special libraries, use studies, journals budget

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Introduction

The McGraw-Hill encyclopedia of professional management defines cost-benefit analysis (CBA) as determining "... the ratio of the benefits of a given project to its cost, taking into account the benefits and costs that cannot be directly measured in dollars"¹ (Bittel ed. 1978, p242) A closely related concept of cost-effectiveness analysis (CEA) "... is defined as a way of finding the least expensive means of reaching an objective or a way of obtaining the greatest possible value from a given expenditure"² (Bittel ed. 1978, p242). Either to arrive at a benefit to cost ratio of a single project or to assess relatively the effectiveness of different projects, the identification and pertinent measure of all the costs and benefits of projects on an identical scale of measure (e.g., dollars or rupees) is necessary³.

While CBA seeks to develop standards and criteria for determining how well the existing services of a library meet the requirements of its users, CEA aims at discovering new, improved procedures and devices for providing better services to the users. CBA has been considered as a valuable tool for increasing people's awareness of the costs and benefits of information and documentation as a production factor and to provide a better basis for budgeting and strategic planning.

Libraries are largely service-oriented paternalistic systems and are not susceptible to precise quantitative assessment. The cost of establishing and running a library can be estimated, but how does one measure its intangible benefits? In the past, mixed reactions have greeted the use of CBA in librarianship in general and in dealing with journals in particular. Yet, the need for CBA in libraries has been stressed by many⁴ (White, 1979; Leimikuhler, 1978). Though a substantial amount of literature has been brought out on CBA, very little has been done to demonstrate the use of CBA in libraries⁵.

Some attempts to apply CBA to certain areas of library works like library unionisation and networking, union catalogue, electronic security system, catalogue automation, library automation network, catalogue system, library delivery systems, manpower planning, etc., have already been made.

Wills and Oldman⁶ (1977) reviewing some cost-benefit studies of libraries, question the assumption that "use" equals "value", and criticise the use of CBA for two reasons: (1) economic analysis is inappropriate where decisions have to be based on political factors (2) it is essential to explore how information supplied by libraries is used. Jenson⁷ (1978) also concludes that the CBA is not applicable in assessing library service. The upper hand of non-economic considerations⁸ (Sridhar, 1985) in decision making in libraries has been stressed by Raffel⁹ (1974), who says that the more critical the decision, the less useful a CBA to library decision makers.

The numerous use studies of libraries have never attempted to measure "utility" or "value" (it is almost impossible to measure precisely the utility of a document or a library) but have made certain assumptions about the operational definition of "use" of a document. Francis¹⁰ (1976) for example, finds an absence of costing standards and suggests that many problems exist in translating the statistics of book circulation into equivalent social benefits.

Apart from exploring the difficulties of applying CBA to journals, it is attempted in this paper to relate the subscription cost of a journal issue to its "use"¹¹ during the first three months after its arrival. Kent's definition of "use" as physical selection and the act of leafing through pages of journal was adopted for the purpose. Incidentally, the "cost per use" of a journal appears to be a useful figure both in ratio

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analysis¹² (Sridhar, 1986) in libraries and in ranking journals in decreasing order of cost per use.

Cost-benefit analysis of journals

Given a fixed budget, a library has to allocate its funds judiciously to various activities and services, while at the same time ensuring that it maximise benefit to cost ratio. In other words, libraries do carry out benefit-maximising and cost-minimising programs. For example, if the cost of maintaining an old bound journal is much higher than borrowing it from other libraries, the library may opt to weed it out. Similarly, if in-house reprographic or micrographic work is costlier than having this work done on the outside, the library may decide to go outside for it. These are traditional make or buy decisions, and they are often, influenced by non-economic considerations.

Much has been written about cost minimising efforts in dealing with journals. Use studies, bibliometric studies, cost-benefit studies, cost-effectiveness studies, citation studies, etc., are common. All such studies have directly or indirectly attempted to rank journals subscribed to by a library (or published in a particular field) in decreasing order of productivity, "utility" or "use". In the process, assumptions are sometimes made with little attempt to isolate factors/variables that affect both the cost of the journals and the benefit they provide. A sort of straight relation between cost and benefit may be brought forth on the assumption that other factors remain constant. Such a ranked list of journals is supposed to be used, depending upon availability of funds, in making borrow or buy decisions.

Robertson and Hansman¹³ (1979) felt that the traditional Bradford approach to bibliographic scatter involving ranking of journals according to productivity must be modified in order to answer more directly questions concerning the cost-effectiveness or cost-benefit of journal acquisition. The results obtained in using the Bradford analysis alone appeared to

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them to depend upon the particular journals that contribute to a field.

As far as cost-benefit analysis of journals is considered, Byrd and Koenig¹⁴ (1978) have pleaded for an objective cost-benefit ratio for each serial title. They point to an unfortunate situation in which selection is often based on user opinion. In addition to subscription cost, they considered many other factors in assessing values. These included coverage, impact factor, use, location, inter-library loan requests, etc. Similarly, a model for selection of journals titles based on cost-benefit ratios was developed by Kraft and Polacsek¹⁵ (1978), who analysed factors such as usage, relevance and availability of a title elsewhere.

Kent's study¹⁶ at the University of Pittsburgh was another major study in which use of books and journals was related to cost of their acquisition and maintenance (Kent et. al. 1979). But controversy arose concerning implementation of the findings of this report¹⁷ (University of Pittsburgh 1979).

Methodology and sample

In late 1983 a use study of current journals by Indian space technologists was carried out¹⁸ (Sridhar, 1986). As part of the study in-house use as well as lent out use of two latest issues of 485 current journals subscribed to by the Indian Space Research Organisation (ISRO) Satellite Centre (ISAC) Library were monitored and recorded over three months from the date of their arrival and display in the library. For the purpose of applying CBA to journals, the use data of this study has been extracted in the case of about 6% of the titles. The actual sample was picked by selecting every 15th title from the list of current journals arranged alphabetically by title. Thus, this study is restricted to a sample of 33 titles. The purpose of the study was to see how effective the CBA of journals is in a special library, to

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determine how the findings of CBA of journals differ from those of a simple use study and to assess how far other factors influence the decision to retain an item or not, based on its CBA. The subscription cost of the sample journals in rupees for the year 1983 as well as their periodicity have been noted to determine cost per issue. The sample journals are analysed and compared for their cost per use.

Analysis of the data

Table 1 provides the data on 33 sample journals subscribed to by ISAC library in terms of title, periodicity, subscription cost, use and cost per use. As already mentioned, the use data in the table is extracted from an earlier use study of current journals¹⁹ (Sridhar, 1986). The intention here is to extend the analysis done in the use study by incorporating the cost component and assessing to what extent the findings and recommendations of the use study hold good in the CBA. It is intended also to see whether or not further clues are provided by CBA in assessing the relative worth of a journal for a given library.

It may be noted from the table that the average use per issue of a journal (in the sample) during the first three months of its arrival and display in the ISAC Library is 7.5. The average subscription cost of an issue of a journal in the sample is Rs. 153.75 and the average cost per use of a single issue over the three months is Rs. 20.63.

As the journals Energy and the Journal of Photographic Science were not used during the sample use study, their cost per use is not worked out in Table 1, and hence they are excluded from the CBA. Incidentally, these are 2 of the 60 unused journals at ISAC library recommended for cancellation in the use study. In addition, there were another 34 marginally used titles (used once or twice during the first three months of their arrival) suggested for cancellation. The sample list of journals in

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Table 1 contains three such marginally used titles: the Journal of Applied Photographic Engineering, the Journal of Engineering Physics and the Telecommunication Journal of Australia.

On the other hand, it was recommended that 28 heavily used journals (used more than 30 times during the course of the use study) be obtained by airmail subscription and/or additional copy(ies) be subscribed to. Four of them, namely, Aviation Week and Space Technology, Microelectronics and Reliability, Nature and Satellite Communication occur in Table 1.

Table 2 presents the sample journals (31 titles, ignoring 2 that were unused) in increasing order of their cost per use. In addition, their respective ranks as per decreasing order of use and increasing order of cost are also indicated in the table. It is interesting to note that the rank order of these journals by cost per use and by use alone are fairly highly correlated (the Spearman Rank order correlation is 0.70 at the 0.005 significance level). This indicate that as much as 70 percent of the result of CBA is affected by the use data of journals (i.e., benefits).

An examination of Table 2 reveals that the news oriented popular journals score low in cost per use. For example, Satellite Communication received the lowest cost per use of Rs. 0.48. This is followed by Aviation Week and Space Technology (Rs. 0.60), Electrical Communication (Rs. 1.14), Space World (Rs. 1.15), Wireless World (Rs. 1.59), Machine Design (Rs. 1.62), Defense Electronics (Rs. 2.76), Nature (Rs. 2.85) and Control Engineering (Rs. 4.06). Of four heavily used journals (used more than 30 times), three have the lowest scores in cost per use. The journal Microelectronics and Reliability, though used heavily, scores a moderate Rs. 21.29 per use because of its relatively high subscription cost. Hence, it would not be proper to recommend airmail subscription and/or subscribing to an additional copy in its case. The journal Electrical Communication, which had a quite low use score (12), is at the

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top of the list as a result of its low cost. In other words, it has a low cost/low use profile.

On the other hand, the highest cost per use of Rs. 448.58 is scored by the Journal of Engineering Physics. Next in line are: the IEEE Proceedings B: Electrical Power Applications (Rs. 294.33), the Journal of Applied Photographic Engineering (Rs. 202.00), the Telecommunication Journal of Australia (Rs. 132.00), Solar Physics (Rs. 112.98) and the Journal of the Acoustic Society of America (Rs. 112.98). Interestingly, all three of the marginally used (used once or twice during the sample use study) titles mentioned earlier are included in the high cost per use group. In addition, another 3 journals, namely the IEEE Proceedings B: Electrical Power Applications, Solar Physics and the Journal of the Acoustic Society of America, have also become cost ineffective because of their exorbitant subscription cost. It is these high cost per use journals that should be considered for cancellation and alternative arrangements, such as the buying of Xerox copies of relevant articles, made. All six of the high cost per use (> Rs. 100.00) journals are specialised journals dealing with a specific aspect of a subject and are relatively high-priced.

Conclusion

The findings of the journal use study were put before a representative user body for a final decision on cancellation of unused and least used journals and for a decision regarding additional copies and/or airmail subscription in the case of heavily used journals. Not all of the journals recommended for cancellation were actually canceled. Nearly half were retained on the plea of subject specialists. In very few cases was the airmail/second copy arrangement approved. The cost dimension added to the use study has nevertheless substantially influenced the decision makers in cutting down the number of highly priced subscriptions. An exception occurs only in the case of a few specialised journals.

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Another factor considered was the nature of journals. For example, most of the local (Indian) journals were not only cheaper but also were demanded as a means of supporting the indigenous publishing efforts.

Two further considerations were taken into account. One had to do with whether a journal is published by a professional body or by a commercial publisher. Normally journals published by professional bodies are lower in subscription cost than are those published by commercial publishers. The second consideration dealt with whether a journal is a news/current-awareness journal meant for generalists or one that deals with a subject of interest primarily to specialists.

CBA is helpful in furthering the findings of the use study by grouping the journals of a library into four profiles, as depicted in the Figure given below.

		USE	
		Low	High
COST	Low	1	4
	High	2	3

Figure: Four Profiles of Journals

Cell 1: Low cost and low use journals. A library does not mind having such journals as long as they are not creating an abnormal maintenance cost. Alternatively, as long as they are not to be kept in the library for a long time, they are desirable.

Cell 2: High cost and low use journals. These need to be carefully considered for cancellation. Strong user opinion and non-economic considerations need to be given attention.

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Cell 3: High cost and high use journals. These need a separate ranking to see whether or not some with a very high cost per use can be canceled and Xerox copies of needed articles acquiring and whether or not the journal can be shared with local cooperating libraries.

Cell 4: Low cost and high use journals. These are the ideal journals from a CBA angle for any library.

It can be concluded that CBA may not provide a completely satisfactory solution to problems of journal retention or cancellation. It does, however, provide some clues as to how to proceed over and above those provided by a simple use study. CBA increases the awareness of librarians, administrators and users concerning collection prerogatives, but must be used in conjunction with intuitive judgment. Above all, non-economic considerations and user opinion dominate the decision making in journal subscription.

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TABLE 1

Cost per Use of Selected Journals Subscribed to by ISAC Library

	Title	Peri- odicity	Subs- cription Cost in Rs. per Year	Use of Two iss- ues in First 3 Months	Cost per Use per Issue for First 3 Months
1	2	3	4	5	6
1.	Acta Astronautica	M	4545	29	26.12
2.	Applied Mechanics Reviews	M	3636	11	55.09
3.	Astronomy and Astrophysics	F	7948	11	55.58
4.	Aviation Week and Space Techno- logy	W	667	43	00.60
5.	Celestial Mechanics	8/yr	750	17	11.03
6.	Control Engineering	M	707	29	4.06
7.	Defense Electronics	M	364	22	2.76
8.	Electrical Communication	M	82	12	1.14
9.	Electronics and Communica- tions in Japan	M	4245	10	70.75
10.	Energy	BM	2828	0	NA
11.	Hydraulics and Pneumatics	M	505	5	16.83
12.	IEE Proceedings.B:Electrical Power Applications	BM	5298	6	294.33
13.	IEEE Trans. on Biomedical Engineering	M	1197	8	24.94
14.	IEEE Trans. on Engineering Management	Q	364	10	18.20
15.	IEEE Trans. on Plasma Science	Q	545	7	32.43
16.	International Journal of Control	M	3227	8	67.23
17.	Journal of Applied Photographic Engineering	Q	808	2	202.00

TABLE 1 (continued)

1	2	3	4	5	6
18.	Journal of Engineering Physics	M	5383	2	448.58
19.	Journal of Photographic Science	BM	587	0	NA
20.	Journal of the Acoustic Society of America	M	1869	3	103.83
21.	Journal of the Optical Society of America	M	1818	7	43.29
22.	Machine Design	F	505	24	1.62
23.	Microelectronics and Reliability	BM	2172	34	21.29
24.	Nature	W,	2820	38	2.85
25.	Optics Communication	M	3648	13	46.77
26.	Plating and Surface Finishing	M	404	6	11.22
27.	Radio and Electronic Engineer	M	885	10	14.75
28.	Satellite Communication	M	151	52	0.48
29.	SIA M Journal on Control and Optimisation	BM	889	7	42.33
30.	Solar Physics	8/yr	6779	15	112.98
31.	Space World	10/Yr	167	21	1.15
32.	Telecommunication Journal of Australia	3/Yr	198	1	132.00
33.	Wireless World	M	277	29	1.59

Key : NA, Not Applicable; M, Monthly; F, Fortnightly; W, Weekly; Yr, Year; BM, Bimonthly; Q, Quarterly.

Note: 1. Average use per journal issue for first quarter is $(\frac{492}{66} =) 7.5$
 2. Average cost of an issue of journal is Rs. $(\frac{66268}{431} =) 153.75$
 3. The average cost per use of single issue in first quarter is
 Rs. $(\frac{2 \times 33}{492} \times 153.75) = 20.63$

TABLE 2
Ranked List of Journals by Cost Per Use

Rank in Increasing Order of Cost Per Use		Title	Rank in Decreasing Order of Use	
1	(0.48)	Satellite Communication	1	(52)
2	(0.60)	Aviation Week end Space Technology	2	(43)
3	(0.14)	Electrical Communication	14	(12)
4	(1.15)	Space World	10	(21)
5	(1.59)	Wireless World	6	(29)
6	(1.62)	Machine Design	8	(24)
7	(2.76)	Defense Electronics	9	(22)
8	(2.85)	Nature	3	(38)
9	(4.06)	Control Engineering	6	(29)
10	(11.03)	Celestial Mechanics	11	(17)
11	(11.22)	Plating and Surface Finishing	25.5	(6)
12	(14.75)	Radio and Electronic Engineer	18	(10)
13	(16.83)	Hydraulics and Pneumatics	27	(5)
14	(18.20)	IEEE Trans. on Engineering Management	18	(10)
15	(21.29)	Microelectronics and Reliability	4	(34)
16	(24.94)	IEEE Trans. on Biomedical Engineering	20.5	(8)
17	(26.12)	Acte Astronautice	6	(29)
18	(32.43)	IEEE Trans. on Plasma Science	23	(7)
19	(42.33)	SIAM Journal Control and Optimisation	23	(7)
20	(42.29)	Journal of the Optical Society of America	23	(7)
21	(46.77)	Optics Communication	13	(13)
22	(55.09)	Applied Mechanics Review	15.5	(11)
23	(55.58)	Astronomy and Astrophysics	15.5	(11)
24	(67.23)	International Journal of Control	20.5	(8)
25	(70.75)	Electronics and Communication in Japen	18	(10)
26	(103.83)	Journal of the Acoustic Society of America	28	(3)
27	(112.98)	Solar Physics	12	(15)

TABLE 2 (continued)

Rank In Increasing Order of Cost Per Use		Title	Rank In Decreasing Order of Use	
28	(132.00)	Telecommunication Journal of Australia	31	(1)
29	(202.00)	Journal of Applied Photographic Engineering	29.5	(2)
30	(294.33)	IEE Proceedings B:Electrical Power Appli- cations	25.5	(6)
31	(448.58)	Journal of Engineering Physics	29.5	(2)

Note: The Spearman₂ Rank Order Correlation between two rankings is

$$r_s = 1 - \frac{6 \times D1^2}{n(n^2 - 1)} = 0.7068. \text{ The t-test value based on}$$

$$t = r_s \sqrt{\frac{n-2}{1-r_s^2}} \text{ is } 5.3805. \text{ By looking at the tabulated value of}$$

t, it is found that correlation is statistically significant at 0.005.

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About the Author

Dr. M. S. Sridhar is a post graduate in Mathematics and Business Management and a Doctorate in Library and Information Science. He is in the profession for last 36 years. Since 1978, he is heading the Library and Documentation Division of ISRO Satellite Centre, Bangalore. Earlier he has worked in the libraries of National Aeronautical Laboratory (Bangalore), Indian Institute of Management (Bangalore) and University of Mysore. Dr. Sridhar has published 4 books, 83 research articles, 22 conferences papers, written 19 course materials for BLIS and MLIS, made over 25 seminar presentations and contributed 5 chapters to books.



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