that are never converted into demands on the library, and why are some needs (information needs, document needs) of the library never converted into demands. Studies of the performance of information retrieval system have shown clearly that, in many cases, there is a substantial gap between what the user states as a need and what is actually needed, that is, the latent need behind the expressed need. We face the danger of a distorted situation because one side of the picture is looked at very intensively, while other part is largely neglected. It creates a kind of self"reinforcing" situation. If we always evaluate library service in terms of expressed needs of the present users, then as a result of our evaluation, when we attempt to improve the service, we tend to move the library service towards the demands of the present users, and away perhaps from the unexpressed needs of the users and the needs of nonusers too.

The evaluation of services in terms of the expressed needs of the present users is the most serious defect of all the work that has been done in the evaluation of Libraries in the last ten years. It is easier to understand the demands of the present users, whereas it is much difficult to recognise, needs that are never converted into demands either by present users or present non-users.
Another problem is that certain library services are difficult to measure objectively. Ideally the user behaviour may be measured by unobtrusive means to counteract the danger that the behaviour may be altered if the individual knows he is being observed. In most aspects of Library usage, there is no way of measuring the performance unobtrusively. The procedures followed affect the results and influence the performance of the people observed.

The major activities of an University Library can be divided in to three services: (1) the document delivery services; (2) reference service; and (3) Literature searching service, both retrospective and current.

With respect to document delivery services of an University Library, there is a danger in viewing any Library service which looks on the surface to be a very simple situation of failing to recognise all the underlying factors which determine the success of the user. Determining the probability of an item being available when a user comes in to the Library, looking for it is not a simple situation. There are many factors influencing this probability, and consequently, many factors that have to be considered
in a comprehensive evaluation of the degree to which successful completion of this event is likely to occur. 53

When an user comes to a library looking for a particular item, the question which arises first of all, whether an entry for that item is available in the catalogue and secondly if an entry for the item is found, whether the item is available on the shelves. Finding an entry in the catalogue depends upon a large number of factors, including how familiar the users are with the use of the catalogue, how good the cataloguing is, and, very importantly, how many access points are provided in the catalogue.

Assuming that the entry is found, what is the probability that the patron will find a copy on the shelf? Duplication policy and the length of the loan period both affect the probability that the item will be on the shelf when it is needed. Assuming, that it is on the shelf depends on the persons ability to transcribe and/or remember call numbers, the number of shelf sequence in the library, the guidance of the shelves, whether material have been filed or shelved

accurately, and how much staff assistance is available. Security factors also affect the probability, that is the extent of theft.

The whole services of factors which affect this probability may be, some of these factors are collection factors, relating to the quality of collection; some are catalogue factors, relating to the quality of cataloguing and the patrons ability to use the catalogue; while others are related to document delivery capability, based upon duplication policy, loan period and security.64

Collection evaluation is another aspect of the total evaluation problem. The emphasis on methods used to evaluate Library service and collection has changed considerably in last few years. The literature on evaluation of Library service, up to about 10 years ago, reveals that collection evaluation used to be, almost exclusively, an evaluation of a collection of the Library against some external standards. This external standard could be one or more outside specialists. A common technique to evaluate the collection of the

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Library against some external standards. This external standard could be one or more outside specialists. A common technique to evaluate the collection of the library was to call in one or more subject specialists who examined the collection and attempted, subjectively, to assess its adequacy. A somewhat less subjective method was using a standard list as the external standard instead of a subject specialist: a standard list of best books, a basic core collection for historical libraries, and undergraduate libraries, etc.

An improvement on this technique was the creation of specially prepared lists of titles for evaluation purposes. One of the best studies of this kind was done by Coale which was done over the collection of Newberry Library in Chicago in Latin American history, of the Colonial times. It involved evaluation against a list, but by the way he derived the list, he developed a technique which is potentially applicable to many other situations. He prepared a bibliography on the topic out of the recently published monographs discussing various aspects of the subject and used this bibliography as a check on the holdings of the Newberry Library.

Now more emphasis is given on evaluation of the collection in terms of the amount and type of use it receives, either by drawing a sample of the materials from the collection itself (a collection sample), and examining the data labels to find out which categories of materials are most used, or by taking a sampling in a particular time period and observing what kinds of materials are being borrowed over a particular period of time (a circulation sample or a check-out sample). Both techniques have value and applicability under certain circumstances.

The classic example of the collection sample, of course, is the fussier and Simon (1969) study at the University of Chicago. Examples of studies from circulation samples include the work of Trueswell (1966), Norse (1968) and Chen (1976), and Jain (1967, 1969), at Purdue, had a rather interesting technique in which he drew both a collection sample and a circulation sample and compared the two. The purpose of analysis of this kind is

(1) to improve selection of materials and

(2) to optimize space utilization. More specifically techniques of this kind can be used to identify portions of the collection that can be
considered to be most active, as well as portions of the collection, which can be retired to less accessible storage areas. 66

One of the limitations of any study of a collection, by any procedure is that collection evaluations generally tells us a lot about our success, but not much about our failures. Since we are likely to learn more from our failures than from our successes, document delivery tests, in one form or other are particularly important.

The document delivery test, originally devised for the National Library of Medicine for evaluation purposes, has turned out to be an useful tool in discriminating among the performance capabilities of various Libraries. When the test was applied to University medical Libraries in the United States, as one of the basis for evaluating the probability that these Libraries would be useful as regional medical Libraries, some Libraries scored in the 90s' meaning that there is 90 percent probability that the item wanted would be in the collection and on the shelf at

the time of need..., and some libraries scored as low as the 30's. Thus the test can be used to compare library performance because it is a standard which can be maintained from one library to another.

Another technique which studies the performance of the particular library has been used by Urgahant and Schofield and by Buckland at the University of Lancaster. This technique involves asking users during a specified period of time to complete failure slips and determine the reason for the failure at the time it occurs. From the failure slips, the staff may identify items that are not in the collection or, more importantly, items that are in the collection, and the location of these items when they are needed. Were these items out on loan, in the bindery, in use in the library, etc.?

This test is more difficult to administer than the document delivery test because it involves a high level of user cooperation on the other hand, one can reasonably argue that the document delivery test is an abstract situation because the underlaying

assumption in citation studies is that items cited in recent literature are items that are going to be most in demand by Library users.

Maurice Line in his study at Bath University Library attempted to study the ability of Bath University Library to satisfy what he described as the "latent needs" of the users rather than simply their demands.

Factual reference service is another area which can benefit from evaluation. Reasonable evaluation of the success of Libraries in providing reference service, that is, in answering quick reference enquiries, is quite new. Before six or seven years ago, the most work that was done to evaluate reference service was to count the number of reference requests, and not all Libraries had good statistics on the number of requests they were handling.

One technique used by Institute for the Advancement of Medical Communication, as part of its evaluation on Medical Libraries, was to devise a set of factual test questions in medicine and to apply it

68. LINE (MB). The ability of a University Library to provide books wanted by researchers. Journal of Librarianship. 5; 1973; 37 - 51.
obtrusively to a group of libraries to assess the ability of the Library staff to answer these questions completely and accurately. This has the obvious disadvantage that the Library staff knows that they are being observed and, in some cases, this means that they perform better than they would normally; in other cases, performance may decline because of the pressure of the situation.

Another technique developed by Crowley and Childers (1971) in New Jersey in some University Library is to have a set of questions to which the answer is known, but to apply them unobtrusively by telephone, so the library does not know it is being evaluated. Their studies in New Jersey public libraries revealed an average success rate in answering questions completely and accurately in between 50 and 60 percent. A similar technique applied in the University of Minnesota Libraries came out with comparable results. The results suggest that when some one calls a Library looking for a piece of factual information, he has a 50 to 60 percent probability of receiving the correct answer. 69

Using this particular technique, we have evaluated the three different University Libraries in

69. LEIMKUBLER (FF), Unit-cost study of Library Operation a quantitative approach. In CHIH (Chew Ching), ed. Quantitative measurement and dynamic Library Service. 1978; Mansell; London. p 179 - 205.
Orissa. The following results are worth mentioning:

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Evaluation of Efficiency of University Libraries in Orissa

It is relatively easy to observe the cost and time factors of an information service, it is difficult to measure its quality and, consequently, the relationship between cost and quality (i.e. the cost-effectiveness of the service). Several measures of quality use is shown in table below. Completeness and accuracy of response are the major criteria by which the effectiveness of a reference service can be evaluated when a single factual answer is sought. But in the evaluation of literature searching, when there is no single correct answer, other measures of quality must be sought. Recall and precision are two such
measures. Whether the literature search is manual or mechanised, and whether the end results are actual documents or some form of document surrogate, its performance can be evaluated against some principal criteria. The result of any literature search can be depicted in a $2 \times 2$ table as illustrated below.

To clarify the table, consider a user coming to a library or other information centre to find bibliographic materials on a particular subject, general or specific. A finite number of items are 'relevant' to his information need; that is, where this library user to look at every item in the collection, he would consider relatively few (in relation to the total collection) relevant and the others (the great majority of the collection) not relevant to his information need.\(^\text{70}\)

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<td><strong>Not</strong></td>
<td>$c$</td>
<td>$d$</td>
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<tr>
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</tr>
<tr>
<td>CORRECTLY REJECTED</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$a + c$</td>
<td>$b + d$</td>
<td>$a + b + c + d$</td>
</tr>
<tr>
<td>Relevant</td>
<td></td>
<td></td>
<td><strong>Total Collection</strong></td>
</tr>
<tr>
<td>Total</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
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</table>

(a) Result of Literature Search

"Relevance" is a personal quality; that is, each user will have a different interpretation of what is and what is not "Relevant" to his information need. Here the assumption will be that the user is the sole judge of relevance decisions, and that the subject of relevance has generated a great deal of argument and literature reflecting this argument.

For the purposes of evaluation, the situation is complicated by a number of factors, the most important of which are.

1. That users have different "recall" requirements.

2. That in some cases, the information seeker will conduct his own search (e.g., in the Library catalogue or in one or more printed indexes) and in other cases, the search will be conducted for him by a Librarian or other information specialist.

The "Recall Ratio" of a search is the proportion of all relevant items in a particular collection or data-base that the search is able to retrieve. The recall ratio is expressed by the
fraction $a / (a + c)$. If a library holds 15 books on a particular subject, and the user finds 12 of these, but misses the other 3, the recall ratio of his search is $12/15$, or 80%.\textsuperscript{71}

When a reader requires a comprehensive search, recall is not the only criterion by which the results should be evaluated. Time and effort also are important considerations. If the user is prepared to work assiduously and long enough, he will find all relevant items in the "system" and will achieve 100% recall. The efficiency of a search regardless of the system used must therefore, be judged by the amount of effort expended and how long it takes to achieve a particular level of recall, whether be it three books or all of the relevant references in a particular index or machine-readable data base. It is in the measurement of time and effort that the delegated search (in which the user does not conduct his own search) differs most from the non-delegated search. In this situation, user effort may be equated directly with elapsed time. One method of measuring efficiency of a non-delegated search would be to divide the total searching time by

\textsuperscript{71} Op. cit. p 143.
the total number of relevant items discovered, thus producing unit cost (in time) per relevant item found. For example, if it takes the Library user 15 minutes to find three relevant books, the unit cost in time would be five minutes per item. In case of delegated search, conducted on behalf of the user, by the Librarian, the search can be evaluated at a latter time. Here a user cost (in time) can not be derived directly. Instead, the success of delegated search is measured in terms of the recall ratio, the response time (time elapsing between submission of the search request and receipt of the result), and undertake a comprehensive literature search in Chemical Abstract (CA) on a specific topic. The result of this search are presented to him a few days latter, either as a typed list of references or photo copies of abstracts appearing in CA - a total of 80 references. After examining the retrieved references, he judges 62 to be relevant to his information need and the remaining 24 not relevant, then the precision ratio is 62/86 or approximately 72%. The precision ratio, then is a valid measure of the performance of any type of delegated search in which the user submit a request to some "System" and awaits the results, whether the search is manual or mechanised.
The precision ratio is an indirect measure of user time and effort; that is, the higher the precision ratio (proportion of relevant items among the total retrieved), the less effort the user will need to expend in separating relevant items from those that are not relevant. In a search of very low precision ratio, in which say only 10 items among 80 retrieved are relevant, considerable user time and effort might be required to identify the relevance of results.

Relevance of search results required further explanation. When a delegated search is conducted the user may look upon the system as a "black box" in to which he places his request and out of which, eventually he receives a group of documents, or at least, reference to them. The amount of direct user effort is relatively minor; it consists of negotiating his requirement with the system (e.g. discussing his information need with a librarian). The user will judge the results of the search primarily by their relevance to his requirement and secondarily by how long it took to get the results. In the delegated search situation, it is customary and meaningful to express the relevance of results in terms of proportion of items (whether actual documents or reference to them) retrieved and delivered that the requester judges
relevant. The proportion frequently is referred to as a precision ratio. In the table (figure) above precision ratio is expressed as $a / (a + b)$.

Four performance criteria by which any type of literature search may be evaluated from the viewpoint of user satisfaction will be recall, precision, response time and user effort.

Recall: Important to all users of information services, who are seeking bibliographic materials on a particular subject. In some cases only a minimum level of recall is required and this is likely to be typical situation for a user consulting the Library catalogue. In some cases maximum recall is sought requiring a comprehensive search. Over and above recall refers to exhaustivity or comprehensive search strategy.

Precision: A meaningful measure of the performance of a delegated search conducted in any form of system, manual or mechanized. It is an indirect measure of user time and effort - not particularly appropriate in the evaluation of non-delegated searches. Precision refers to specificity of the literature search, the relevant items in a typed list, especially if this list contains only bibliographic
citations, and the user must retrieve copies of many of the documents before he can decide which are and which are not relevant. 72

The precision ratio is not meaningful when applied to the non-delegated search. Here, the user conducts his own search and makes relevance decision continually as he proceeds; that is, when he consults a subject heading in a catalogue or printed index, he rejects irrelevant citations and records only those that are relevant. A precision ratio could be derived from this type of search by counting the total number of citations the user consulted in the catalogue or index and the number he judged relevant; the precision ratio being, number of relevant citations found/total number of citations consulted. This is rather artificial measurement however, because user effort is the non-delegated search situation can be measured more directly by the time required to conduct the search and, from this, determining the unit cost (in time) per relevant item found. The higher the precision of a non-delegated search the less time it will take, all other things being equal.

Users' effort: In a non-delegated search, effort is measured by the amount of time the user spends conducting the search. In a delegated search, it is measured by the amount of time he will need, when the search results are delivered to him, to separate the relevant items from those that are not relevant (which is directly influenced by the precision ratio).

Response Time: In a delegated search, this represents the elapsed time between submission of a request by the user and his receipt of the search results. In a non-delegated situation, it represents the time involved in the actual conduct of the search; in this case, it also is a measure of user effort.

Two other performance criteria like, coverage and form of output are also applied in the evaluation of information retrieval system. Coverage is an extension of recall; it is expressed in terms of how much literature coverage is provided on a specific subject by a particular collection. Form of output is the form in which the results of a search are presented to a user, which could be the actual documents or abstracts, full bibliographic citations, titles or other forms of these items. This is not a performance measure that is quantifiable but it is
certainly a factor affecting user satisfaction. The form in which bibliographic information is presented is especially important to the user in judging the relevance of particular items to his information need.

Response time: (How long the user must wait to obtain the results of the search) is easily recorded. The major problem in evaluating any type of literature search is the estimation of recall but this is important only when the user requires a comprehensive search. There are a number of ways in which recall can be estimated.

Perhaps the most viable technique in the typical library situation is to compare the actual search against one or more searches conducted solely for the purpose of evaluation. Suppose that a particular literature search conducted for a library user is to be evaluated. When the search has been completed, and the results are presented to the requester, he is asked to cooperate in the evaluation of the search. First he is asked to examine the citations delivered and to assess their relevance. This provides a precision ratio for the search. Next, the written statement of the user's information need (it is always desirable to have this in the user's own words) is given to one or two
additional members of the library staff, and they are asked to conduct a literature search; any new citations (i.e. those not listed in the original results) are identified and submitted to the requester for assessment of the relevance. Using this technique, an estimated recall ratio for the original search can be developed as follows:

Recall ratio of search A = \frac{\text{Number of relevant items found by searcher A}}{\text{Total number of unique relevant items found by A, B & C combined}}

Note that the results of the second and third searches are not being evaluated, but are merely being used as a means for estimating the performance of the first search. 73

(b) Sample Study:

A sample study leading to the evaluation of a literature search was conducted at the Sambalpur University. The bibliographies were prepared for the research scholars and teachers working in various post-graduate teaching departments, as per the titles

of their Ph.D. theses. The literature search was made out of the collection of the Central Library, Sambalpur University. After supplying them the typed copies of the bibliographies, the research scholars were asked to evaluate their bibliographies leading to relevance of their need. It was estimated that the precision ratio leading to relevance of the search was over 65% of the total search.

(c) Evaluation & Measurement of Library Collection

Quantitative

1. Absolute size of collection

2. Size of collection by various methods of categorization (e.g., subject area, date, language, type of material)

3. Current growth rate

4. Size in relation to other variables, including number of volumes per capita and number of volumes per item circulated.

5. Expenditures on the collection, including per capita expenditure and expenditure on the collection in relation to the total budget.
Qualitative

1. Impressonistic (Subjective) methods

2. Evaluation against standard list or holdings of other institutions.

Use factor

1. Amount of collection use as reflected in statistics of circulation and in Library use.

66 MEASURING THE PERFORMANCE

The performances of any Library and Information Services can be measured or evaluated from several possible viewpoints.

(1) How well the service is satisfying its objectives, which usually means how well it is satisfying the demands placed upon it. This is an evaluation of the effectiveness of the service.

(2) How efficiently (in terms of costs) it is satisfying its objectives. This is cost-effectiveness evaluation.
(3) Whether the service justifies its existence (i.e., the worth of the service). Keeping the service as constant, it suggests to find out alternative methods to justify the costs (in put) of a library.

In addition to the above considerations the efficiency of the Library services can be viewed as:

1. The ability of the Library to deliver a particular item when it is needed.

2. The ability of the catalogue and the shelf arrangement to disclose the holdings of particular items or of materials on particular subjects.

3. The ability of reference staff to answer questions completely and accurately.

4. The speed with which a particular item can be located when needed.

5. The speed with which a reference enquiry can be answered or a literature search conducted and the results presented to the Library user.
6. The amount of effort that the user must himself expend in exploiting the services of the library (including factors of physical accessibility of the library and its collections, the size and the quality of the library staff and the ways in which the collections are catalogued, indexed and shelved.

The above measures bear a similarity to the performance criteria for an information retrieval system. Information services, like most other services, generally will be evaluated in terms of time, cost, and quality factors. "Cost" does not necessarily mean monetary cost; although, if the information service does change it, users directly, the actual cost of the service will be an important characteristic by which the service will be judged. In cases where no direct charge is made for service, other types of "cost" factors still are important. One of these, is the amount of effort a user must expand (a) in using the system (and in learning how to use it) (b) in interpreting the form of output provided by the system (some forms will require more effort than others especially in trying to identify the documents that are
actually relevant in lists of document representations
delivered by the system) and (c) in obtaining the actual
documents referred to by the system.74

The work that has been done in the last ten years illustrate two things rather clearly. First, evaluation of Library service has tended to indicate that Librarians have been or are some what complacent about their services are much better than they really are. There is a strong tendency for Librarians to assume that their services are much better than they really are. When they are exposed to reasonably objective evaluation procedures, the results show that if a student or faculty member walks in to a major University Library there is only a 40 percent probability of finding needed items on the shelf. Secondly, we must keep in mind the concept of 90 percent Library. As long as resources are limited, we can not continue to say we are trying to serve everyone. We must identify a homogeneous group of interests that can be satisfied reasonably and efficiently with the resources available. As per the saying of Lancaster and McCut Cheon. "You can serve some of the people all of the time and all of the people some of the time but you cannot serve all the people all of time. However for

measuring the performance of University Library services, leading to operational efficiency, operational effectiveness, Library efficiency, Library effectiveness, Library cost-effectiveness and cost-benefit analysis, an operational efficiency measurement model has been developed as shown in Appendix B, Fig. 12.

**651 MEASUREMENT OF USERS SATISFACTION: A SAMPLE STUDY**

A study measuring the users satisfaction over the important services offered by the central Library, Sambalpur University was undertaken as a sample study. The services evaluated the document acquisition policy, document delivery service, technical processing of documents, information and documentation service, and the delegated search offered by the Library staff. The users community included only the faculty members of the post graduate teaching departments.

The criteria that can be applied to the evaluation of the public services of the library, eventually have to be related in some way to users satisfaction: that is we have to have some measure of the extent to which the user demands or needs are satisfied.
A methodology for decomposing the unit cost with a view to enhancing the decision making process within the University Library is presented in this chapter. The approach is based on Lancaster's ideas. Lancaster's ideas and concepts are the basic foundations to the Library professionals. His approach has the advantage of enabling the decomposition of aggregate effects on financial measures into satisfactory effects. The purpose of this analysis is to establish, through a network of relative changes in the variables concerned, cause and effect relationships between inputs expressed in either physical or financial terms, on the one hand, and performance criteria, on the other.

(A) Testing of Hypothesis

A model leading to the measurement of users satisfaction over the services offered by the Central Library, Sambalpur University, has been developed over an Analysis of Variance, a quantitative statistical model.

(B) Analysis of Variance

The analysis of variance is a powerful statistical tool for tests of significance. The test of significance based on distribution is an adequate
procedure for testing the significance of the difference between the two sample means. In a situation when we have three or more samples to consider at a time an alternative technique is needed for testing the hypothesis that all the samples are drawn from the same population i.e. they have the same mean. This technique is known as "Analysis of Variance". Thus the basic purpose of the analysis of variance is to test the homogeneity of several means. There are techniques dealing with one-way, two-way ..........k-way analysis of variance depending upon the number of characteristics to which the data is associated.

Here we are interested in the measurement of users satisfaction over the services offered by Central Library, Sambalpur University, for which one-way analysis of variance is essential due to presence of one characteristic only. Under this technique it is revealed that there is a significant difference in respect of different aspects of services offered by the Central Library, Sambalpur University as regards to the users satisfaction.
(C) Measuring users satisfaction over the services offered by the Central Library, Sambalpur University.

Aspects of the Services

1. Document acquisition service (Strength of the Collection)

2. Document processing and House keeping Service

3. Document delivery service (Loan service)

4. Reading facility (Both text & Reference Section)

5. Information & Documentation Service

6. Personal attention paid by the Library Staff (delegated search).

Scale used (order of decreasing intensity)

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### Aspects of Services

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(E) Table (Questionnaire)

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<th>Sl. No.</th>
<th>Source</th>
<th>Sums of Degree of freedom</th>
<th>Mean square A/B</th>
<th>F</th>
<th>F* (5.114)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Between aspects of questionnaire</td>
<td>14.55</td>
<td>5</td>
<td>2.93(A)</td>
<td>7.91</td>
</tr>
<tr>
<td>2</td>
<td>Error</td>
<td>42.34</td>
<td>114</td>
<td>0.37(B)</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>56.99</td>
<td>119</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Aspects of questionnaire

1 2 3 4 5 6

Please use the scale

(F) Summary of Analysis of Variance Table
Note:

\[ F \] - Ratio of variances
\[ F^* \] - Value taken from the table for the purpose of comparison of aspects.

Since \( F > F^* \) the observed value of \( F \) is significant and hence the data indicates that there is a significant difference between the services offered by the Library as regards to the users satisfaction.

(G) Analysis

1. Opinion reveals that the users are partially satisfied over the strength of the book collection of the Library in their respective subject fields.

2. The users are not satisfied with the documents processing and house-keeping services of the Library.

3. Further it shows that the users are partially satisfied with the document delivery service of the Library.
The users are not satisfied over the reading facility offered by the Library in its reading rooms.

The users trend reveals that the reference and documentation service provided by the Library are not satisfactory.

Further it shows the personal attention (i.e. delegated search) provided by the Library is more or less satisfactory.
Fig. 8  Cost and benefit of book use: acquisition cost included in variable cost.
Fig. 9. Cost and benefit of book use: acquisition cost included in the fixed cost.
Fig. 10. Behavior of cost and benefit over time
Fig. 12. Cost-benefit operation of University Library: an operational efficiency measurement Model.