Information Processing & Management Vol. 19, No. 5, pp. 307–311, 1983
Printed in Great Britain.

0306-4573/83 $3.00 + .00
Pergamon Press Ltd.

JOURNAL ACQUISITION—COST EFFECTIVENESS OF MODELS

K. S. CHUDAMANI*
Indian Statistical Institute, 31 Church Street, Bangalore 560 001, India

and

R. SHALINI
University of Mysore, Manasagangothri, Mysore 570 006, India

(*Received for publication* 24 *February* 1983)

Abstract—This paper attempts to compare some of the available models for journal acquisition and indicates their utility in library acquisitions.

INTRODUCTION

The development of models for journal selection has received considerable attention in the immediate past for its significance in application of bibliometric techniques to library decision making.

Basically the models seek to determine the optimal allocation of present expected budget to the purchase of journals, using an objective function based on expected usage as a measure of each journal's worth.

JOURNAL LITERATURE: BIBLIOMETRIC ANALYSIS

Bibliometrics is the "Quantitative analysis of gross bibliographical units such as books, journals (articles) and the like"[1]. Bradford's law of scattering[2] provides the basis for the development of later models developed by Brooks, Robertson, Henaman, *et al.*[3–5] for journal selection programs. The development of any model is characterised by the following elements: (a) unit of effectiveness; (b) method of ranking; (c) threshold point; (d) ranked list; (e) graph.

(a) *Unit of effectiveness.* Unit of effectiveness is the measure of the implied utility of any bibliographic unit to the user. The utility is measured in terms of relevancy. The relevancy of a journal is established by a measure of frequency of citation/use/occurrence of relevant items, etc. Measurement of this frequency is based on the assumption that all are of equal utility.

(b) *Method of ranking.* Ranking is the process of ordering bibliographic units with reference to a chosen ranking factor. Ranking factor can be defined as the ratio of the effectiveness of a journal to a second variable (such as cost, total number of articles, etc.) in relation to which the utility of journals are to be compared.

Various ranking methods have been developed by varying the second variable in the models developed for journal acquisition. In the Brookes model (BM) the two variables are effectiveness and cost (here the average cost of subscription to a journal is used as the cost); the second variable being a constant, ranking is in effect dependent on the effectiveness of the journal alone. For the precision ranking model (PRM) the two variables are effectiveness and total size. The ratio being called the precision factor. As far as the cost effectiveness model (CEM) is concerned effectiveness and the individual subscription cost are the two variables and their ratio is called the cost effectiveness factor. These ranking techniques are correspondingly called absolute ranking, precision ranking and cost effectiveness ranking methods. They in turn give rise to different ranked lists.

(c) *Threshold point.* Threshold point is the point of influxion on the curve beyond which

*Author to whom correspondence should be addressed.

Table 1. Comparison of the characteristic elements of the Brookes model, precision ranking model and cost effectiveness model

Characteristic elements	BM	PRM	CEM
Unit of effectiveness	Total number of relevant items per journal	Same as BM	Same as BM
Method of ranking	Absolute ranking	Precision ranking	Cost of effectiveness ranking
Unit of cost	assumed to be the same for all (i.e. average cost)	-	actual cost of the journal over head cost
Threshold point	The point at which the semilog curve runs parallel to Y axis	The point at which the exponential curve runs parallel to X axis	The point at which the exponential curve runs parallel to X axis
Limitation	It does not take account of actual cost of journals	It does not take account of cost of journals.	--

the exponential curve will run almost parallel to X-axis. In otherwords, it implies that purchase of periodicals lying beyond this point tends to be uneconomical.

(d) *Graph.* Graph is a two dimensional representation of ranked list of journals by plotting their cumulative productivity and the second variable of the models.

Table 1 gives a comparative account of some of the characteristic elements of the models.

PRESENT STUDY

An analysis and comparison of the three models might offer empirical evidence for selecting a model for journal selction program.

This paper presents an attempt to compare the features of the three models namely: the Brookes model (BM)[3]; precision ranking model (PRM); cost effectiveness model (CEM)[5]. The Brookes model as proposed by Brookes makes use of a semi-log curve whereas the other two models make use of an exponential curve. In order to achieve comparison on equal footing it was decided to use an exponential curve instead of the semi log curve for the Brooks model also in this study and this is denoted as BM (exp).

The effectiveness factor is measured in terms of the total number of relevant items produced by a journal. The relevancy of the article is established by matching a user profile with a document profile (i.e. article).

Data collection

For the purpose of the present study journals acquired by the Mysore University in the field of Physics for the year 1976 was the population studied (46 titles). These journals were assessed for their worthiness to the user population in their research work. The user group was the faculty and research staff of the department of physics of the Mysore University.

The data required for the study: (a) productivity of journal; (b) journal cost; (c) journal size; (d) photocopy cost.

(a) *Productivity of journals.* The items relevant to the user population were identified by matching the user profile with the document profile. The total items per journal were cumulated.

(b) *Journal cost.* For BM the average cost of the journals was determined by dividing the total library budget for periodicals in physics by the total number of journals. In the case of CEM the subscription cost of each journal was used as the journal cost.

(c) *Journal size.* Total number of articles published by a journal per year was used as the journal size.

(d) *Photocopy cost*: The cost per photocopy of an article in physics was estimated by dividing the total expenditure on photocopies of physics articles by total number of articles photocopied.

COMPARATIVE STUDY

Comparison of the models is made with reference to the following features: (1) cost vs threshold point; (2) $P\%$ literature vs cost; (3) journal productivity vs cost; (4) nuclear zone.

Cost vs threshold point

Table 2 shows the investment required to purchase journals lying within the threshold point. It also gives the number of journals lying within the threshold point and the 'P' percentage of literature covered by them.

Both BM (exp) and CEM recommend an equal number of journals with marginal variations in the investment. But CEM suggests an optimum investment when compared with BM (exp). For an additional investment of Rs. 3000, BM (exp) offers a 3% increase in the literature coverage. This is not economically viable as a higher rate of cost investment is involved for the purchase of relevant item. PRM nowhere compares with these two models as it suggests nearly same $P\%$ of literature coverage for an increased investment of Rs. 9000/-.

$P\%$ of literature vs cost

From Table 3 it can be inferred that the cost effectiveness model provides the optimum literature coverage with least investment. Hence the highest savings attainable for covering a given percentage of literature is predicted by the model. Conversely it can also predict the maximum literature that can be covered for a given investment. Given a statement of

Table 2. Cost vs threshold point

	Cost	p% of literature	No. of journals upto the Threshold point
BM (exp)	41000	96%	26
PRM	51000	97%	35
CEM	38000	93%	26

Table 3. $P\%$ of literature vs cost

Model	50%	75%	85%
BM (exp)	20219	32800	38500
PRM	21180	29000	38337
CEM	9000	19200	28862

budget allocation both the maximum literature coverage and minimum investment required can be directly read from the graph of CEM.

Journal productivity vs cost

Relating cost with yield significantly influences the journal placement in the ranklists. To cite a few cases: *Indian Journal of Pure and Applied Physics* (cost 1000: productivity 8) is ranked 1st in CEM but only 20th in BM (exp).

Nuclear Physics and *Physics Letter* ranked 1st and 3rd in BM are not as cost effective as the *Indian Journal.*

Nuclear zone

Variations in the method of ranking gives rise to varied ranklists. This necessitates the comparative study of the rank lists of different models to find out their unity in diversity.

First of all, from the ranked list of BM (exp) it can be inferred that the top ranking journals of the model are highly productive foreign journals. The nuclear zone ends with the 26th ranked journal. In the case of PRM, as seen from the ranked list, review journals are assigned the first few places and the nucleus zone ends with the 35th ranked journal. As far as the CEM is concerned Indian journals are deemed to be more cost effective as they are assigned the top ranks in the ranked list. The nucleus zone consists of the first 26 ranked journals.

Table 4. Comparison of the ranks of the 21 common periodicals of the nuclear zones of BM (exp), PRM and CEM

Sl No.	Title	Rank BM(exp)	PRM	CEM
1	Molecular crystals and liquid crystals	2	1	10
2	Journal of quantitative spectroscopy and radiation transfer	12	5	12
3	Pramana	25	6	2
4	Physics letters	7	7	4
5	Journal of Molecular spectroscopy	18	8	21
6	Nuclear Physics	3	11	22
7	Canadian journal of Physics	3	13	13
8	Journal of Mathematical physics	9	15	10
9	Soviet Journal of nuclear physics	11	16	15
10	Nuovo Cimento A	25	17	17
11	Indian Journal of pure and applied physics	1	18	16
12	Journal of Physics B	9	19	16
13	Progress of theoretical physics	15	20	11
14	Nuclear instruments and methods	7	22	26
15	Physics Review letters	5	24	5
16	Journal of physics (A+C)	21	25	21
17	Soviet physics cryctallography	23	26	17
18	Physical Review A	8	27	14
19	Physical Review D	6	29	6
20	Physical Review C	20	30	13
21	Journal of chemical physics	8	34	14

A comparative study of the ranked list shows that there are 21 journals in common for all three nucleus zones. Between the nuclear zones of BM (exp) and PRM there are 25 journals in common; between BM (exp) and CEM there are 23 and between PRM and CEM there are 25.

When the rank correlation coefficient is estimated for the different pairs, it does not get a value beyond 0.5 implying that the ranked lists disagree to a greater extent. This implies that the journals are ranked variedly (see Table 4); but still there is a lot of commonness in the nuclear zone (nearly 80%) implying that one could still accept the common journals for acquisition as they are cost effective and productive.

CONCLUSION

From the comparative study it can be inferred that though all three models offer cost effective approaches to journal acquisition the best cost effective measure is offered by CEM. Since review journals, a special category (suggested by PRM only) cannot be compared with other primary journals either in size, coverage or cost, they can be treated as a separate category, as are abstracting and indexing journals, and thereby be acquired. For all other purposes CEM offers the best results. Though the quality factor is not measured here, there is an indirect effect of quality assessment.

REFERENCES

[1] J. C. DONOHUE, A bibliometric analysis of the structure of information science literature. *JASIS* 1972, **23**, 5.

[2] S. C. BRADFORD, *Documentation.* Croby Lickwood, London (1948).

[3] B. C. BROOKES, Derivation of Bradford-Zipf distribution and its application. *J. Documentation*, 1968, **24**, 4.

[4] B. C. BROOKES, Optimum p% library of science periodicals. *Nature* 1971, **232**, 1.

[5] S. E. ROBERTSON and S. HENSMAN, Journal acquisition by libraries; Scattered and costeffectiveness. *J. Documentation* 1975, **31**, 3.

[6] A. SINGLETON, Journal ranking and selection—a review in physics. *J. Documentation* 1976, **32**, 4.