

EDITORIAL

Library Statistics to Enjoy – Measuring Success!

John Sumsion, Guest Editor

I am enormously grateful to the *IFLA Journal* Editorial Board for this opportunity to guest edit a number devoted to Library Statistics - partly because there is at present much activity in this corner of the library world, and partly to demonstrate the potential for library statistics to reveal and confirm the outstanding value that libraries provide. Hidden revelations always lie around the next corner - bringing to light the success stories and surprise information developments for which the profession is, or should be, praised and rewarded. It is my contention that greater knowledge and communication of statistics about libraries can raise their profile and allow us 'to blow our trumpets' of success. From time to time the library success story needs to be sounded abroad to balance out the all too common descriptions of seemingly intractable problems and future uncertainties!

The Nature and Scope of Library Statistics

The potential audience for library statistics is wide:-

- funders
- managers
- library staff
- partners
- users and user groups
- interested parties (including politicians, political economists, journalists).

Where statistics are aimed at policy makers, managers and funders, they are essential for decisions on levels of service and future strategic planning. They are also important in generating *confidence* in library staff that they are delivering good value for money and services well taken up by their users.

For each according to their need: here are the principal Types of Statistics - the main components of the Statistics menu.

- medium term and strategic planning
- time series
- standards related
- comparative with others
- operational, e.g. statistics of use to get the right product on offer = stock selection/stock management.

In an ideal world this is the model to determine the quality of statistics produced. These are the prerequisites for the 'Creative Use of Statistics': -

- definitions: defined and consistent
- responses complete
- careful accurate data collection
- ratios for performance
- trend data over several years
- individual and library sector analysis
- meaningful and dramatic presentation.

It is common for statistical series to concentrate on basic data and to leave the analysis, interpretation and policy questions to others. This is a valid approach - since it is already no mean task to achieve the goals of accuracy, consistency, validity, completeness and timeliness in the basic compilation work. A primary aim is to get statistics out promptly. Their 'sell by' date comes all too soon, so speed and the series are more urgent than the elegance of particular releases and their interpretation.

Nothing in this world is perfect - even less in statistics than in other disciplines. 'Garbage in garbage out' is as true here as elsewhere. So the quality of national statistics depends directly on the quality of statistics provided by contributing institutions and on careful editing

to detect errors and obvious misunderstandings. But there are some points of reassurance:

- many errors and shortcomings are of the sort that will tend to cancel each other out in totals and averages
- comparisons with previous years and 'per capita' calculations can often pinpoint 'wrong' data to be edited or investigated
- sometimes negative effects can be established even if positive data is missing: for example, we may not know the costs or use of networked electronic material, but we can still quantify the continuing and perhaps declining use of hard copy journals and monographs
- consistency may be more important than absolute accuracy: data that is consistently wrong or incomplete from year to year will not invalidate the trends shown.

In general - as any accountant will confirm - there is more reliability in the averages and large numbers produced by national statistics than can be expected when comparing their component parts.

Since statistics are by nature historical, they cannot keep pace with developments at the research frontier. However, they can measure the speed with which new services are taken up.

Then there is the rather obvious fact that, in many instances, local statistics are more meaningful and stimulating than national. To discover that, for example, Staines (a local authority in the United Kingdom) was under-resourced relative to other parts of Surrey (the larger county area in which Staines is situated), and then to get that put right, is more directly satisfying than study of national trends. To argue for a new and differently configured library building on the base of statistical analysis - and then to

see it built - can be even more exciting.

The Contents of this Issue Introduced

The contents of this issue of the *IFLA Journal* are designed to show the variety of library statistics and to illustrate the most significant trends of the last decade. There is currently much international activity and change in the statistics field. Some movement that is not covered in the articles is reviewed briefly later in this Editorial.

The first article, *Web Based Collection of Public Libraries Statistics*, describes in some technical detail the Canadian web site of British Columbia Public Libraries. Their whole collection of library statistics is now publicly and promptly available on the web - together with facilities for the user to download the results of specific queries over more than one year. Such pioneering - paralleled for academic libraries in the ARL article that comes later - is likely to become common practice in the years ahead. Its importance cannot be too highly assessed; the extent of their data processing ingenuity 'behind the scenes' is impressive. In other instances (CAUL in Australia; CIPFA in the United Kingdom, etc.) statistics can be downloaded from the web in Excel or similar formats - easier to produce but less friendly for the average manager to read and appreciate.

The second article, *Library Statistics and Marketing*, gives examples of the developing focus that libraries place in their impact on the user. Analysis of the user community by age, gender, socio-economic status, employment, geography, educational background, and race all demonstrate the wide appeal of libraries - whose impact extends across the boundaries of education, training, culture and leisure activity. Typically such information is collected from sample surveys - some of them on a substantial scale. These surveys focus at present on traditional services: in

future they will measure changed patterns of use in the context of fundamental changes in the structure of the publishing and information business world. How far new media will supplant traditional, and how far they will promote and extend traditional use, are as yet open questions. The focus in this paper is on developments in reporting the UK public library scene that have, until now, had little international publicity.

In the next contribution, *Measuring the Added Value of Library and Information Services: The New Zealand Approach*, we move from relatively safe ground to a bold and speculative use of statistics in New Zealand - to assess in *monetary terms the value of library services* delivered. This is innovative methodology which concentrates on the essential feature of the library business - how much more economic it is to provide communally what would otherwise cost unaffordable amounts if supplied privately through commercial markets. Ruth MacEachern's contribution should kick-start a lively debate on economic issues too frequently ignored in the interest of respectable conformity! While the main purpose of this work is to postulate value estimates, an incidental by-product is to clarify - through the statistical tables produced - the operational differences between academic, public and special libraries.

Stephen Bensman's exposition of, and commentary on, *Bradford's Law and Fuzzy Sets: Statistical Implications for Library Analyses* will meet readers' needs in several ways. You may be unfamiliar with the classic texts of Bradford, Zadeh and Pearson: you may not have kept up to date with developments in this area where mathematics, philosophy and information science overlap. You may be unaware of the philosophical concepts underlying the common statistical phenomenon of 'outliers', where 'fuzzy sets' or 'overlapping sets' move from the straightforward theories of classification into the real world of untidy divisions. You may not appreciate

the links between philosophers (Aristotle included!) and surveys of periodical use. You will be much the wiser after a second reading of this learned and expert paper.

Having moved firmly into the academic library sector, Maurice Line's article *The Use of Citation and Other Statistics in Stock Management* starts by asking the question how useful citation statistics are in practice and then progresses to review the adequacy of various statistical measures in serials management. Maurice is as well placed as anyone in the IFLA world to review the past decades. But both here, and in his book review, the analysis is central to what is now the major concern in the academic library world - how to measure and manage the transition to electronic and networked resources. To understand the complex options now available for document access is the essential prerequisite to finding measures for those options that become most widely used.

Still in higher education libraries, Roswitha Poll describes succinctly the latest developments in *The New German National Statistics for Academic Libraries*. She includes some reference to the current revision of the International Standard, which she is leading. She also presents of a set of performance indicators - the latest contribution in the quest for a short set of ten to do the work of 100!

Martha Kyriallidou's *To Describe and Measure the Performance of North American Research Libraries* describes both the historical background to the Association of Research Libraries (ARL)'s statistics and also an explanation of the splendidly developed ARL interactive web site. This is the university library parallel to the British Columbia public library web site with which we began. Both are likely to be the model for all library statistics in future. With all the detail available for inspection, and software to select what is pertinent to the particular enquiry, we really are promised the best of all worlds!

Finally, in *LibQUAL+: Service Quality Assessment in Research Libraries*, a team from Texas A & M University outline the statistical background to their development of *LibQUAL+*, derived from SERVQUAL methodology. This is the latest and most refined use of statistics to measure the quality of library services. Returning to marketing considerations, its central feature is to relate performance perceived by the user to users' expectations. This is a base for much further research and development in years to come. How far do users' perceptions of the service correspond with its intrinsic quality? How well do libraries succeed in raising the expectations of their clientele? Does a more discriminating clientele mean lower quality performance scores? There is much mileage left to explore on the quality front!

Other Developments

Many current trends, but not all, are referred to in the above mentioned articles. Here are a few other developments that call for brief reference.

Revision of ISO 2789 'International Library Statistics'

The present standard dates from 1991. A Working Group has been engaged on the latest revision since 1998. The new revised Draft Standard now awaits the final voting stage. It is available through national committees in membership of ISO TC46/SC8.

A number of objectives have been met in the revision:

- integration and definitions of electronic resources and services, with an annex on the difficult area of measuring electronic use
- recognizing the validity of statistics derived from sampling procedures
- encouragement of 'good practice' included as an objective
- defining statistics required for ISO 11620 'Performance Measurement'

- separation of Special Libraries into categories: government, health service/medical, professional institutions/associations, industry and commerce, the media, regional libraries, and others
- statistics of space and facilities
- statistics of catalogue records, open access, and OPAC provision
- new definitions for Loans and In-Library Use
- an Annex of optional categories - mostly applicable to only one or two library sectors
- methodology for 'Grossing Up' to deal with missing data in global estimates.

There are many other extensions and revisions included in what has turned out to be a major revision exercise. It will take some time for new definitions to work their way into national and other statistical series.

LIBECON

The other major development in international library statistics is the initiative of the European Community to collect and publish statistics for all countries in (and associated with) the European Union. Its scope and plans were comprehensively described last year by David Fuegi in *IFLA Journal* (2000) 26 (2) p. 112-114.

Since then a large scale summary of the position and trends in recent years has been published on the web as *LIBECON2000 Library Economics in Europe: Millennium Study*. Trend data for the years 1992-98 was presented and analysed. Data was surprisingly complete for the Higher Education, Public Library and National Library sectors. Returns were quite incomplete for Schools Libraries and for Special Libraries, although the new sub-divisions of Special Libraries (mentioned above) had an encouraging first outing.

Several variables were introduced to the survey that were new to international statistics:

- workstations for users

- percentage of stock on open access
- percentage of catalogue records automated
- sector population to be served
- costs of electronic information resources
- costs of automation.

While these had only a limited response, more complete data on such items can be anticipated in future.

Not surprisingly the comparison of financial data presents particular problems of currency conversion and living standards. The report explores various analytical ratios such as the proportion of Gross National Product spent on libraries and the relationship of librarians' salary levels with average national earnings. The report is valid not only for its national comparisons and trend data but also for its comprehensive treatment of the statistical data and methodology problems encountered. In some places overall estimates are, as yet, made on the basis of inadequate responses - but these cases are transparent to the reader.

The data collected in LIBECON is vastly more extensive than the traditional *UNESCO Library Statistics*, and it is likely that they will increasingly take over the UNESCO role. Current plans (to be detailed at the 4th. International Northumbria Performance Measurement Conference at Pittsburgh, 12-16 August 2001) include the continuation of the series and extension of data to cover the remaining OECD countries, Australia, Canada, Japan, Korea, Mexico, New Zealand, Turkey, the Russian Federation and the USA.

Important objectives are to encourage better forms of collating statistical information; to create a virtual community of those who create and use library statistics - in Europe and associated countries; to reduce their isolation; and to improve access to their data. The project has already raised the awareness of library statistics - particularly in smaller countries.

Performance Indicators: Electronic Resources

In recent years these two topics have tended to monopolize the attention of library professionals in this measurement field. They are not centre stage here - for the simple reason that the professional and academic press is already full to bursting with these concerns.

Performance indicators can be said to represent the meal, where library statistics provide the menu! In simple terms 'performance indicators' are the ratio between two sets of statistics - most typically the ratio of use to the population to be served. Soundly compiled statistical data are essential for useful performance indicators: novel statistics can turn into valuable measures of performance. What matters for both is that they are not restricted to traditional measures but extend into a wider and contemporary arena. The papers in this issue show that this is indeed happening.

Measuring expenditure on electronic resources is fairly straightforward: measuring their use is highly

complex - partly because means of user access are still evolving. Libraries in the past have acquired physical objects that contained, and limited, the access to intellectual property. The removal of the physical object from the networked electronic chain alters both the counting procedures and the economic transaction features. Instead of libraries providing the data, database suppliers now control much of the data - which can, potentially, be used to charge by volume of use rather than by right of access. While the scene shows great activity and innovation, the outcome is still uncertain.

It would, however, be quite wrong at this stage to discard the statistics of traditional library services. Without them we shall not know the extent to which the new media have taken over - or have possibly stimulated an increase in use and interest overall.

Simple Presentations

Statistics can all too easily put off the reader through their complexity and thickness. This is a danger with

Excel and 'pdf' files just as much as with print. In several countries simple short pocket size sets of Statistics about Libraries are now circulating. In the UK *The L.I.S.T.* is widely circulated and is sent annually to every member of the professional associations. It is commended as a simple way to inform both the profession and the public about library features - and is, of course, also available on the web!

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Web-Based Collection of Public Libraries Statistics

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Introduction

The Library Services Branch of the provincial Ministry of Municipal Affairs of British Columbia is the agency responsible for administration of the *Library Act* and for promoting the improvement and extension of free public library service for all British Columbians. The Branch provides leadership and support to seventy public library authorities through a variety of programs and services. These include conditional grant programs, advice and training for librarians and boards, support for the provincial interlibrary loan network, and production and distribution of audio books for persons with disabilities.



The Branch is also responsible for the annual collection and publication of statistics summarizing the activities of the province's 229 public library outlets. British Columbia's public libraries obtain about 80 percent of their annual (1999) CAD 133 million funding from local governments. *British Columbia Public Libraries Statistics* are an important accountability, planning and performance measurement tool for library trustees, library staff and local government officials. They allow detailed comparisons to be made between peer organizations as part of the budget building and approval process.



The Province of British Columbia has published annual basic financial and circulation statistics since 1928, as the *Report of the Public Library Commission* from 1928 to 1965, and as *British Columbia Public Libraries Statistics* since 1966. Collection and publication of the province's public library statistics requires considerable staff effort and financial commitment. The number of public library organizations surveyed has increased from thirty-four in 1928 to seventy in 1999, and the number of statistics reported has risen from seven to sixty-seven over the same period. Introduction of computerized tabulation in the early 1980s spurred a rapid increase in the number of statistics collected.

Until 1996 libraries completed a paper-based survey which was manually verified and tabulated by Library Services Branch staff and then processed to produce the printed report. By 1997 the Library Services Branch had a web presence and public libraries were connected to the Internet and a web-based survey instrument was introduced, replacing the paper-based survey. While web deployment required a significant development effort, the migration has facilitated more accurate and complete data collection and supported more efficient tabulation of the data, permitting faster publication of the annual statistics.

A simple web-hosted reporting tool was created in 1998 to provide ad-hoc reporting on raw data collected through the web-enabled survey (<http://www.bcpl.gov.bc.ca/Annual-Report/>). More recently, the statistics have been published on the World Wide Web. *British Columbia Public Libraries Statistics 1999* may be found at: http://www.marh.gov.bc.ca/LIBRARY/STATISTICS/bcplstats_1999.pdf.

The Paper-Based Process

In the early days of British Columbia libraries' annual reports there were only a handful of libraries and a small number of statistics that were collected and tabulated. In 1928, reporting was confined to:

- total income
- expenditures - books and periodicals
- expenditures - salaries, library service
- expenditures - other
- number of volumes
- number of borrowers
- circulation.

Over time the scope and detail of the statistics collected has increased, with a proportional increase in the collection and publication effort.

The tabulation has been assisted by spreadsheet, database and word processing technology of the personal computer revolution. Even so, the basic steps of the original paper-based process have remained the same:

- design and prepare survey form and completion instructions
- mail survey forms and completion instructions to responding libraries
- responding libraries collate information, complete and return survey forms
- review and verify completed forms
- resolve problems with survey respondent
- enter data into a paper table, spreadsheet or database
- calculate derived quantities

- type, typeset or word processing activity to prepare print copy from tables
- proof and correct copy
- print and distribute *British Columbia Public Libraries Statistics*.

This process was time-consuming and error-prone, requiring tedious manual checking of work. The most concentrated annual effort was required after the completion of forms, with attendant delays in the publication. Much staff effort was expended in learning to use the current generations of spreadsheet and word processing systems. Once editorial copy was ready, additional unpredictable delays of up to six weeks could be incurred before printing. The value of the report to participating libraries was maximized when it was available for consideration at the start of the next budget cycle, increasing the pressure for quick publication.

The Web-Based Process

Internet access among British Columbian public libraries expanded rapidly in the mid-1990s, assisted by funding from both the federal and provincial governments. When the Branch established a web-presence in late 1997, it became possible to replace the paper-based annual survey form with a web-based online survey with assurance that it would be accessible by all public libraries.

The web-based survey for 1997 was mounted during the months of May and June 1998. Timing was important - some libraries wished to complete the annual survey as soon as possible, while others relied on financial reports only available in late May or June. All libraries wanted publication to take place as soon as possible once the filing deadline had passed.

The business motivation for web-enabling the survey collection was to eliminate some of the labour intensive steps that have been identified and to reduce the time

between data collection and publication. Nevertheless, the new web-based publication process still includes a formidable number of steps:

- design and prepare survey form and completion instructions
- deploy survey form and database to web site and open survey web site
- notify responding libraries of web site address and sign on procedures
- responding libraries collate information, complete online survey forms
- provide call centre assistance as required
- ensure all responding libraries have completed the survey
- close survey web site (30th June, 2000 for 1999 statistics)
- minimal review of data
- transfer data from database to spreadsheet
- publish preliminary data in spreadsheet on the web (9th July, 2000 for 1999 statistics)
- check calculation of derived quantities
- format spreadsheet report views
- integrate spreadsheet reports into a camera ready document
- proof and correct copy
- produce web publishable version of *British Columbia Public Libraries Statistics* (15th September, 2000 for 1999 statistics)
- print and distribute *British Columbia Public Libraries Statistics* (15th September, 2000 for 1999 statistics).

Some of these steps have direct equivalents in the paper-based process. Others are entirely new, and most have changed to some degree. The staff effort is distributed differently among the steps. In the web survey there is greater weighting prior to survey collection, but the post-survey processing for publication is less onerous. Because of staffing changes, we do not have accurate figures to support a quantitative comparison. However, the statistics can now be processed and published in about fifty staff hours - with an elapsed time of about two weeks, plus an additional month for distribution of the printed version

Web-Based Survey for 1997 to 1999

The Library Services Branch assigned an individual login and password to a designated individual from each public library. Once online, this person was presented with a menu of web links to eight general categories of forms to be completed and to those already completed. Each form was designed to provide the data for the corresponding page of the publication, e.g. Income, Expenditure, etc. Completed forms could be visited for revision. The survey web site was opened for a limited period of about two months, ending in June following the 31 December fiscal year end.

The web survey was hosted on a Unix system, using the Netscape Enterprise Server. Web pages used server side scripting (Netscape's LiveWire) and client side scripting (JavaScript). The database was Informix Personal Database Server. Server side scripting is a web methodology to provide content to a web page at the time that it is sent to a web browser. Client side scripting is a web methodology to provide limited content or behavior to a web page while it is being displayed in a web browser.

The survey forms were designed to provide a certain amount of feedback and previous related data, in order to minimize data entry blunders. Web hypertext links were provided to definitions and clarifying statements for each question. The forms were customized for each library to display the corresponding answers for the previous reporting period. The forms also displayed some data provided by Library Services Branch, such as population estimates and provincial grant amounts. The forms contained client side scripting to perform simple validation and some calculations. Totals and some derived (e.g. per capita) quantities were calculat-

ed in the form. Only fully-completed forms could be saved by the respondent library.

Data entered on saved forms were stored in an Unix hosted SQL database (ANSI/ISO SQL92, ISO/IEC 9075:1992(E) Information Technology - Database Languages - SQL. (580 pages) ANSI X3.135-1992 American National Standard Database Language SQL), from which values were extracted if a form was visited for revision. Each form's data were stored in a separate table, one row for each library for each year. Certain data, such as library name or population served, common to each form, were duplicated in each of these tables.

A management report was used to identify libraries that had not completed all or part of the survey, and they were contacted by telephone during the week prior to the survey closing date

After the site was closed the survey results were exported from the SQL database and imported into a Microsoft Access database. Library records were filtered and sorted into the various reporting groups, and then cut and pasted into Microsoft Excel spreadsheets for calculation and printing.

1997 to 1999 Survey Publication

The annual statistics for 1997 and 1998 were published only in paper. A web-hosted reporting tool (<http://www.bcpl.gov.bc.ca/Annual-Report/>) created in 1998, and made raw data available online for 1996 and later years. As the web-based annual survey calculates some selected performance measures, these are also available via this ad-hoc query tool. The interface supports selection of a set of statistics from a single form of the web-based survey (corresponding to one database table). The statistics may be chosen for multiple years and libraries (Figure 1). The selection of multiple statistics and reporting format follow (Figure 2). The generated report is in either text or HTML table format (Figures 3, 4). The text format is useful for import into a spreadsheet or database application.

Experimentally in 2000, the raw 1999 statistics were also published on the web in an Excel spreadsheet (http://www.marh.gov.bc.ca/LIBRARY/STATISTICS/1999_web_prelim.xls). The data were published in spreadsheet format as an interim

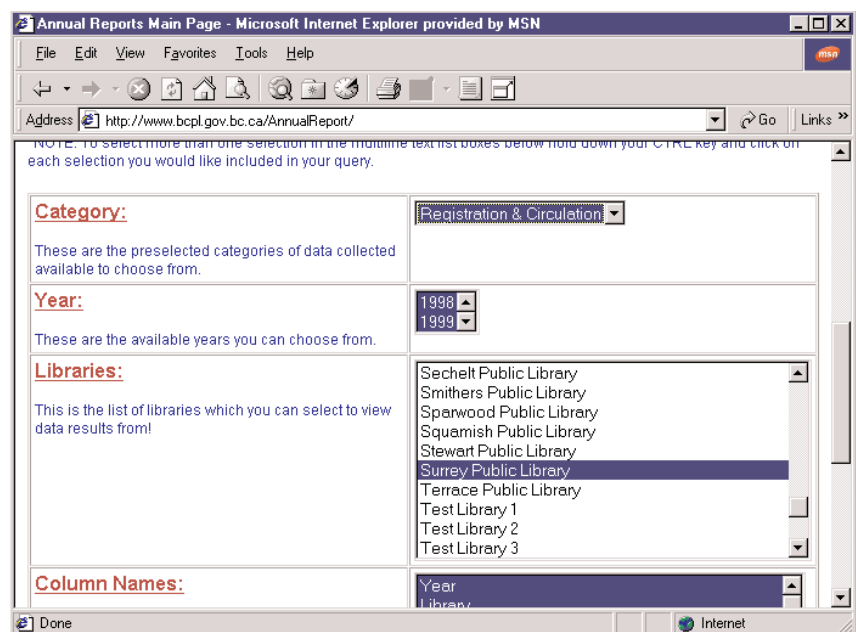


Figure 1. Selection of Category, Year(s) and Set of Libraries for Ad-Hoc Report.

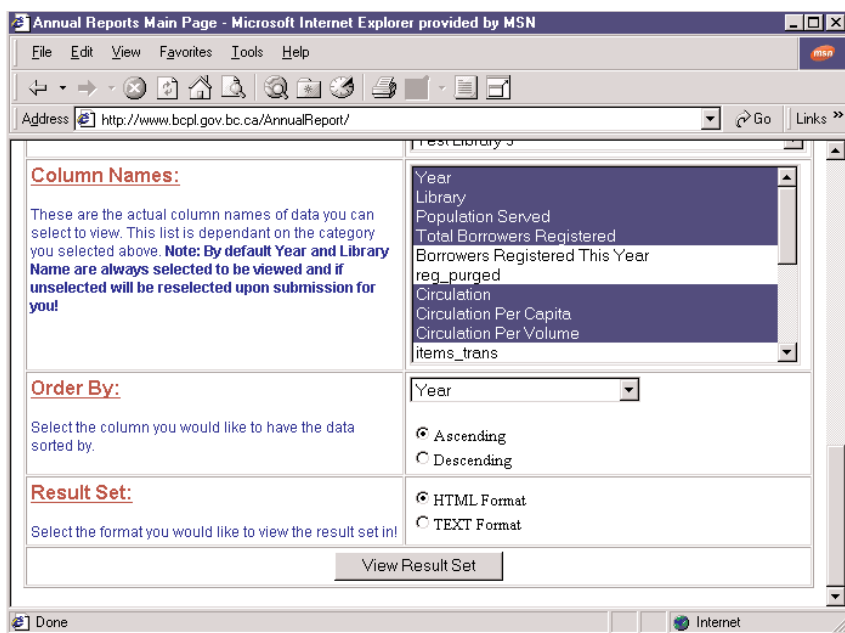


Figure 2. Selection of Statistics to Report, and Output Options.

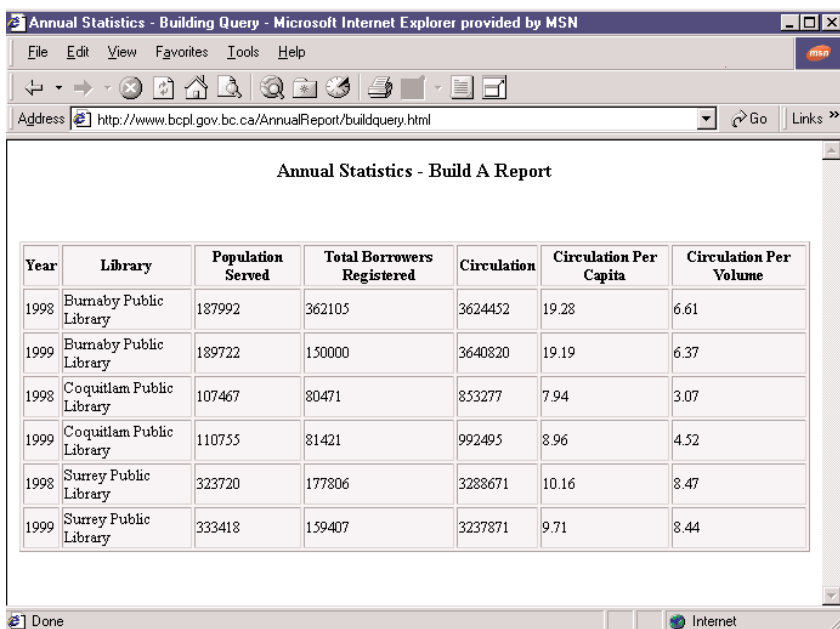


Figure 3. HTML Report for Selected Circulation Statistics for Three Libraries for Two Years.

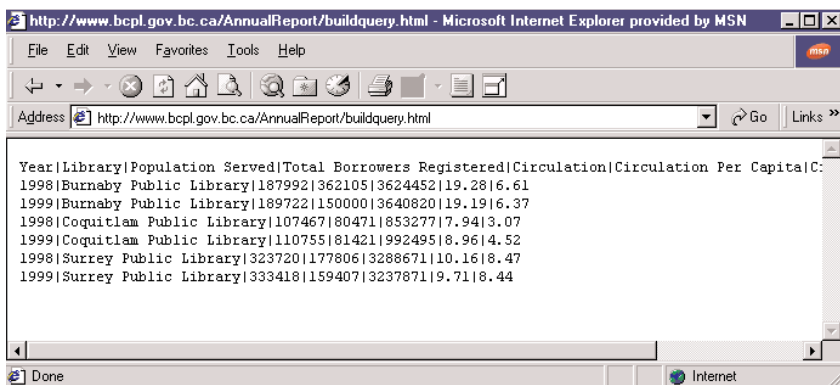


Figure 4. Text Report for Selected Circulation Statistics for Three Libraries for Two Years.

measure to provide early distribution of preliminary statistics. The latest edition of the Branch's published statistics, *British Columbia Public Libraries Statistics 1999*, was published on the web as a PDF file (http://www.marh.gov.bc.ca/LIBRARY/STATISTICS/bcplstats_1999.pdf), as an adjunct to the traditional limited distribution print version.

Web access statistics are displayed in Figure 5. The requests to display the Library Services Branch home page are shown for comparison. The spreadsheet and Adobe publication were each accompanied by an email message to chief librarians and library authority chairs. For the spreadsheet and Adobe reports the number of hits drops off exponentially, falling to half the initial peak value in about two weeks. The Adobe report has two later peaks each associated with external events: the first with a high profile opinion editorial about provincial funding for public libraries; the second with a provincial election call. It is clear that the ad-hoc report tool is little used, but the web statistics give little indication of the reason: promotion, usability, need, or some other factors. In future we could enhance the web-based ad-hoc reporting, or we could provide the raw data in an Excel spreadsheet, or both. Distributing the data via an Excel spreadsheet has the advantage of a neatly packaged distribution. The disadvantage is that we cannot be assured that our user community is skilled in the use of Excel. Over time, we anticipate increasing user sophistication, and will use download web statistics to determine which formats to support and enhance.

The mechanical steps of survey distribution, collection and publication consume less effort than prior to the web survey. A thorough review of the survey questions, instructions, and associated definitions, was undertaken between September 2000 to April 2001.

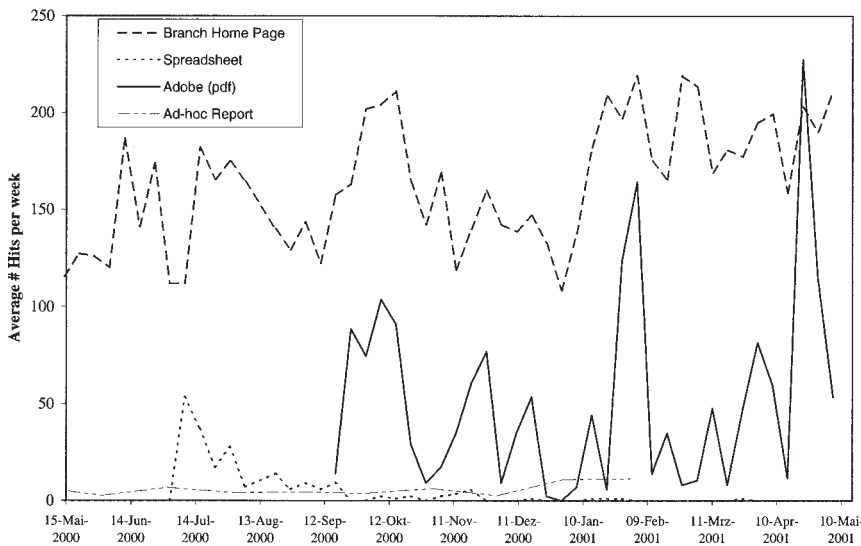


Figure 5. Weekly Web Requests for 1999 Statistics Pages.

Problems with the 1997 to 1999 Survey Web Site Design

There are several weaknesses in the web-based statistics collection system described above:

- storing client side calculations is an inherently poor design choice - the calculations have not been validated, and may have been completely disabled
- it is difficult to add, remove, or change questions from year to year
- the database table structure is difficult to change
- only relatively simple validation of entries is feasible
- a separate web page and dedicated database table is maintained for each form in the printed survey, complete with duplication of the logic to update the underlying SQL database
- derived field calculations on one form cannot depend on data entered on another form
- the survey presentation is difficult to evolve
- there is a strong coupling between the survey itself and its implementation - changes to one are hard to make without affecting the other.

Some Criteria for Improvements to the Survey Web Site Design

In 2000, the Branch began work on improving the annual survey web site in order to address some of the inherent problems of the original design, subject to the usual constraints:

- survey data must be collected in a consistent manner from year to year
- changing library technology requires the ability to continuously adapt and adjust survey subject areas and to refine questions and definitions.

The survey's implementation technology should support, not impede,

these requirements. For example, it should be possible to edit, add or delete survey questions without necessitating changes in web site design. Library Services Branch staff are making changes to address these issues. A comprehensive data model (Figure 6) has been developed and the survey's web pages adapted to implement it:

- a configurable set of entities, and their associated question wording
- a set of definitions, and their associations with entities
- addition and removal of entities over time
- evolution of questions (independently of the related entities)
- survey recreation for any previous year
- definition of calculated quantities (and support for both client and server side calculation)
- specification of database storage location (table, field) for each entity.

This survey configuration data comprises the administration side of the survey.

The 2000 Web-Based Survey

The data model was implemented in an administration database in Access and used to review and update the questions, instructions and definitions in use. The Access tables were then exported and loaded into the online database. All survey forms, and their questions,

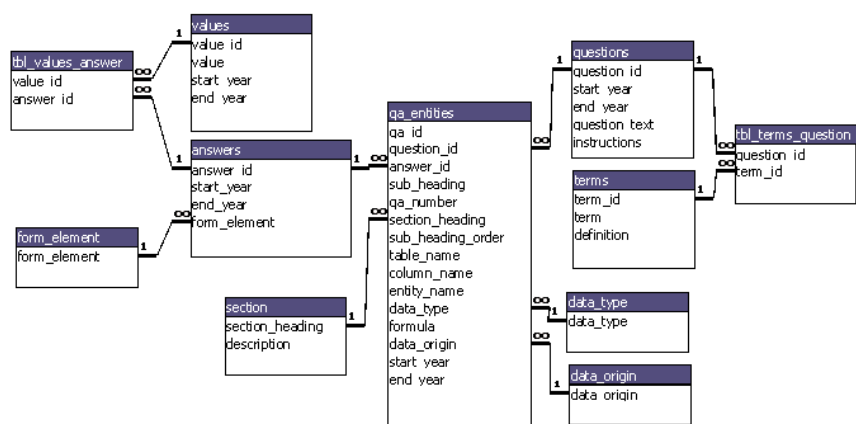


Figure 6. Data Model Adopted For 2000 Survey.

definitions and instructions were produced as dynamic (server side) reports from the online database. As for 1997 to 1999, the libraries' responses were stored in the online database, and immediately available to the ad-hoc reporting tool. The web survey for year 2000 was opened in May 2001.

Plans for Presentation and Processing of the Data

The Library Services Branch has identified three over-arching goals respecting future editions of *British Columbia Public Libraries Statistics*:

- reduce the overall cost of publication
- minimize the time between collection and publication
- publish results as an Excel spreadsheet, enhancing users opportunity to manipulate data directly.

The Branch intends to continue the distribution of the paper publication. We will use a single vendor's tool set (Microsoft's Access, Excel, and Word). This will permit direct printing to an Adobe Portable Document Format (PDF) file, with web publication preceding print publication by about three weeks.

The Excel spreadsheets used to calculate and print the tables contain the statistics year in both the file names and in some column headings. There is a single file for each table of the printed statistics. Calculations across tables would be simpler to maintain, publish and archive, if all the tables were in one Excel file.

Summary and Conclusion

The change from a paper-based to a web-based survey has enabled earlier publication of better quality statistics. Web-based publication offers

the best option for widespread, rapid dissemination of public library statistics, but at the cost of increased systems effort and planning. Ron Clancy, Chief Librarian of the New Westminster Public Library, which serves a city of 55,000 in the Greater Vancouver area, had this to say about the switch to a web-based survey:

Councillors frequently look to neighbouring municipalities for comparisons on funding and service levels. Timely statistics assist in determining the cost effectiveness of service relative to that provided by other libraries in the region. By using a web-based format for gathering statistics, the Library Services Branch has made the process easier for users and the data more quickly available.

Library Statistics for Marketing

John Sumsion

Following a career in shoe manufacturing John Sumsion was appointed in 1981 to set up the new Public Lending Right (PLR) scheme in the UK. This gave him the opportunity to study public library lending patterns in some depth. In 1991 he was awarded an Honorary Fellowship of the Library Association. He then moved to Loughborough University to spend five years as Director of LISU (Library and Information Statistics Unit) where his interests extended to all library sectors. He was an active member of the Library and Information Services Council (England) during an interesting and critical period. On retiring from LISU in September 1996 he was appointed Senior Honorary Fellow in Loughborough's Department of Information and Library Studies - which is his present base for personal teaching, research and consultancy. Both at PLR and at LISU he developed international contacts: he chaired IFLA's Statistics Committee from 1993-98. His research interests and publications focus on: quantitative analysis of library services, users and books; national issues of library and information policy and research; and international comparative statistics and standards. Until prevented from continuing by ill health he was Convenor of the Working Group revising ISO 2789 'Library Statistics' - where he remains an active member. He has just retired as Editor of *LIRN (Library and Information Research News)*.

Introduction

The current enthusiasm, particularly noticeable in IFLA circles, for 'marketing libraries' and for the techniques of market research have a parallel in the increased emphasis



on users - their needs and satisfaction. 'Marketing' and 'user studies' may employ different terminology but, in reality, they are two sides of the same coin. Measuring effectiveness and impact are set to take over from counts of efficiency and of crude transactions.

Library statistics are often criticized for lagging behind these trends, for failing to move with the times. In his Bangkok paper Gary Gorman (2000) cited the shortcomings of quantitative variables:

Counting users and collections may give us some data, albeit of limited value, but one feels compelled to reiterate that too many library services hide behind such raw figures, and rely on these as a substitute for meaningful data analysis.

Counting people tells us very little, as it does not specify the various categories of users and thus the demands they are likely to make on the service. ... By looking beyond 'how much' and 'how many' to the attributes of the

people, things and activities being counted, librarians cannot help but have a more useful understanding of their organizations and their work.

In the final analysis what we are arguing for is a greater awareness among library professionals that meaningful data are contextual and that meaning depends on interpretation, that they are derived from variables that are complex and difficult to measure, that understanding is an inductive process. This differs from, but is not necessarily in conflict with, the traditional quantitative approach of the statistician...

He admits, however, that

... collecting this more useful, and therefore more sophisticated, data on users and non-users is fraught with difficulties, and is a time-consuming and expensive proposition.

It is the first purpose of this paper to draw attention to cases and places where this more meaningful data has already been collected and analysed, where library statisticians are already more 'on the move' than is generally appreciated.

The second purpose of the paper is to point to places where the techniques of market research have been employed and to point to opportunities for library statistics to improve the marketing of libraries. Again, these two purposes can properly be regarded as two sides of the same coin - depending on whether or not one wishes to use the terminology (or camouflage) of the marketing approach! As we shall see, in practice many initiatives have benefited from the approaches used in other disciplines - principally market research, geography and economics - and there are advantages in viewing libraries in the context of the wider book business and of the whole information scene.

There are in broad terms three marketing roles for statistics: Description of Services Available; Statistics of Market Penetration/Popularity; and Statistics of Feedback on Marketing Initiatives/Policies.

Description of Services Available

Objective: To increase demand by greater awareness of what is on offer; get 'regular users' to extend their interests; get 'occasional users' to become regular users.

Surveys invariably reveal a shocking ignorance in the user community (both users and non-users) about what the library has to offer. This may well be repeated for library staff members, especially in remote locations. It is important to dispel false myths even where a picture is incomplete - for example, many authors thought public libraries had no paperbacks long after they became commonplace.

There is no substitute for counting the number of people using the diversity of library services - particularly those 'fringe' services that are often overlooked as non-mainstream. The 'whole' can only be appreciated if all its 'parts' are identified! In public libraries these services typically include:

housebound; mobiles; music; drama - play sets; art; patents; genealogy; local history and newspaper archives; meeting room use; training sessions; homework clubs; school holiday clubs; storytelling sessions; reading and literacy groups; Braille and talking books; ticket sales and booking.

Tables 1 and 2 are based on a sample survey which was nationally representative of the United Kingdom; it covered 1,006 households and 2,416 individuals. Table 1 shows, not only the spread of activity reported by users but also the significant fact that these went hand in hand with borrowing, not in conflict. (The term 'Additional'

'Additional' services	All individuals	All borrowing in last 12 months	All not borrowing in last 12 months
	%	%	%
<i>Whole sample</i>	100	47	53
Information - general/leisure	17	31	6
Used photocopier	11	19	4
Bought second hand books, other items	9	17	2
Local community information	8	14	3
Read newspapers/magazines	8	15	3
Information - business or work	7	12	3
Attended exhibition, meeting, event	7	13	2
Used space for study/work/homework	5	9	1
Careers information	3	5	1
Used fax machine	*	1	*
Used Internet/e-mail	*	*	*
Other	3	6	1
Used any facility/service	44	79	12

(Source: Book Marketing Ltd. 1998 - abbreviated)

Table 1. 'Additional' Public Library Services/Facilities Used, United Kingdom, 1998.

* = less than 0.5 percent.

Public library users	Total sample	Borrowed monthly	Borrowed less often (but within 1 year)	Did NOT borrow in last year
	%	%	%	%
<i>Whole sample % (individuals)</i>	100	28	19	53
<i>(households)</i>	100	43	17	40
Sex of individual				
Men	36	24	30	25
Women	42	50	43	37
Boys	10	11	11	9
Girls	11	13	13	9
Age of individual				
0-5	10	9	7	12
6-11	7	10	10	4
12-14	4	5	7	1
15-24	8	7	12	7
25-34	17	13	16	20
35-44	13	12	13	14
45-54	14	12	13	14
55-64	10	11	7	10
65+	16	18	14	15
Social grade of household				
AB	14	16	15	12
C1	30	34	34	25
C2	25	23	26	27
DE	31	27	26	37

(Source: Book Marketing Ltd, 1998)

Table 2. Demographic Profile of Public Library Users, United Kingdom, 1998.

Notes: Some totals add to less than 100% where respondents did not state age. Socio-economic groups are constituted as follows: AB = Professional and managerial; C1 = Supervisory and skilled crafts; C2 = Clerical and less skilled; D = Unskilled; E = Retired and unaged.

refers to all users' activities unconnected with borrowing.) Of the 53 percent non-borrowers only a small proportion (12 percent against 79 percent) used the 'additional facilities' of the public library.

Statistics of Market Penetration/Popularity

Objective: To identify potential for increased use by some people/groups. To extend use across status, socio-economic, age, race and sex categories.

Probably the single most important statistic is the proportion of the target population reached. This presents technical problems if data is obtained from membership files or by sample surveys, and the count of active borrowers must be supplemented by estimates of in-house (non-borrowing) use.

But such methodological problems can be avoided with surveys of the whole population - users and non-users together. Conceptually this is best done in conjunction with other questions - either commercial or local government or academic. In the United Kingdom questions on public library use have been added into annual surveys of book use conducted by Book Marketing Ltd. This has the very considerable advantage that data can be presented not only by gender and age but also by terminal education age, by occupation and by socio-economic (class) structure.

The format of the market research (or borrower) data in Table 2 has been developed and extended during the 1990s, so that a picture over time ('time series') can be extracted. It is interesting to compare these results with a different formulation, published throughout the 1980s by Euromonitor Ltd but now discontinued, that compares public library borrowing with book buying, etc. from the user's angle - Table 3.

	Library borrowing	Bought	Borrowed from friends	Other (gifts, etc.)
	%	%	%	%
Age				
16-34	22	42	21	16
35-44	25	49	18	8
45-54	30	40	16	14
55+	48	26	13	14
Social Class				
AB	33	41	12	15
C1	31	39	20	10
C2	27	40	18	16
DE	40	29	18	13

(Source: Euromonitor, 1989. *Book Report*. Reproduced in: Sumsion, J., 1991)

Table 3. *Source of Reading Material, United Kingdom, 1989.*

A further analysis (Table 4) shows that the number of users borrowing non-fiction is almost identical to those borrowing fiction: is this another myth demolished? The volume of fiction loans is always higher, but fiction readers read more heavily than non-fiction readers. Counting people gives different results from counting transactions!

To promote and extend library use generally.

Clearly there is a role for statistics to record and monitor the effects of marketing initiatives. It is not easy to provide specific examples, but in general terms there are two features of recent performance in UK public libraries that fall into this

Age group	Population	Library Users	Using Fiction	Using Non-fiction
	%	%	%	%
15-24	15	18	15	15
25-34	21	20	18	20
35-44	16	18	18	18
45-54	14	13	14	15
55-64	13	13	14	13
65+	20	18	22	19
Total	99	100	101	100

(Source: Book Marketing Ltd., 1997)

Table 4. *Fiction and Non-Fiction Users by Age Group, United Kingdom, 1997.*

Statistics of Feedback on Marketing Initiatives/Policies

Objectives: To identify how well libraries meet 'public good' objectives such as income redistribution, social inclusion, helping the disadvantaged, promoting education and equal opportunities, cultural enrichment, etc.

category. As Table 5 shows, book loans have declined drastically in recent years. However children's lending has hardly been affected, and the decline in adult non-fiction is much less pronounced than it is in fiction. While the fall in adult fiction loans may be ascribed in part to increased competition from quality paperbacks in modernized bookshops and book clubs, this statistical result can also be ascribed to the positive efforts of most authorities to shield the children's service from budget cuts and to emphasize

the information and vocational features of non-fiction lending.

Audio-visual data are added for interest: while they show a huge percentage increase their overall volume is still tiny compared to books.

public library. Just how to market such a wide interest spread is not obvious, but marketing policy makers ignore such facts at their peril. And such analyses certainly raise questions about the need for marketing initiatives focusing on most popular areas such as computer

UK Public Library	Per Capita Loans		Ten year trend trend
	1988/89	1998/88	
Adult fiction	6.0	4.0	- 31 %
Adult non-fiction	2.3	1.9	- 14 %
Children's	1.9	1.8	- 1 %
Total books	10.2	7.8	- 24 %
Audio-visual	0.4	0.6	+ 54 %

(Source: Loughborough University. Library and Information Statistics Unit, 2000.)

Table 5. Features of Lending Decline Analysed, United Kingdom, 2000.

A more detailed analysis of book lending in the UK has come as an offshoot of the Public Lending Right (PLR) operation - both its scope and the recent trends. Not only do these figures confirm the trends, they also demonstrate the exceedingly wide spread of interests met through the

books, DIY, travel, and even, perhaps, humour!

In future marketing policies can be expected to aim to develop an even more eclectic clientele and take up of services across all ages and all educational and class backgrounds.

Subject Category	Percentage of Loans	
	1989/90	1999/00
Adult Fiction		
Romance	13.0	10.1
Mystery/Crime/Thrillers	13.9	12.8
Historical	4.8	2.5
SciFi, Horror	2.4	1.2
War	4.0	1.3
Westerns	0.9	0.7
General	20.7	23.0
Adult Non-fiction		
Biography	2.7	2.2
History	1.5	2.4
Literature, Religion	1.0	1.3
The Arts	1.0	0.8
Travel	2.2	2.3
Science, Social Science	3.0	2.7
Health	1.9	1.6
Nature, Pets, Country Life	1.8	0.9
Domestic, Leisure and Misc.	3.9	5.0
Humour, Short Stories	1.1	0.3
Children's		
Fiction	15.8	22.8
Non-Fiction	4.1	6.1

(Source: Public Lending Right Office Press Releases)

Table 6. Analysis of Loans of Works by PLR Registered Authors, United Kingdom.

Note: Some category changes during period affect the precise comparability.

Analysis of What Borrowers Borrow - Computer Data

When borrowers are surveyed on the books they have borrowed, the validity of analysis relies on respondents' memory. To overcome this limitation, consulting the hard evidence of actual circulation records would be preferable. Such research would be laborious and expensive without the ability of computer systems to retain historical data of books lent to individual users. A study by Pauline Liu (1994) described how the *Bookshelf* computer system permitted such statistical analysis of historical borrowing data. Borrowers' loans in two UK library authorities were analysed to establish characteristic features of borrowing activity. The computer system was the main criterion in selecting the two authorities, which were Sandwell - an inner city suburb of Birmingham - and Hounslow, a suburb in Outer London. The interesting results showed how types of material borrowed were linked with borrowers' age and gender, and assessed how far borrowers' tastes were specialized or eclectic.

Plots of the type referenced '6.2.3' in Figure 1 below yielded a typical negative exponential (or 80/20) curve showing a few very high borrowers but a great many borrowers of less than ten books per annum.

With data for the elderly added at Sandwell, adults borrowed some fourteen books a year on average - but the over 60s ('elderly') averaged forty books a year. This age difference is dramatically displayed in Figure 2 (where 'Adults' refers to those under 60).

After this a first assessment was made as to how far borrowers' tastes were specialized or eclectic. The data were re-organized to classify as 'Mainly Fiction' those borrowers whose fiction loans were 90 percent or more of their total loans. The same rule was applied to borrowers of non-fiction. People whose

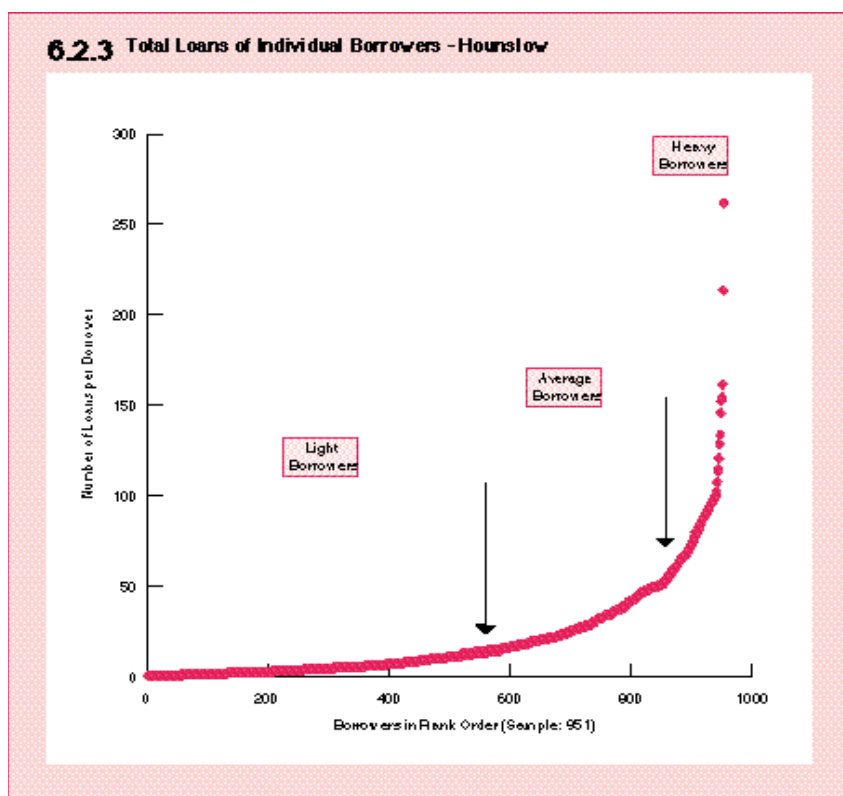
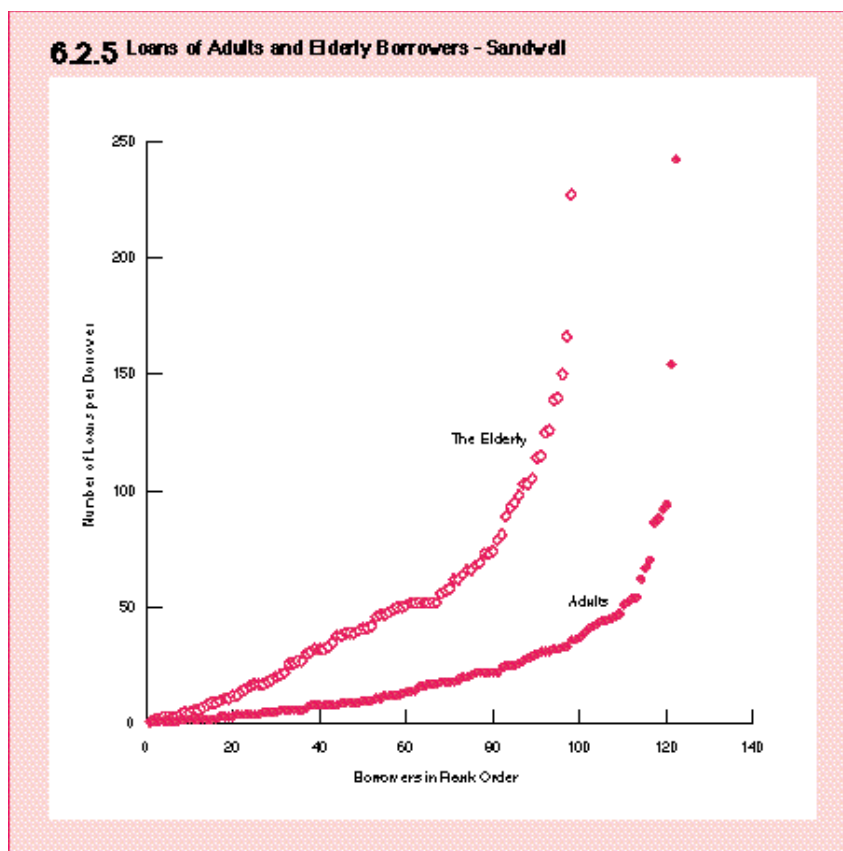


Fig. 1. Borrowers' Cumulative Frequency Distribution by Number of Loans.



(Source: England and Sumsion, 1995)

Fig 2. Spread and Intensity of Borrowing by Age.

loans of fiction and non-fiction were each less than 90 percent of the total were regarded as borrowing "Both fiction and non-fiction". In this Table 'Heavy Borrowers' were those clocking up over sixty items in the year and 'Light Borrowers' those borrowing thirteen items or less.

The results in Table 7 cannot, for technical reasons, be used to compare the two local authorities, Sandwell and Hounslow: the Sandwell data was incomplete. But they do indicate the large proportions of borrowers taking both fiction and non-fiction as well as the marked preference for fiction among Heavy Borrowers.

Subsequently this 'eclectic' feature was further analysed by counting the number of fiction genres and of non-fiction genres in borrowers' cumulative records, and then by including audio-visual loans. An example of the type of analysis derived is shown in Table 8.

The conclusions from this study were stated as follows:

1. When we count the number of borrowers rather than the number of books borrowed, the importance of non-fiction soars. Non-fiction borrowers, fiction borrowers and those who borrow both categories are roughly equal, whereas loan statistics show fiction loans at 53-55 percent and non-fiction at 23-24 percent.
2. In all categories there is firm evidence to support survey findings that the majority of borrowers spread their interests over several categories. There is a substantial section of prolific single-category borrowers, but - when counting users - they are clearly a minority.
3. Statistical data support the commonly held views on which types of fiction appeal most to men, women, the young and the old. The most popular non-fiction categories were Travel and Biography. When the most popular non-fiction categories were further

	Mainly Adult Fiction	Mainly Adult Non-fiction	Both	Total
	%	%	%	%
SANDWELL:				
Light borrowers	9	15	6	30
Average borrowers	16	7	18	41
Heavy borrowers	22	0	7	29
ALL borrowers	47	22	31	100
HOUNSLOW:				
Light borrowers	7	32	16	55
Average borrowers	7	5	22	34
Heavy borrowers	5	0	6	11
ALL borrowers	19	37	44	100

(Source: England and Sumsion, 1995)

Table 7. Percentage of Borrowers Borrowing Fiction/Non-Fiction/Both, Sandwell and Hounslow, 1994.

Type of Fiction	Type of Borrower			Sex		Adults		
	Light	Average	Heavy	M	F	Aged 18-59	Aged 60+	All ages
	%	%	%	%	%	%	%	%
General	32	15	0	26	27	29	17	25
Romance	6	6	34	0	12	5	13	8
Crime	11	14	21	18	10	12	21	12
Family Sagas	15	22	12	3	24	14	30	17
Horror	7	7	6	4	7	7	0	7
Action	10	16	18	24	6	12	15	12
Western	0	0	6	1	0	0	1	1
Fantasy	2	0	0	3	1	2	0	1
Historical	1	1	0	0	2	1	2	1
Asian Language	6	8	0	5	7	9	1	6
Humour	4	1	0	4	1	2	0	5
Science Fiction	4	8	3	9	2	5	0	5
Graphic	2	2	0	3	1	2	0	2
All	100	100	100	100	100	100	100	100
No. in sample						221	82	377

(Source: England and Sumsion, 1995)

Table 8. Analysis of Borrowers' Fiction Categories, Hounslow, 1994.

Note: Not shown here are columns for Sex and Age for children and 'not known' data, so some percentages do not equal 100.

analysed there were vast differences by age, by gender, and between Sandwell and Hounslow libraries.

4. This study shows what a wealth of raw data is contained in computer records. They can be analysed to show the overall borrowing patterns in a library and the borrowing patterns of each sub-group. To make the analysis feasible on a large and continuing scale attention would need to be paid to codes for subject cate-

gories and to software to retain historical records.

5. This source of data on loans and borrowers could be further explored. This study looked at borrower groups, sex and age. ... Further studies could examine the socio-economic background, residence and education levels of the borrowers in relation to the type of material they borrowed.

(England and Sumsion, 1995, p. 132)

From the marketing angle it is once again clear how diverse is the range of interests catered for in the public library. While traditional research tends to focus on 'Heavy Users' and on 'Non-Users', there is evidence here to suggest that it might be even more profitable to focus on the huge contingent of 'Light, Occasional Borrowers' and to explore policies to persuade them to increase their rate of borrowing.

This research depended partly on the availability of suitable software: if specified at the design stage, there appears to be no major technical problem with its provision. However, there is also the policy question relating to the retention of borrower records. It was clear during the study that data was only to be used for research purposes and that any personal data was confidential. In practice we know that retention of such data is not allowed in several states of the USA. On the other hand, it is common practice in many systems to retain loans data for the specific purpose of avoiding sending out previously-read titles to household readers!

Proactively to advise borrowers of newly acquired titles within their field of interest is a service that might well be considered as part of a 'customer marketing plan'. For this borrower records could be useful - though not essential.

Impact Analysis of Borrowing - Survey Data

From amongst a great deal of survey research two recent examples progress from the straightforward analysis of WHAT IS BORROWED to more complex analysis including data on PURPOSE OF BORROWING - and take us closer to assessing IMPACT. In the first example Timperley and Spiller (1999) questioned 400 borrowers of non-fiction books in the UK on their purpose and the degree of satisfaction obtained. Tables 9 and 10 give a flavour of their results. Here again the diversity of response is remarkable. Public libraries satisfy needs

Age	Recreation		Personal/Information			
	Hobby	Pleasure	Learning	Practical	Study	Job
	%	%	%	%	%	%
15-24	21	6	5	21	45	2
25-34	16	4	12	40	20	8
35-54	26	12	15	32	6	9
55-64	26	17	17	33	4	1
65+	39	29	11	19	1	1

Table 9. Reason for Borrowing Non-Fiction: Percentages of Each Age Group, United Kingdom, 1998-99. (Source: Timperley and Spiller, 1999)

Subject	Hobby	Pleasure	Personal	Practical	Study	Job
	no.	no.	no.	no.	no.	no.
History, War, Transport	30	7	13	12	4	
Biography	5	31	5	1	3	
Science, Technology	7		10	5	14	9
Geography, Travel	2	5		33	2	2
Family, Health, Food	2	1	3	29	5	2
Social Science, Religion		1	11	10	12	7
Arts, Music	15	3	3	2	8	
Nature, Animals	11	3	2	11	3	
Craft, DIY	16			6	1	
Sport, Games	17	1		2		
Language, Literature	1	3	3	5	1	

Table 10. Reasons for Borrowing by Subject Category of Book, United Kingdom, 1998-99.

varying from the frivolous to the most serious across a wide range of interests both theoretical and practical. There are significant differences between the age groups.

The second survey was undertaken jointly by Book Marketing Ltd and the Reading Partnership (2000) and covered a wide range of issues: how readers related the value of reading to their life style, age and occupation and how this varied across material types. The survey covered 1457 adults and 402 children. For our purposes perhaps the most interesting results are those reproduced in Tables 11 and 12 - since they give invaluable clues as to the relative strengths of libraries as against bookshops in the marketing of books to the user and to ways in which public libraries might market their services more effectively.

Such statistical survey results have been used to establish:

- that book buyers and book borrowers are largely the same people - with overlapping interests

- that library users are spread widely across the whole population
- that, within these parameters, public libraries have a positive effect in redistribution of income, since there is a marked tendency for the more affluent professional classes to buy rather than borrow, whereas the less affluent are

more active library borrowers than buyers. (Morris, Hawkins, and Sumsion, 2000).

Analysing Use and Users in Each Library

The data presented so far have all been global - at the whole country level - appropriate to market the whole library service. Mostly it has been derived from sample surveys rather than complete counts. In practice, of course, most library managers need data about their own library or libraries to make local comparisons and to be made aware of good results emanating from good practice which they can emulate. (This is plain man's vocabulary for 'performance measurement', 'best value', and the rest of the sophisticated management armoury!) How do the analyses by age, wealth, and employment status look in the local situation?

In the early 1990s British public librarians wanted a standard user survey rather than piecemeal development - and the result is a survey methodology generally known as 'CIPFA PLUS' (where the acronym 'PLUS' stands for 'Public Library User Survey'). This was developed independently under the auspices of the Committee for Public Library Statistics with support from central government and the British Library.

Reason	Adults	Children
	%	%
To keep for reference	54	36
In case I want to re-read	40	55
Just because it's nice to own them	38	43
Library doesn't have enough new titles	15	12
Just never think of going to the library	16	6
Take too long to read books, hence renew/fines	12	7
Library doesn't have the sort of books I want	11	7
Prefer bookshops - more up-to-date	10	4
Prefer bookshops - more convenient to visit	9	3
Books in the library are sometimes a bit tatty	6	4
Prefer bookshops - less intimidating	2	1
Prefer bookshops - staff more helpful	1	1
Other	5	6

(Source: Book Marketing Ltd. and Reading Partnership, 2000)

Table 11. Reasons for Buying Rather Than Borrowing, United Kingdom, 1999-2000.

Reason	Adults	Children
	%	%
Can't afford to buy all the books I want to read	60	63
Means I can try new authors/subjects	49	37
Don't have space for all the books I want to read	41	32
Always gone to library to get books wanted	29	30
Only read books once - no point in buying them	28	15
Only want to dip into books - not to buy them	19	14
The library has all the books I want	16	22
Prefer libraries - more convenient to visit	14	13
Prefer libraries - staff more helpful	9	4
Prefer libraries - less intimidating	6	3
Prefer libraries - more up-to-date	2	2

(Source: Book Marketing Ltd and Reading Partnership, 2000)

Table 12. Reasons for Borrowing Rather Than Buying, United Kingdom, 1999-2000.

The development work was undertaken by IPF Ltd. the wholly owned consultancy subsidiary of CIPFA. CIPFA - the Chartered Institute of Public-Finance and Accountancy - is a professional association of local government accountants.

At the time of writing the main results for each participating authority, hitherto confidential to participants, have recently been published in CIPFA's *Public Library Statistics 1999-2000 Actuals* - although not the totals or averages. It seems likely that in the next few months or years they will become

generally available on the website: <http://www.ipf.co.uk/sis/Leisure/PublicLibraryActuals/default.htm>, where access is currently restricted. (For a description of the survey and data for earlier years see Bohme and Spiller, 1999.)

Libraries have, until now, decided themselves whether or not to contract in and participate. But the initiative has been so successful that over 70 percent of public library users are now covered, and the government will now rely on this survey for some of its centrally imposed standards.

Activity in Library	UK average	Age Groups			
		Up to 24	25-44	45-64	65+
	%	%	%	%	%
Borrow/return book(s)	77	60	71	79	86
Borrow/return cassette(s)	7	4	7	7	6
Borrow/return CD(s)	4	6	6	3	2
Borrow/return video(s)	7	6	12	5	3
Read newspaper/magazine	15	12	13	15	17
Seek information/find something out	22	32	24	22	15
Use photocopier	6	9	6	5	4
Browse	30	34	31	31	26
Sit to study or work	7	20	8	5	2
See exhibition/event	3	2	2	4	4
Did something else	7	9	8	6	4
Total	185	194	188	182	169

(Source: CIPFA PLUS Data Archive - age categories amalgamated and results rounded)

Table 13. CIPFA PLUS User Survey 1998 - Percentage of People Undertaking Various Activities on Their Library Visit.

Note: Data available on application to Institute of Public Finance, Ltd. Croydon, Surrey, UK. Details at: www.ipf.co.uk/sis.

Authorities have the choice of sampling all their libraries every year or on a three year rotation. The survey is a self administered questionnaire completed on leaving the library saying what the user did on that visit.

Much of the questionnaire is taken up with straightforward Five Point Scale evaluations of perceived service quality. For our purpose here the more interesting data shows what services have been used on that visit to the library. The basic analysis is shown in the 'UK Average' column of Table 13. Visits included 77 percent performing a book borrowing transaction while 22 percent wanted 'To find something out' - plain person's English for 'Seeking Information'. It is arguable whether 'Browsing' should really be included as a separate item - since that is typically part of the Borrowing activity and, as such, represents double counting. But the main conclusion is to demonstrate multiple use - with several services normally accessed on each visit.

The data in Table 13 show the average percentage of times that an activity was undertaken on each visit. Thus the total shown - 185 percent - indicates that, on average, 1.85 of the activities listed were undertaken on each visit. (The total would equal '100' if users averaged only one activity per visit.)

The questionnaire also asks for basic personal information - Age, Sex, Occupational Group, Postal Code, Race. It is when such personal data are cross tabulated with data on service activity that the great potential of these statistics becomes apparent. In the example shown in Table 13, the activities undertaken in the library are analysed by age of user. Older users score high on book borrowing and reading newspapers/magazines; younger users score high on borrowing CDs/videos, information seeking and study/reading.

Ethnic Minorities

One feature not previously established statistically was how well UK

public libraries are used by ethnic minority populations. The untested feeling had been that these minority racial groups used the public library at a much lower level than the white population. The position has recently been clarified by the inclusion of a question on race in the CIPFA PLUS survey. The question was 'Ethnicity, how would you best describe yourself?' The results for the whole of the UK showed library use considerably higher by the ethnic groups as compared to the white population. Ethnic minorities comprised 10.3 percent of library users but only 5.9 percent of the total population. In the greater detail the CIPFA PLUS survey showed how the type of use made by the various minority groups differed both from each other and from that of the white population.

Another British study/survey on children's book reading found that "... on a general level, ethnic background makes very little difference to the type of book a child chooses to read." (Hall and Coles 1999)

For interest the position in the United States is shown in Table 14.

These statistical results for the USA are interesting enough in dispelling any myth of white hegemony among public library patrons. But the extensive survey work carried out under the GEOLIB research programme (Florida State University, 2000) has, in effect, produced cross-tabulation results by correlating patterns of use with racial features. This established, inter alia, that informal activities - magazine

reading, places to work and to converse - were a feature of non white use. Consequently plans to develop these clientele, particularly among the Hispanic population, called for a different service mix and different physical library layouts (Jue, Koontz and Lance 2000).

Other Variables

There is not space here to show in detail similar examples for sex, occupational group, and topography - but the reader should have no difficulty in visualizing questions to be explored. One of the most telling results (from Essex County Libraries) showed how much younger people in the 14-25 age group use large city centre libraries rather than smaller suburban and rural libraries (England and Summison, 1995, p. 196).

The CIPFA PLUS Survey has already been extended to cover children's use of libraries - with a separately developed methodology - though its results are not yet analysed.

While the data shown here are estimates for the whole country, remember that library managers can have this data prepared for each library, for the whole of their service, and to compare with results for neighbouring and similar organizations. To match the overall user profile such data gives strong pointers on which services should be prioritized and to track changes in use - for instance, as electronic services develop.

A 'Success Story' - in One Complete Graph

Here is a particularly dramatic statistical illustration of the success recorded by Essex County Libraries (UK) in their attempt to reduce the time taken to satisfy requests and so improve and extend their service to borrowers. Essex is a very large authority that is able to buy a wide range of stock - but which is typically held in only a handful of locations. So copies have to be fetched for the interested user from another of the ninety-one branch libraries.

Improved system facilities allowed staff to ascertain whether the desired book was in fact on the shelves at a particular location or out on loan - thus eliminating delays when previously the request form had to go backwards and forwards between several branches. Along with reorganization of transport and clear improvement targets this resulted in reducing the average time taken from twenty-one days in 1990 to ten days in 1992 and, subsequently, to six days.

Not surprisingly the public responded by trebling their use of this particular service. A second improvement was the introduction of a self service reservation facility through the Online Public Access Catalogue (OPAC) - at slightly less cost to the user - which allowed the increased 'business' to be handled efficiently.

This story is cleverly illustrated in Figure 3 - a good example of time series presentation.

The success of Essex - and of several other authorities - in these technological and management developments, with a marketing objective, proved to be convincing pathfinders for all public libraries in Britain - where national standards now reflect the much shorter times being achieved country wide.

Information Services

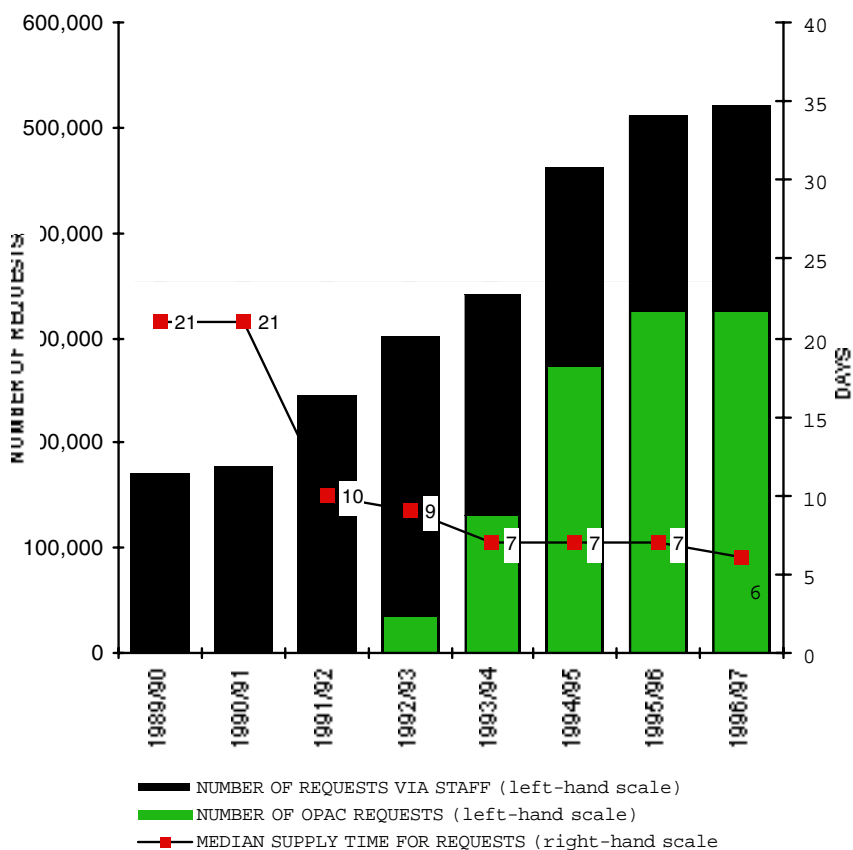
The statistics presented so far show that public library use - book bor-

Ethnic Group	Households Using Library	
	in past month	in past year
	%	%
White	44	65
Black	45	63
Hispanic	41	58
Asian/Pacific Islander	53	72
American Indian/Alaskan	46	65
National		
Other	51	66

(Lynch, 1997)

Table 14. Use of Public Libraries by Ethnic Group, United States.

Figure 3: ESSEX REQUESTS 1989/90 - 1996/97



rowing in particular - is well spread, though not equally, across all ages and socio-economic levels. When it comes to the information services, however, there is evidence that the very young, the very old, and socially deprived groups produce many fewer information queries than middle class users in the prime of life (Marcella and Baxter, 1999). This finding should encourage social inclusion programmes to concentrate on information provision even more than on lending.

There is not space here to do more than mention the many sample sur-

veys to monitor and analyse satisfaction of information needs that have been undertaken (see, for example, England and Sumsion 1995 section 6.1) The CIPFA PLUS Survey results in Table 15 below show both users' assessment of success and how this correlated with staff involvement. Both features show the library service in a good light!

What this table shows is that 72 percent of users seeking information were successful; of these, 62 percent had consulted library staff. Of the 13 percent who did not suc-

Were You Successful?		Did You Consult Staff?	
		Yes	No
	%	%	%
Yes	72	62	38
Yes in part	14	49	51
No	13	19	81

(Source: CIPFA PLUS Archive, 1999)

Table 15. Did You Seek Information/Find Something Out?

ceed in finding what they were looking for, only 19 percent had consulted staff.

Other Types of Library

This paper has concentrated exclusively on public libraries. However, the reader should have little difficulty in imagining how these statistical principles and practice apply in other types of library. Particularly in higher education libraries there are impact questions susceptible to analysis such as:

- Where materials are acquired for teaching/information/research are they in fact used for these purposes?
- How much use do materials get outside the department for which they were acquired?
- Is 'academic exclusion' a problem? Is this affected by user training programmes?
- Users' effectiveness in using catalogue and search facilities.
- Effectiveness of reading lists as reflected in acquisitions/use.

Such questions can, of course, be directed both to traditional materials and to electronic networked sources - and to monitor the speed and extent of transition. Typically over the last decade statistics have pointed to the provision of study spaces in libraries as being equally critical in users' eyes as the provision of networked and digital facilities.

In higher education libraries one piece of statistical research (Hull, 2000) found that "generally barriers to libraries ... are seen to increase from the Professional Classes, through the Skilled Manual Classes, and are highest in those from Unskilled or Unemployed backgrounds. As use of information services generally is higher amongst PC owners and PC ownership is strongly related to Social Class, this may be an effect of PC ownership, rather than Class membership."

It will be a statistical task to monitor how successful libraries are in developing and educating the dis-

advantaged - where such is their marketing policy.

Final Conclusions

What is the main feature of the new type of statistics we have been looking at? It is:

The cross-feature analysis: data of services provided analysed by types of user.

How feasible is this? We have seen interesting examples from the CIFPA PLUS survey - where the standard survey questionnaire had the foresight to collect data on characteristics of the user. We have seen the Liu data where the library computer system retained borrowing data for the individual user so that this could be analysed. It is easy to envisage academic library analysis by faculty and status - since the university computers already hold the relevant personal data. Then there is the SQL type of enquiry programme - which should be simplicity itself with modern relational database software.

Such statistical analyses are entirely feasible and altogether fascinating - if we set our minds to do it. And if we believe in the value of a marketing approach, then we must open our minds and find the resources to move with speed in this direction.

Almost as important is the need to collect data on the impact of the information resources we provide - as some of these examples demonstrate.

This all assumes that there is a high level target objective to expand library services to such a point that all reasonable demands are met and that the maximum number of people are brought into the fold of library users. (For an elaboration of the public library economic case see Morris, Hawkins and Sumsion, 2000). This needs to be vigorously

stated as the fundamental plank of marketing policy.

The statistics we have been describing will be useful, first in showing how desirable this is, then in building up a favourable positive attitude in the general public, and finally in monitoring its achievement. But essential to all is a convincing policy to develop and expand the user base - the fundamental of all marketing philosophy.

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Measuring the Added Value of Library and Information Services: The New Zealand Approach

Ruth MacEachern

Ruth MacEachern was raised and educated in Canada, receiving a Master of Library and Information Service from Dalhousie University in 1981. She held progressively responsible roles in several Canadian federal government departments, focussing on making technology work for information seekers. In 1995, Ruth emigrated to New Zealand, where she worked at the Parliamentary Library as Development Manager (1995-1998), and as Acting Parliamentary Librarian (1998-2000). During this period, the Parliamentary Library used the V+LM methodology to measure the added value of its services. Ruth is now an independent consultant, specializing in people-focussed knowledge management. She recently completed a Master of Public Management at Victoria University of Wellington.

Introduction

A universal challenge for libraries is their ability to quantify and justify the services they provide. This is not only a funding issue but also impacts significantly on their



ability to qualify strategic decisions relating to what services they do, or would like to, provide.

This article describes an example of an approach taken in New Zealand. It provides background to the development and uses of the *Value-Added Library Methodology (V+LM)* to measure the added value of library and information services. It describes the purpose of the methodology, key concepts, and the results of three implementations in three very different libraries. The article identifies strengths and weaknesses of the methodology, and discusses the critical role of adequate management information.

Background

The V+LM was developed by Suzanne Snively of PriceWaterhouseCoopers in collaboration with the Library and Information Association of New Zealand/Aotearoa (LIANZA) and the National Library of New Zealand. The common goal

was to develop a tool for libraries to demonstrate their worth to their funders and client base.

Because of the nature of the services libraries provide and the way in which they receive funding, they are often viewed as cost centres. Also, due to the 'altruistic' nature of services provided, the benefits of the services are not easily identifiable or monitored. Therefore the value that libraries provide to their client base is difficult to quantify.

The intention of V+LM is to provide a process for a library to demonstrate and quantify:

- what it does that adds value
- which activities add the greatest value
- whether the funding is going to the right places; and
- inconsistencies between principles and actions.

The Methodology

V+LM collects, analyses and presents information to identify the net benefits of library services in the same way as a private sector firm demonstrates its profits. It allows the estimated rate of return on investment to be identified and compared to the organization's other investments or programmes. This is done by defining and valuing the quantity and price of the benefits of library services to estimate 'turnover'. Then actual and imputed costs are deducted from turnover to impute a profit figure.

Overview

The V+LM uses a set of spreadsheet-based templates to calculate the added value derived from library usage, services and resources. The templates can be customized to measure the specific benefits of any given library, in line with its outputs and objectives. The

process includes analysis of library functions in order to understand better how the services they provide support their client base. All services can be assessed to quantify the value that they add to the organization.

The spreadsheet framework enables the calculations to be transparent and open for discussion. Spreadsheets can readily be revised when new cost and benefit data are available. Any assumptions applied to value, costs and benefits are recorded alongside the spreadsheets in a series of footnotes.

The V+LM is designed so that library services can be analysed both in relation to spending for current consumption and for longer-term outcomes. Processes to fund outcomes can be treated as long-term investment decisions, rather than simple expenditure allocation.

The V+LM framework can also serve as an ongoing monitoring tool, illustrating both the financial state of the library and the development of its services. It can show how services have become more efficient (by producing more at the same cost), or more effective (by giving clients more of what they need). New services can also be modelled using V+LM to compare anticipated benefits to costs.

Concepts

V+LM uses two approaches to quantify the net benefit of library services. The first, the 'top-down' approach, focuses on measuring benefits. The other 'bottom-up' approach measures the value of the library's assets and calculates return on investment. This serves as a double-check on the top-down measure.

The top-down approach relies on the calculation of the added value of library services using proxies which represent the market prices of the library services. From this, three main measures of economic benefit can be calculated:

1. Market Price Proxy: estimates the price of the service as if there is a willing seller and a willing buyer.
2. Replacement Cost: estimates what it would cost to obtain information if the library did not exist. This measure is a common method for valuing assets, including library assets, and widely understood.
3. Opportunity Cost: The value of a client's time freed by having a library service. This measure assumes that clients will choose to use the library, rather than spending their time finding information in other ways.

The benefit measures are applied to the library's services, to establish a range of potential benefits. The bottom of the range is the minimal undisputed value of the service, while the upper estimate reflects possible values for intangible aspects of the service which often cannot be directly measured.

Collection of Management Related Information

Initially, data for a V+LM study can largely be obtained from information already held by the library, in the catalogue system, client usage data, expenditure and library financial statements. Where explicit information is not available, assumptions are made based on the experience of library staff and their understanding of clients' needs and wants. All assumptions are documented so that they can be revisited when improved information becomes available. A key part of V+LM implementation is the identification of key gaps in the information required to support robust evaluation of the library's performance.

Values for each service are calculated based on a variety of inputs, including the replacement value of client's time and the purchase cost of assets used to provide a service.

Analysis and Identification of Return on Investment in Assets

Library funding represents an investment, and every investment has a minimum required rate of

return on its assets. The 'bottom-up' approach starts with the fixed assets of a library and applies the library's required rate of return to derive the net benefit required. This is then used along with the costs, revenue and turnover to derive the overall benefits of the library.

The bottom-up approach allows funders to compare investment in the library with investment in their other services or programmes.

Trials

Several trials have been done to test the robustness and applicability of the methodology. Details of three such trials and their outcomes follow.

New Zealand Parliamentary Library

The Parliamentary Library is a large special library, providing a wide range of services to members of the Parliament of New Zealand, and the staff who work for them. The client base ranges from novice to experienced users, with many varied requirements. In this environment, timely and accurate service is crucial, as is the need to demonstrate effective, efficient use of resources.

V+LM was used to identify and measure the activities that the Parliamentary Library carried out to allow its clients to locate and use new information as soon as it becomes available.

Services Examined

The Parliamentary Library chose to analyse its four highest-profile services. These were:

- the Reference Service, which quickly provides accurate and relevant information in response to client queries
- the International Documents Service, which builds a national collection of international official publications, and provides a reference service to Parliament and the New Zealand public

- the Profile Service, a current awareness service built around individual interest profiles for Members of Parliament
- the Bills Digest Service, providing accurate, timely summaries of legislation before the House.

Any function not directly valued was broken down according to its support for these four products. For example, the benefits and costs of indexing newspapers were attributed directly to the Reference Service, as the work involved supports fast, accurate answers to reference queries. On the other hand, the cataloguing function supports both the Reference and International Documents services, and costs and benefits were assigned on a pro-rated basis.

Results

Overall, the Parliamentary Library found that each service had a value of between two and twenty times its annual budget. Each service showed a rate of return on assets between 9.8 percent and 16.4 percent. These figures are consistent with the Parliamentary Library's quality of service survey results.

The services valued most highly were the Profile Service and the Bills Digest Service, which deliver proactive information of high interest to Members of Parliament. This confirmed a feeling among Parliamentary Library managers that additional targeted information delivery services would be valuable to clients. A new Research Bulletin service was subsequently launched and was very well received.

There was a direct correlation between the quality of the Parliamentary Library's services and the expertise and experience of its staff. The study also indicated a close relationship between the ability of the Reference team to meet tight deadlines and the availability of its collections on site.

In addition, the Parliamentary Library gained:

- an updateable database of its activities, resources, costs and usage profiles; and
- a cohesive view of how the work performed in various areas (Acquisitions, Cataloguing, Information Systems) supported the Library's mandate.

The Parliamentary Library also learned that:

- staff liked the idea of measuring their value; and
- dollar values are an incomplete measure of service value.

A much simplified illustration of the types of calculation involved is given in the Annex to this paper 'Information Service Benefits'. Apart from the value calculations shown there these spreadsheets give an interesting summary of services offered and used in a parliamentary library.

Canterbury University

The University of Canterbury Library's main client base is the staff and students of the University of Canterbury. The Library has approximately 125 staff and an annual budget of over NZD10 million.

Services Examined

The University of Canterbury Library provides a wide range of services to its client base. For the V+LM trial, it was decided to examine the following three key services:

- Restricted Loans
- Serials Collections
- Information Literacy.

Each of these three services was analysed in considerable detail. It was possible to accomplish this due to the work undertaken by library staff, who were responsible for the bulk of the data gathering and input. This involved an initial high investment of staff time; more time would be required to develop the concepts across all services.

Results

The most comprehensive and measurable data available were those

used to calculate the 'Market Price Proxy' benefit measure. The results discussed are based on this, as it is currently the most robust approach.

An important aspect of the University of Canterbury library services is that they are provided through the university as a public good to enrolled students to enhance the investment in students' education. The analysis shows that the three services analysed do add value to enrolled students and faculty.

The Restricted Loans service is estimated to have potentially the highest return to users, especially when valued in relation to what it would return if the same service was provided in the market place. Analysis of its replacement cost value suggests it is an efficiently run service and it appears to return high value by enhancing users' future earnings.

The Serials Service has a strong return on investment when valued in relation to what it would return in the marketplace and an above market return based on opportunity cost measures. The results are in line with those of other libraries and suggest that the basis of measurement is more robust than for the Restricted Loan service.

Because of the high demand for Information Literacy skills, the Information Literacy Service provides a high return on investment, enhanced by the expertise of the staff. The future benefits of the service may be even higher.

Manakau Public Libraries

Manakau Public Libraries serve one of the most ethnically and socially diverse populations in New Zealand. The city has the largest urban Maori population in the country, and over 40 percent of the population are under 25 years old. The libraries have approximately 140 staff and a budget of NZD 12 million.

Services Valued

The libraries offer a wide range of leisure, information and education-

al activities and services. For the trial, these were grouped into seven broad categories.

1. Resources Delivery
2. Information Delivery
3. Heritage Collection
4. Information Literacy
5. Community Services
6. Reference and Research Service
7. Knowledge Management.

Each category was further divided into constituent sub-categories, e.g. Information Literacy was divided into Reading Programmes and Class Visits, while Community Services was split into Holiday Programmes, Author Visits and Housebound Services. Each subcategory was then valued using the Market Proxy Price (as described in section 3.2).

Results

The Market Proxy Price indicated that for the 1999 financial year, the libraries returned to the community at least NZD 18 million in direct value, representing a 66 percent return on the year's initial investment.

The libraries' physical collections are currently the foundations of their service, but other services such as information literacy programmes may in future provide a much higher return on the community's investment.

Due to gaps in available information, some services (such as public use of electronic resources) could not be assigned a value. This indicates that the libraries' return to the community is even higher than the figures estimated.

Strengths of Methodology

- the database can be tailored to suit the organization
- database can be updated annually, or as services change
- comparisons can be made as to the value of each service relative to other services provided
- new or changed services can be costed and their added value used to gain support

- gaps in information gathering are clearly highlighted
- all assumptions are well documented so that they can be tested and updated; and
- staff are interested in demonstrating their value, and want to contribute.

Shortcomings

- Results may take years to develop. For example, hard data on the impact of information literacy, in relation to academic success, future work and career prospects, is needed in order to calculate the full value of the service.
- Libraries and clients may not measure value in the same way. To ensure that results are acceptable to funders, the library needs to define and measure value from that perspective. This is a challenge for any library, and increasingly complex if clients groups are diverse and their collective opinions hard to define, as in the case of a public library.
- The time required to gather missing or new information can be considerable. This is especially true when the library chooses to value services separately, rather than valuing the library as a package.
- The availability of good management information is critical to a robust valuation outcome. All three V+LM implementations highlighted gaps in current information about the library and information services.
- Finally, the methodology can be very difficult to understand. Some important issues are at present only explained in footnotes. Based on a combination of accounting principles and economic concepts, it is not always easy to grasp quickly, or to explain to busy library staff and managers.

Management Information Requirements

An important deliverable of the Value Added Library Methodology trial is the identification of gaps in

current information. To be truly effective, V+LM requires robust management information on the library and its staff, services, and assets. Among the management information commonly lacking was:

- measurements of costs in direct relation to services
- measurements of customer satisfaction in relation to the services
- a more robust measure for just-in-case acquisitions
- depreciation
- the value of electronic assets
 - accurate statistics on usage of the collections and other resources
 - measures of quality
- the impact of individual services on overall library use; for example monitoring of enquiries to determine the influence an information literacy program has on enquiry numbers and types
- investigation about the opportunity cost of information, in relation to clients' ability to perform their work, or on the future potential earnings of university students
- credible valuations of assets, particularly the library computer system and collections
- measurement of the usage of electronic resources, in particular electronic databases, e-journals and resources on Intranets and web sites.

Improving this management information will strengthen V+LM results by developing more robust measures, amount of use by different user groups, and how current use is reflected in future benefits.

Conclusions

The V +LM results indicate that library services provide a significant net benefit and a substantial return on investment. While results show a wide range in estimated benefit and added value, all of the services valued in all of the libraries provided a good return on investment.

Library collections are a critical 'building block' for service, but the expertise of the staff is the factor which particularly adds value.

This study highlights those features that are common to parliamentary, higher education and public libraries and those that are distinctly different.

The shortage of management information has an impact on the accuracy and credibility of some measures in some areas, and normally results in library services being under-valued.

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New Zealand Parliamentary Library INFORMATION SERVICE BENEFIT MEASURES				
<i>Period covered: Financial year 1997/98</i>				
The figures below represent a simplistic illustration of how the benefits of information services are calculated using the V+LM. The figures are taken from complex calculations in several templates, and have been modified for the sake of simplicity.				
Benefits of Services and Documents Supplied				
Document type	Average value	Supplied or consulted	Service charge	Total
	<i>NZD</i>	<i>No.</i>	<i>NZD</i>	<i>NZD</i>
Monographs (New Zealand Collection)	93	1,605	15	173,340
Monographs (Core Collection)	48	11,718	15	738,209
Serial issues (New Zealand)	8	1,274	15	29,877
Serial issues (Overseas)	10	1,274	15	31,850
Newspaper issues	11	11,583	15	302,445
Reference Collection items	83	4,866	15	476,858
Press Statements	50	889	15	57,798
Maps	50	130	15	8,450
Parliamentary material (New Zealand)	7	3,260	15	71,136
Select Committee papers	7	84	15	1,833
Bills, Regulations and Statutes	7	346	15	7,545
Microfilm reels	66	n/a	15	0
Microfiche	11	3,120	15	81,120
CD-ROMs and Diskettes	593	593	15	360,422
Catalogue Hits	10	129,773	0	1,297,725
Newspaper Index Hits	10	207,636	0	2,076,360
Reference Vertical File items	20	56,810	15	1,988,350
Media Monitoring items	50	1,814	15	117,910
Video/audio programmes kept permanently	50	300	15	19,500
Subtotal				7,840,728
Assumes that for all documents supplied, clients would have incurred the full purchase cost (value) plus time to locate and arrange delivery (service charge).				

Opportunity Cost				
Total number of enquiries answered x average time to answer x average client hourly rate	Queries per year	Average time	Client rate/hr	Total
	<i>No.</i>	<i>Hrs.</i>	<i>NZD</i>	<i>NZD</i>
Reference Requests	14,837	0.67	35	346,197
Economist/Statistician	1,601	3.08	35	172,588
Inward Interloans	427	0.87	35	12,952
Subtotal				531,737
Assumes that clients would have sought information themselves. Client hourly rate is based on Parliamentary library clients (MPs, Executive Secretaries, Researchers) working on average 80 hrs/week.				

In-house publications supplied	Items per year	Average time	Client rate/hr	Target Clients	Total
	<i>No.</i>	<i>Hrs</i>	<i>NZD</i>	<i>No.</i>	<i>NZD</i>
Monthly economic reviews	10	15	35	236	1,236,375
Economic bulletins	59	1	35	120	247,800
Background papers	4	75	35	120	1,260,000
Electorate Profiles	22	85	35	120	815,150
Guide to Services	1	26	35	503	457,275
Bills Digests	144	13	35	60	3,931,200
Subtotal					4,016,600
Number of target clients differs for each publication. This study assumes that all 120 MPs will use from 25% to 100% of the items produced, and that each item produced will also be used by 25% to 50% of other parliamentary staff.					

TOTAL BENEFIT RANGE (UPPER)	NZD 12,389,065
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Bradford's Law and Fuzzy Sets: Statistical Implications for Library Analyses

Stephen J. Bensman

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It was more than sixty years ago that S.C. Bradford published his first paper on the bibliometric law that bears his name.¹ Since that time much has been written on Bradford's Law of Scattering. Yet there is still much to be learned from this law. After considerable practical and theoretical research on the evaluation and utilization of scientific journals, I have come to the conclusion that Bradford's Law is actually a conflation of two concepts of vast importance in the utilization of statistical techniques in library analyses - probability distributions and fuzzy sets. As a matter of fact, this law can be considered as a mathematical description of a probabilistic model for the formation of fuzzy sets. In this paper I will discuss the statistical implications of Bradford's Law as a generator of fuzzy sets.

Bradford's Law

Bradford was Chief Librarian of the Science Museum Library (SML) in South Kensington, London. His main aim in the research, which led to the Law of Scattering, was to improve the coverage of science literature by the indexing and abstracting services. He was particularly disturbed by the gaps in this

coverage, estimating that approximately 500,000 of the 750,000 scientific articles published each year were missed by the abstracting and indexing journals. The reason for this oversight was suspected to be the manner in which the literature of a subject was distributed among the periodicals containing it. Bradford summed up the hypothesis that was investigated by the research in the following terms:

... An alternative hypothesis...is that, to a considerable extent, the references are scattered throughout all periodicals with a frequency approximately related inversely to the scope. On this hypothesis, the aggregate of periodicals can be divided into classes according to relevance of scope to the subject concerned, but the more remote classes will, in the aggregate, produce as many references as the more related classes. The whole range of periodicals thus acts as a family of successive generations of diminishing kinship, each generation being greater in number than the preceding, and each constituent of a generation producing inversely according to its degree of remoteness.²

This hypothesis was tested with two sets of references from the current bibliographies being compiled in the SML. One of the sets pertained to Applied Geophysics; the other set was constructed from references in Lubrication. In this paper I will restrict the analysis to the Applied Geophysics set, mentioning only that the results in Lubrication were basically the same. The Applied Geophysics set encompassed references for the four years 1928-1931 inclusive, and it contained 1,332 references to 326 journals. When ranked in descending order, the journals ranged from one journal receiving 93 total references to 109 journals receiving one reference each. In his report Bradford

described the results of grouping the journals in each set into the following three classes:

- (a) those producing (on average) more than 4 references a year;
- (b) those producing more than 1 reference and not more than 4 a year; and
- (c) those producing 1 reference or less a year.

Table 1 below presents the results of Bradford's description of the grouping of the Applied Geophysics journals into classes. It is evident that these results validated the hypothesis being tested. Thus, class (a) accounted for only 2.8 percent of the journals but 32.2 percent of the references; class (b) contained 18.1 percent of the journals but 37.5 percent of the references; and class (c) had 79.1 percent of the journals but merely 30.3 percent of the references.

As Table 1 clearly shows, whereas the number of journals in each class rises exponentially, the number of references accounted for by the journals in each class remains approximately the same. The picture that emerged from the data caused Bradford to give the following verbal formulation to the Law of Scattering:

...if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the number of periodicals in the

nucleus and succeeding zones will be as 1 : n : n²...²

Here it should be pointed out that Bradford never related the number of articles on a given topic in various journals to the sizes of those journals. This was a question that did not interest him, because his main aim was to coordinate the indexing and abstracting agencies' handling of titles in such a way as to ensure full coverage on any topic. His focus was therefore on the articles on a topic and how they were distributed over various titles. We are dealing, therefore, in terms of percentages of articles. However, to classify the journals in the standard way, it would be necessary to investigate the matter in terms of the journals themselves - not the articles - and to verify how big a percentage of articles in a given journal was dedicated to a given topic. It could be that the title with the most articles on a topic - particularly, a narrow topic - would be a large multidisciplinary journal with only a small portion of its articles dedicated to the topic. Here I have followed Bradford's method of classifying journals by percentage of articles for the entire topic and not by percentage articles of a given journal. Nevertheless, the assumption underlying Bradford's law as revealed by the law's phrase "a nucleus of periodicals more particularly devoted to the subject" is that of a core of journals with most of their articles devoted to a topic, and it is this assumption on which I am basing this paper.

In terms of fuzzy set theory, the important aspect of Bradford's Law of Scattering is that it demonstrated

the truth of the final point in the initial hypothesis that for any given subject set "[the] whole range of periodicals...acts as a family of successive generations of diminishing kinship, each generation being greater in number than the preceding, and each constituent of a generation producing inversely according to its degree of remoteness."

Fuzzy Sets - Zadeh

Classical set theory is based on the idea that we can make clear, exact distinctions between groups. According to this theory, we should always be able to tell exactly whether an individual is definitely in a group or definitely outside a group. In his book on fuzzy logic Kosko traces this concept back to Aristotle, whose ideas in this respect he summed up in the following manner:

Aristotle's binary logic came down to one law: A or not-A. Either this or not this. The sky is blue or not blue. It can't be both blue and not blue. It can't be A and not-A.³

"A or not-A" is a simple statement of the law of the excluded middle. In classical set operations A is assigned the number 1, whereas not-A is assigned the number 0.

Bradford certainly thought in terms of classical set theory. This is evident in a paper which he delivered in 1944 before the British Society for International Bibliography. In this paper Bradford explored the bases of the Universal Decimal Classification, defining a class as a "set of beings or things, having something in common."⁴ He utilized the system of symbols and logic presented in George Boole's book *The Laws of Thought* of 1854 to demonstrate how the human mind logically classifies things into such sets. He derived an equation, which he considered as forming the basis of Boole's calculus of logic, coming to the following conclusion:

We have, therefore, the law that "It is impossible that the same

Class	Journals		References	
	No.	%	No.	%
(a) 4+ References per Year [93 to 17 Total References]	9	2.8	429	32.2
(b) 2-4 References per Year [16 to 5 Total References]	59	18.1	499	37.5
(c) 1-0.1 References per Year [4-1 Total References]	258	79.1	404	30.3
TOTALS	326	100	1,332	100

Table 1: Bradford Journal Classes in Applied Geophysics, 1928-1931 (inclusive).

quality should both belong to and not belong to the same thing," which is Aristotle's Principle of Contradiction, which [Boole] regarded as the most certain of all principles.

The fact that this equation is of the second degree, with two roots, 0 and 1, indicates the we perform the process of classification, by separation into pairs of opposites, e.g., men and not men, and we notice that only values 0 and 1, apply to whatever class we designate by any symbol x .

Nevertheless, Bradford was well aware that "the mutual exclusiveness of classes is not always practicable."⁴

Classical sets are called 'crisp' sets in the literature in order to distinguish them from 'fuzzy' sets. The latter concept was first developed in a paper published in 1965 by Lotfi Zadeh.⁵ In this paper Zadeh described fuzzy sets and their importance thus:

More often than not, the classes of objects encountered in the real physical world do not have precisely defined criteria of membership. For example, the class of animals clearly includes dogs, horses, birds, etc. as its members, and clearly excludes such objects as rocks, fluids, plants, etc. However, such objects as starfish, bacteria, etc. have an ambiguous status with respect to the class of animals. The same kind of ambiguity arises in the case of a number such as 10 in relation to the "class" of all real numbers which are much greater than 1.

Clearly, the "class of all real numbers which are much greater than 1," or "the class of beautiful women," or "the class of tall men," do not constitute classes or sets in the usual mathematical sense of these terms. Yet, the fact remains that such imprecisely defined "classes" play an important role in human thinking, particularly in the domains of pattern recognition, communication of information, and abstraction.

Zadeh defined a 'fuzzy set' as "a class of objects with a continuum of grades of membership," and he stated, "Such a set is characterized by a membership (characteristic) function which assigns to each object a grade of membership ranging between zero and one" (p. 338). In set theory, a Set A ("the class of tall men," to use one of Zadeh's examples) is delimited as a subset of some Universe of Discourse X ("the class of all men"). According to Zadeh's concept, a membership function assigns to each member x of the Universe of Discourse X a 'grade of membership' in A that ranges from 0 (not-A) to 1 (A). He pointed out that his fuzzy sets differed from ordinary crisp ones in that with the latter the membership function could only take on two values, 0 and 1, according to as x does or does not belong to A.

In classic set operations with two sets, for example, an observation is assumed to have a membership of one in both sets, i.e. a human can be simultaneously a girl and an undergraduate and therefore is in both these overlapping sets. However, with fuzzy sets, the membership is not clear, and this can introduce all sorts of exogenous variables. Taking the example above, the girl is actually bisexual. From this one can see how fuzzy sets can complicate the relationships.

In their book on measurement in information science Boyce, Meadow, and Kraft state, "The major measurement issue associated with fuzzy sets is the assignment of the value representing the degree of set membership."⁶ According to these authors, this is often a more or less arbitrary process, and in respect to the indexing of documents they suggest two basic methods: subjectively by human indexers; or empirically by computer software on the basis of the frequency of word counts in the documents.

Bradford himself provided in his report on the Law of Scattering an empirical basis for deriving a membership function applicable to this law.⁷ The empirical basis is inherent in the method used to establish

classes (a), (b), and (c), which are shown in Table 1 above. Reviewing this process, the method was to divide the total number of references for each journal by the number of years encompassed by the sample - four years in the case of Applied Geophysics - to arrive at the average number of references per year. The classes were then defined according to the following criteria: (a) those producing more than 4 references a year; (b) those producing more than 1 reference and not more than 4 a year; and (c) those producing 1 reference or less a year. Replication of this technique resulted in quotients with no more than two decimal places, so that it was possible to establish the following class boundaries: between (a) and (b) at 4.01; between (b) and (c) at 1.01; and between (c) and the zero class, which I added and named (d), at 0.01. If one considers class (a) - which accounted for 2.8 percent of the journals but 32.2 percent of the references in Applied Geophysics - as "a nucleus of periodicals more particularly devoted to the subject," then it is possible to derive the following membership function for Bradford's sets:

If the number of references per year to a journal is greater than 4, then the membership grade of this journal equals 1; but if the number of references per year to a journal equals or is less than 4, then the membership grade of this journal equals the number of references to it per year divided by 4.01.

The number 4.01 was selected as the divisor in the second part of the membership function, because this number marked the lowest limit of the nuclei. Applying this membership function to Bradford's data yielded the results shown below in Table 2 for Applied Geophysics. In this table Bradford's classes plus the additional zero class (d) have been named in accordance with the following fuzzy set principles that show descending set membership: (a) = A; (b) = A and not-A; (c) = not-A and A; and (d) = not-A. Inspection of this table reveals that below the nucleus or class (a) the

membership grade of the journals skews rapidly downward as the number of these journals skews rapidly upward until the vast bulk of the journals can be considered to be only marginally in the Applied Geophysics set. The number of journals in the zero class (d) has been left deliberately open, as this is a complex question, which Bradford himself never successfully answered.

ford stated, "every scientific subject is related, more or less remotely, to every other scientific subject."⁸ Due to this principle, as the membership grade of the documents or journals in a given Bradford set diminishes, the way is opened for materials from other scientific disciplines and therefore for influences exogenous to this set. The result is the inhomogeneity - sometimes the extreme inhomogeneity - of Bradford sets.

tion, stating, "The classification of facts and the formation of absolute judgments upon the basis of this classification - judgments independent of the idiosyncrasies of the individual mind - essentially sum up the *aim and method of modern science*."¹⁰ According to his view variability is an essential characteristic of reality, and it plays an important role in establishing the conditions under which science operates. Thus, he wrote:

...The conclusions of the physicist and the chemist are based on *average* experiences, no two of which exactly agree; at best they are routines of perception which have a certain variability. This variability they may attribute to errors of observations, to impurities in their specimens, to the physical factors of the environment, but it none the less exists and, when it is removed by a process of averaging, we pass at once from the perceptual to the conceptual, and construct a model universe, not the real universe.¹¹

On the basis of the variability of phenomena Pearson developed a new theory, by which he replaced the traditional idea of causation with the concept of category of association. He explained the new theory in the following passage:

If we realize individuality at the basis of all existence, and sameness as a relative term depending on the fineness of classification, then we see that cause and effect ...only connote a degree of likeness, not an absolute repetition. The law of causation is a conceptual figment extracted from phenomena, it is not of their very essence. The actual problem before mankind is a far wider one than that of "causation," and may be summed up as follows: If the "causes" have such and such a degree of likeness, how like will be the "effects" be? Here in the broadest sense anything is a cause which antedates or accompanies a phenomenon, and we ask if we vary that cause to what degree we vary or change the

Classes	No. References per Year	Journals Producing References	Membership Grade (*)
(a) Applied Geophysics	23.25	1	1.000
	21.50	1	1.000
	14.00	1	1.000
	12.00	1	1.000
	11.50	1	1.000
	8.75	1	1.000
	7.00	1	1.000
	5.00	1	1.000
4.25	1	1.000	
<i>Classes a/b Boundary</i>	4.01		1.000
(b) Applied Geophysics/ Not Applied Geophysics	4.00	4	0.998
	3.75	1	0.935
	3.50	5	0.873
	3.00	1	0.748
	2.75	2	0.686
	2.50	5	0.623
	2.25	3	0.561
	2.00	8	0.499
	1.75	7	0.436
	1.50	11	0.374
1.25	12	0.312	
<i>Classes b/c Boundary</i>	1.01		0.252
(c) Not Applied Geophysics / Geophysics	1.00	17	0.249
	0.75	23	0.187
	0.50	49	0.125
	0.25	169	0.062
<i>Classes c/d Boundary</i>	0.01		0.002
(d) Not Applied	0.00	?	0.000

Table 2. Bradford's Law in Terms of Fuzzy Set Theory: Applied Geophysics, 1928-1931, inclusive.

Statistical Implications - Pearson

The inherent fuzziness of Bradford sets has major implications for the utilization of statistical techniques in library analyses. These implications derive from the principle of the unity of science, which Bradford placed at the basis of his law. "According to this principle," Brad-

This process of inhomogenization complicates what Karl Pearson once described as "the fundamental problem of science."⁹ Pearson described the essence of this problem in the 1911 edition of his *The Grammar of Science* in the chapter in which he introduced to the broader public the new concepts of contingency and correlation. In his approach to science, Pearson started out from the principle of classifica-

phenomenon. If we say that variation of the cause produces no effect on the phenomenon we have absolute independence; if we found variation of this cause absolutely and alone varied the phenomenon we should say that there was absolute dependence. Such absolute dependence of a phenomenon on a single measurable cause is certainly the exception.... It would correspond to a true case of the conceptual limit-of whose actual existence we have our grave doubts. But between these two limits of absolute independence and absolute dependence all grades of association may occur.¹²

Pearson placed "the fundamental problem of science" within this context of classification and variation, writing:

The universe is made up of innumerable entities, each probably individual, each probably non-permanent; all man can achieve is to classify by measurement or observation of characteristics these entities into classes of *like* individuals. Within these classes variation can be noted, and the fundamental problem of science is to discover how the variation in one class is correlated with or contingent on the variation in a second class.¹³

Pearson illustrated the new theory with a scatter diagram plotting variable A against variable B. The points on the diagram were scattered in the general shape of a curve. According to him, a physicist would handle the diagram by photographing it from 50 yards off or looking at it through an inverted telescope. By such methods the scattered points reduce to a smooth curve, and actual experience is replaced by mathematical function. Pearson then utilized the scatter diagram to sum up the relationship of causation to correlation thus:

Take any two measurable classes of things in the universe of perceptions, physical, organic, social or economic, and it is such a dot or scatter diagram.... In some

cases the dots are scattered all over the paper, there is no association of A and B; in other cases there is a broad belt, there is only moderate relationship; then the dots narrow down to a "comet's tail," and we have close association. Yet the whole series of diagrams is continuous; nowhere can you draw a distinction and say here correlation ceases and causation begins. Causation is solely the conceptual limit to correlation when the band gets so attenuated, that it looks like a curve.¹⁴

From the perspective of his new theory, Pearson criticized the old view of cause and effect in the following manner:

... Any variation within the existences in one class is found to be associated with a corresponding variation among the existences in a second class. Science has to measure the degree of stringency, or of looseness in these concomitant [sic] variations. Absolute independence is the conceptual limit at one end to the looseness of the link, absolute dependence is the conceptual limit at the other end to the stringency of the link. The old view of cause and effect tried to subsume the universe under these two conceptual limits to experience--and it could only fail; things are not in our experience either independent or causative.¹⁵

Since both his contingency coefficient and his correlation ratio designated absolute independence with 0 and absolute dependence with 1, it is evident that Pearson also was interested in the fuzzy area between 0 and 1, i.e., the fuzzy area of the excluded middle.

Outliers - Barnett and Lewis

Pearson's process of statistical inference through the measurement of the effect of one set upon another is complicated by the fuzziness of Bradford sets through the mechanism of outliers. Beckman and

Cook describe an outlier as "a subjective, post-data concept,"¹⁶ and this assessment is shared by Barnett and Lewis in a book that can be considered the standard treatment of the topic. In this book Barnett and Lewis define an outlier in a set of data to be "*an observation (or subset of observations) which appear to be inconsistent with the remainder of that set of data.*"¹⁷ They then set forth the critical issue involved in outliers thus:

The phrase 'appears to be inconsistent' is crucial. It is a matter of subjective judgement on the part of the observer whether or not some observation (or set of observations) is picked out for scrutiny. What really matters is whether or not some observations are *genuine members* of the main population. If they are not, but are **contaminants** (arising from some other distribution), they may frustrate attempts to draw inferences about the original (basic) population.¹⁸

Barnett and Lewis closely connect the problem of outliers with assumptions about the probability distribution underlying the population. An observation, which may appear to be an outlier under the assumption of a normal distribution, would not arouse any special concern if the observer were expecting a highly skewed distribution of the type to which biological, social and information data usually conform. Therefore they set as the null or working hypothesis of any discordancy test for outliers some basic probability model for the generation of all the data with no contemplation of outliers. If significant evidence is found for the rejection of the working hypothesis, Barnett and Lewis indicate a number of "contamination" or "outlier-generating" models that may serve as alternative hypotheses.

Of these alternative hypotheses two have the most relevance for this paper. The first is what they call the "deterministic alternative," which covers the case of outliers resulting from gross human errors of measurement, recording, etc. The sec-

ond Barnett and Lewis term the "mixture alternative," where it is posited that the sample under investigation reflects contamination from a population other than that represented by the basic model and that such "foreign" sample members, or contaminants, are showing themselves as outliers.¹⁹ Given the rapidly diminishing membership grade of members of a Bradford set and its concomitant rapid opening to such contaminants, the "mixture alternative" is of the utmost import for statistical analyses of library data.

Practical Demonstration

I now give a demonstration of the above concepts by utilizing data resulting from a project to restructure the serials holdings of Louisiana State University (LSU).²⁰ As part of the preparations for this project the faculty of the LSU Department of Chemistry were surveyed in April 1993 on their serials needs. Here it is necessary to emphasize that only the faculty of the Department of Chemistry were surveyed; the Departments of Biochemistry and Chemical Engineering were not included in this survey. The LSU Chemistry faculty were asked to identify those serials important to them for research and teaching purposes from the entire serials universe, without restricting themselves to the ones on subscription at LSU. Their selections were classified according to the subject categories assigned them in the 1993 *Science Citation Index Journal Citation Reports (SCI JCR)* published by the Institute for Scientific Information (ISI).²¹

In conformance with Bradford's Law of Scattering the LSU Chemistry faculty's journal selections ranged over numerous ISI subject categories, among which were the following: Engineering, Electrical and Electronic; Environmental Sciences; Geosciences; Materials Science, Ceramic; Nutrition and Dietetics; Physics; and Radiology and Nuclear Medicine. Due to this, it was decided to restrict the sample only to those journals that were

classified by ISI in the various branches of Chemistry, including Chemical Engineering as well as Crystallography. As an exception, the ISI subject category Spectroscopy was also included due to the emphasis of the LSU Department of Chemistry on it, even though this discipline is generally considered part of Optics within Physics. The final result was a sample of 154 journals.

Three quantitative variables were employed to measure the scientific value of these 154 journals: LSU Faculty Score; Total SCI Citations in 1993; and 1993 SCI Impact Factor. Of these measures, only the first two were found to be valid.²² LSU Faculty Score was considered to be the key measure of scientific value, because the logic of the journal set had been defined by a survey of the Department of Chemistry as well as for philosophical reasons. It was derived in the following manner. The Chemistry professors had been requested to name ten titles, state whether these titles had to be on campus or could be accessed through remote document delivery, and then to rank the titles in descending order from 10 to 1. A title was scored in the following manner: 10 points each time it was selected by a professor; another 10 points if the professor stated that it had to be on campus; and the points from 10 to 1, depending on the rank the professor assigned it. Twenty-five Chemistry professors responded to the survey, and the 154 journals ranged in LSU Faculty Score from 10 to 755 for the *Journal of the American Chemical Society*.

To validate the LSU Faculty Score, I correlated it with Total SCI Cita-

tions to determine how well LSU faculty ratings corresponded to the opinion of the publishing segment of the scientific community. It was in performing this operation that I came across a severe outlier problem. Table 3 below gives the distribution of both variables over classes defined by quartiles. This table clearly shows that we are dealing with a distribution of the Bradford type, as the upper end of the distributions account for most of the value. Thus, in Bradford's Applied Geophysics set 2.8 percent of the journals accounted for 32.2 percent of the references, and here the upper quartile class accounted for 62.5 percent of the 154 journals' combined faculty score and 80.2 percent of their total citations.

The frequency distributions of the faculty score and total citations are graphically shown below in Figures 1 and 2, which clearly manifest evidence of the presence of contaminants from a population other than the one being modeled by LSU Faculty Score. The contaminants are not revealed by the extreme observations on the right, which are a usual occurrence in distributions of the Bradford type, but in the relative positions of the *Journal of the American Chemical Society* (Faculty Score - 755; Total SCI Citations - 148,900) and the *Journal of Biological Chemistry* (Faculty Score - 197; Total SCI Citations - 231,324). In Figure 1, which shows the frequency distribution of the 154 journals by LSU Faculty Score, the position of the *Journal of the American Chemical Society* on the extreme right fits the logic of the set and is not surprising. However, in Figure 2, which depicts the distribution of these journals by Total SCI Citations, the position of the *Journal of*

	LSU FACULTY SCORE		TOTAL SCI CITATIONS	
	Quartile Class Range	% Faculty Score for All	Quartile Class Range	% Total Citations for All Journals
Upper	755 to 111	62.5	231,324 to 11,685	80.2
Upper Middle	110 to 50	20.6	11,586 to 3,305	13.4
Lower Middle	50 to 33	11.1	3,285 to 1,533	4.6
Lower	32 to 10	5.8	1,526 to 255	1.8

Table 3. Distribution of 154 Chemistry Journals in Descending Order by LSU Faculty Score and Total SCI Citations over Classes Defined by Quartiles.

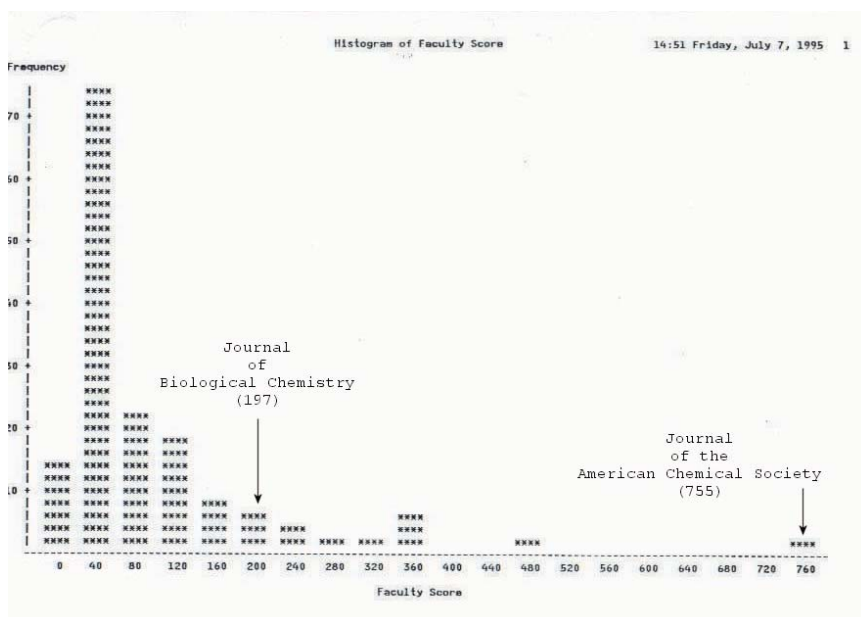


Figure 1. Frequency Distribution of 154 Chemistry Journals by LSU Faculty Score.

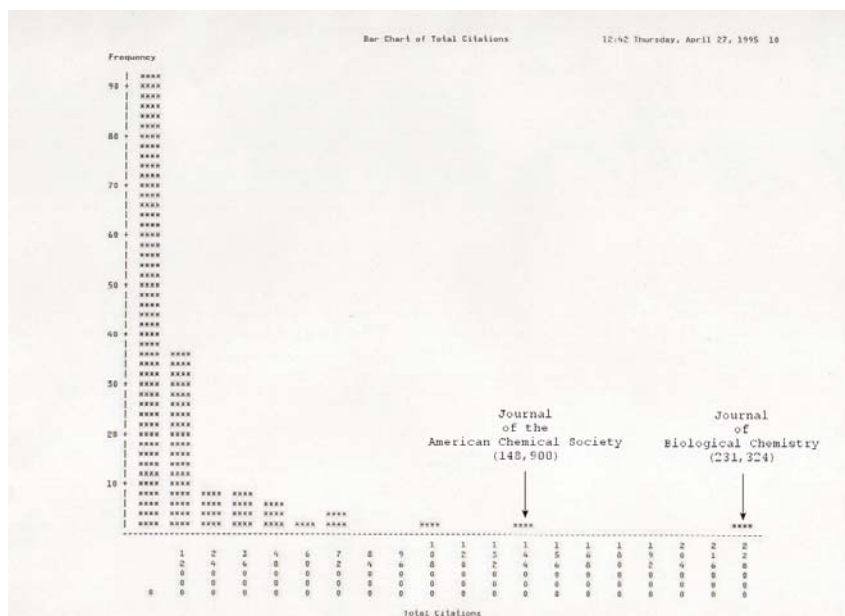


Figure 2. Frequency Distribution of 154 Chemistry Journals by Total SCI Citations.

Biological Chemistry to the right of the *Journal of the American Chemical Society* is surprising and discordant, as it does not fit the logic of the set.

The *Journal of Biological Chemistry* has the definite appearance of being an outlier, and this suspicion is confirmed in Figure 3, which is a scatter diagram plotting LSU Faculty Score against Total SCI Citations. In Figure 3 a hypothetical regres-

sion line drawn from the *Journal of the American Chemical Society* to the origin goes directly through the middle of the points, whereas a line drawn from the *Journal of Biological Chemistry* to the origin is below and to the right of all the points. When I constructed this set, I considered Biochemistry to be a branch of Chemistry. My decision in this respect was influenced by the treatment of Biochemistry by the Library of Congress classification

schedules as a subset of Organic Chemistry within Chemistry. However, the position of the *Journal of Biological Chemistry* made me suspect otherwise. Subsequent research confirmed this suspicion. Unlike the Library of Congress schedules, the Dewey Decimal Classification has Biochemistry not as a subset of Chemistry but of Biology and Life Sciences. Moreover, not only does LSU have separate departments for Chemistry and Biochemistry, but, in the most recent ratings of US research-doctorate programs by the National Research Council, Chemistry was classified under the rubric of Physical Sciences and Mathematics, whereas Biochemistry was combined with Molecular Biology and placed in the Biological Sciences.²³ Thus, the *Journal of Biological Chemistry* together with a number of other biochemical journals was in my set as a result of the fuzziness of Bradford sets. The *Journal of Biochemistry* was both A and not-A, both Chemistry and Biochemistry, as well as who knows what else.

Methods for Handling Outliers

Barnett and Lewis group the methods for handling outliers into four general categories.²⁴ There are no hard and fast rules for determining which category of methods should be utilized, because everything depends upon how the outliers arose and the purpose one is trying to accomplish. Barnett and Lewis term one of their categories **rejection**. By this they mean that one discards the outliers, if these cannot be corrected, and then subjects the remaining sample to analysis. This is in effect what I did, when I found five outliers in performing the Pearson product-moment correlation between LSU Faculty Score and Total SCI Citations.²⁵ Analysis of the residuals revealed five outliers, of which four had a low faculty score in respect to their total citations. Two of the latter outliers had been classed by ISI in Biochemistry and Molecular Biology. The initial correlation coefficient was 0.66, and removal of the outliers from the

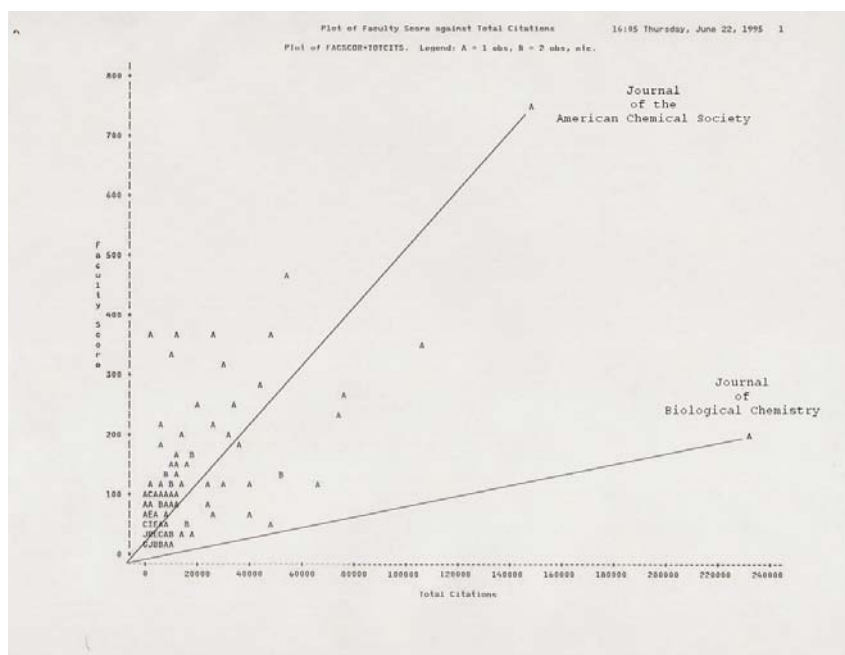


Figure 2. Frequency Distribution of 154 Chemistry Journals by Total SCI Citations.

sample raised this coefficient to 0.72.

A second category of methods for handling outliers is called by Barnett and Lewis **identification**. By this they mean that one should study the discordant outliers as a sign of some unsuspected factors at work in the population under analysis. I also did this, coming to new conclusions on the relationship of Biochemistry to Chemistry. Whereas I first thought of Biochemistry as a branch or subset of Chemistry, I now came to regard it as a separate discipline or set with its own statistical patterns.

Another Barnett and Lewis category of outlier procedures is **incorporation**. The aim of this type of procedures is to replace one homogeneous model with another homogeneous model for the entire sample (incorporating the outliers), in relation to which no observations appear discordant.

The fourth and final category of Barnett and Lewis for handling outliers is **accommodation**. This category is divided by them into two components. The first component contains procedures that are 'robust' or retain reasonable validi-

ty in the face of outliers. An example of a robust procedure would be to utilize the chi-square test of independence instead of correlation techniques to investigate the relationship of LSU Faculty Score to Total SCI Citations. The chi-square test of independence was pioneered by Karl Pearson on the basis of contingency. Whereas correlation techniques entail the precision of a mathematical function in that they measure either the fit of the data points to a regression line, in the case of the Pearson product-moment correlation, or the relationship of one specific rank to another specific rank, in that of the Spearman rank-order correlation, it is possible to test the correspondence of variables to each other within broad categories with the use of the chi-square test of independence. This possibility is evident in Table 3 above, where it can be seen that the *Journal of the American Chemical Society* and the *Journal of Biological Chemistry* fall in the Upper Quartile Class on both measures of scientific quality.

The other component of **accommodation** encompasses those methods that protect against outliers by placing less importance on extreme values than on other sample members.

One such method could be Winsorization, whereby an extreme observation is replaced by its nearest neighbor. By this technique the *Journal of Biological Chemistry* would be assigned the same number of total citations as the *Journal of the American Chemical Society*. However, perhaps a better method of the latter component of **accommodation** would be to apply fuzzy set theory to the handling of outliers. The application of this theory would be empirical in nature and depend on the logic of the set under analysis as well as the purpose of the research. Its main aim would be to adjust the outliers to be proportionate to their membership in the set. In terms of the example being used, one way to accomplish this would be to empirically derive a membership function off LSU Faculty Score and to use the resulting membership grade to adjust the Total SCI Citations of the outliers. Another method could be to analyze the ISI database and restrict the citations only to those that pertain to the logic of the set. From this it can be seen that probability theory and fuzzy set theory are not antagonistic but complementary forms of analysis.

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The Use of Citation and Other Statistics in Stock Management

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Introduction

There is to my knowledge no library that has all the money it wants; with the increase in journal and book titles published and the still greater increase in journal



prices, libraries want to make the best use of what money they have. There are few that have not had to cancel journal subscriptions, in some cases drastically - sometimes making a *post-hoc* justification of principle - "we are moving from a holdings to an access strategy". At the same time there is pressure from users to acquire new titles, and often pressures on space. So libraries regularly have to make decisions on what to acquire and discard, and, in the case of journals, what to discontinue.

Book Selection and Disposal

Books pose quite different questions for the selector from journals. It is impossible to anticipate what books will be used, apart from some obvious reference books and, in academic libraries, titles recommended to students by lecturers (and even they often receive little use). Studies some years ago in two academic libraries in the United Kingdom, neither of them at all

affluent, indicated that some 30 percent of books acquired were not used in the two years after their purchase (Line, 1986); in one subject in one of the institutions the figure was 47 percent. It is true that a relatively small number of prestigious publishers account for a high proportion of above-average books, but these publishers also publish too much for any but very rich libraries to buy them on blanket order. The only fully reliable way - an expensive way - to find out what is going to be used is an empirical one: to buy a fair range of likely books, see what happens to them, and discard most of them that remain unused after, say, four or five years. There would be a further incidental advantage, in that a wide range of current material permits extensive browsing.

Selection for disposal of existing book stock can be done by examining past borrowing usage; this is much easier to do now with automated records. Citations are of no use for either selection or disposal (although Burdick, 1989, argues that citations to books identified as candidates for disposal constitute a useful check on disposal decisions); the scatter of books cited is far too wide, few books are cited more than ten or twenty times, most of them established classics (Budd, 1986), and citation data is available much too late to be of any use for current selection. The nearest approximation to citations is book reviews, which are in fact extensively used for selection in all types of library. However, they are guides (albeit uncertain ones) to books that libraries 'ought' to have, not necessarily to ones that will actually be used.

Journal Selection and Disposal

This paper is however concerned almost exclusively with journals,

and with academic and research libraries; public libraries take relatively few journals, and the great majority of those they do take are not generally cited. The fact that most journals qualify as research journals does not of course mean that they are used exclusively by researchers; students are now frequently expected to consult them as well.

Decisions on journals are of three kinds: what current journals to cease subscribing to (de-selection); what journals to acquire that are not currently acquired (positive selection); and what back runs to discard (disposal). Decisions of the first two kinds are customarily made by academic (or research) staff in conjunction with library staff, the balance of responsibility varying with the institution. In the days long ago when there were many fewer journals and relatively more money, this system did not work too badly, and few decisions were actually made: inertia ruled. But for more than three decades more valid and reliable methods have been sought, based on real needs and usage, as opposed to what users say they need and use. It is a common experience to find that titles that were stated to be essential by a professor were not in fact used more than three or four times a year. (In my first few weeks as a university librarian many years ago I was berated by a professor of chemistry for ceasing to subscribe to a certain title, which he said he used all the time. Where he used it, or if he did at all, was not clear, since in fact the library had never taken the title in question!)

Most research libraries in the United Kingdom and the United States have a high proportion of their stock on open access, in contrast to most European libraries. This obviously affects the nature if not the volume of use made of journals. However, there are very few if any libraries that do not have current issues on open access, which often extends to ex-current issues belonging to the same volume. This article, in assuming open access, therefore does not relate to back runs of jour-

nals in many European libraries, but it is relevant to current issues in the great majority of libraries.

No-one questions that the most accurate initial way of deciding what to continue acquiring or to discard is to collect detailed figures on the actual use of titles in stock, by date (so as to know whether back runs beyond a certain date can be discarded): 'initial', because as well as the number of uses the cost must be known if the budget is to be optimized, and because certain titles may be so absolutely vital that they must be acquired at almost any cost (one of the criteria for absolute necessity may be that a powerful professor publishes in it). Uses are hard to measure, and just as hard to assess: they may range from a quick browse through the latest issue to a thorough reading of an article.

As for ascertaining what to acquire, there is always some demand for titles not held; this may reach (or be supposed to reach) a level where their acquisition is considered. Demand can be measured by requests for remote supply; but this is impossible to gauge precisely for several reasons: 'self-mediated' remote requesting may not be reported; wanted items may not be asked for although they would have been used if they were present; and estimates of their likely use for browsing are obviously not possible. With these provisos, a rough calculation can be made by analysing demand from remote sources, including interlibrary loans and if possible uses made elsewhere, for example in a nearby library (several chemists at the aforementioned university made a good deal of use of the library of the Royal Society of Chemistry). Ideally - though in fact a good distance short of the ideal - as comprehensive a collection of data concerning use and demand should be made.

In view of the above problems, starting with the collection of valid and reliable data, it is not surprising that librarians have resorted to minimal changes and intelligent guesswork - which may actually

work out quite well; or they have used some kind of user voting system, preferably with the cost stated against each title; or, unwilling to give up on statistical measures, they have sought surrogate data in the shape of citation data. A good deal of such data is now available, thanks to ISI; in particular, there are rank lists of titles in order of citations received and also in order of impact factor; but while the latter may measure the quality of a title it is not of much use for the purpose in question, which is to get value for money.

The Uses and Weaknesses of Citation Data

There are two main issues concerning the use of citation data as a surrogate for use data. The first is how far citations represent uses in general. Obviously there is a huge overlap between uses and citations, but it is known that researchers sometimes cite papers they have not read (some notorious studies have shown that spoof citations deliberately placed in one article have been slavishly copied into subsequent papers). More seriously, citations represent only a tiny percentage of uses; the average number of citations per science article is around nine or ten, whereas the average number of *readings* is between 800 and 1,800, depending on the subject (Tenopir and King, 2000). It might be argued that the uses that have not turned into citations may be of less value, but the fact remains that the uses were made - and the reason why they were not cited may be either forgetfulness or because they did not support a particular point, or simply because not every piece of research turns into a publication (even today). Also, the length of time over which uses occur is a good deal longer than in the case of citations (Guitard, 1985). In fact, as Garfield has stressed, citations do not directly measure uses, but quality and importance. It is incidentally odd that the difference (or similarity) between uses and citations is still a matter of debate; I have yet to see a decent comparison between uses and citations.

Bensman (2001) has shown convincingly that rank lists based on citations correlate closely with those based on supralibrary use - in the process proving Scales (1976) and myself wrong. 'Supralibrary use' is the aggregate uses of all libraries, at any rate in developed countries (which are far better represented in ISI's data than less developed countries, and are far more likely to have better journal collections). So it might be said that, whatever the precise relationship of citations to uses, they represent uses reasonably well for management purposes. Bensman argues for the universality of the phenomenon. Others have argued for their use in collection management, not least because they are easy to collect (Pan, 1978; Broadus, 1985a).

However, it is not an aggregation of libraries that needs management data but individual libraries, and here the closeness of match is in much more doubt. A special library will not only be interested in only a small subset of journals; within that subset it will probably have special interests. Its researchers will know perfectly well which core titles they need; they will also know the area around the core, through citations in other articles they read. Beyond that the subset of relevant titles in the ISI data will tell them nothing useful, except perhaps to draw attention to hitherto unfamiliar titles that might be worth looking at for positive selection (Line, 1977).

Similar points apply to academic libraries. Library uses in a large university with a full range of disciplines approximate quite closely to aggregate use and citations (Urquhart and Urquhart, 1976), but even here there will be exceptions because of highly specialized fields of research in certain departments. By the time exceptions - excisions and additions - had been made to the citation rank lists the researchers could almost certainly have made a better list themselves. In smaller universities, the same would apply with greater force. Moreover, the top titles choose themselves, as do the titles that are definitely not wanted; it is those in

the middle, potential candidates for acquisition if money permits, that the librarian needs to know about, and here citation rank lists tell him little, partly because the numbers of citations they receive do not differ very much from title to title, partly because the rank order varies somewhat from year to year.

Some studies (e.g. Singleton, 1976) have shown poor correlations between uses and citation data; the fact that others (e.g. Baughman, 1974) have shown quite good ones may be due to chance, or to close relationships at the top level of the rank lists, which masks weaker ones lower down the list. Even those who have advocated the use of citation data (e.g. Stankus and Rice, 1982; Wiberley, 1982) added that it needed to be handled with care. There was quite a debate about this in the literature in the late 1970s and early 1980s (see e.g. Line, 1977, 1978; Broadus, 1985b; Line, 1985). The fact that little has been written since may mean no more than that people grew tired of the issue, and went on doing what they had been doing before - which was probably relying on intelligent guesswork and the recommendations of researchers.

The above refers to citations as made by authors everywhere and recorded by ISI - not quite a comprehensive collection, but a reasonable approximation to one. Citations as made by a library's users ought to be more useful; and as Kreider (1999) has shown, local citations correlate well with aggregate citations. They can be extracted from their published work; every university perhaps ought to keep a central file of publications (though few do). Otherwise they can be hunted out, or researchers can be asked to provide lists of all works cited, though this may not produce a very good response. Once again, it has to be borne in mind that citations are not uses; numerous items may be used without being cited, especially those used for teaching purposes. A point in favour of citations is that the great majority represent *useful* uses, since many uses prove fruitless. However, the

biggest argument against using citations is that they are likely to show some bias towards the existing local collection, *and* thus to confirm the status quo. An ideal solution might be to collect citations *and* uses; items that are cited and used are almost certainly useful. However, like most ideal solutions, it is impracticable: it is difficult enough to collect local citations, and even harder to collect uses.

Comparisons between local citation and use data (i.e. data on remote use or use in other libraries) would be particularly useful when considering not what to continue acquiring (inertia selection?) but what to newly acquire. If the relationship is a good one, local citation data could be used with more confidence. Other information that should be used is data on remote demand (including interlibrary loan and photocopying), but as noted this is much harder to collect comprehensively than it used to be when all or nearly all such demand went through the library. In the absence of any good alternative, highly cited journals in areas of interest could be regarded as potential candidates; if these were acquired in consequence, they should be placed on probation for a year or two (longer in the humanities and social sciences).

Analysis of Data

What to do with the data collected - assuming it can be? It can of course be used 'raw', but this does not produce a cost-effective solution. The journals ranked highest are much the same as those that are largest and possibly those that are most expensive, though Bensman and Wilder (1998) argue that cost is negatively associated with quality, because the quality journals (at least in the USA) are published by learned societies, which do not seek large profits. This incidentally suggests that size (and possibly cost) might be as useful a selection guide for science journals as citations received. (I have not seen any correlation calculated on the rank lists produced by (a) citations received,

(b) cost, and (c) size; it would be interesting to see one done.)

The **number of uses per unit of cost per journal per year** is the ideal measure for current selection purposes. The number of years of each journal used that is included can be restricted to the last twelve months, or extended to five years. To the purchase cost should ideally (that word again!) be added the costs of processing (higher for journals with many issues per year), of binding (the larger the journal the more volumes per year), and of keeping (again, size incurs costs); but in practice the extra (non-purchase) costs would be roughly proportionate to the purchase cost, and so would not change the rank order much. It might also be useful to know the number of *users* per journal, since while a given title may receive a lot of use, it may be made by only one user, and would thus normally be rated lower in the selection stakes than the same number of uses made by ten users.

Current selection is one thing; disposal of back runs is another. The main reason for disposal is shortage of space, and the consequent need to save space and/or build new storage space; but there are costs involved in simply keeping items on the shelves, and there may be benefits for users in less cluttered shelves, particularly in the case of books. For purposes of disposal, the ideal measure, which is as valid for books as for journals, is the **use per unit of shelf space occupied** (Line and Sandison, 1975). The cost of keeping may be in the order of GBP 1.00 per centimetre per year (it will vary according to local factors such as the site and density of shelving); this can be compared with the one-off cost of disposal and the cost of obtaining the item from elsewhere if wanted. Since, as noted above, uses have a longer life than citations, citations have to be used with extra caution, if any library is unwise enough to use them at all. It should be added that if a title is not considered worth acquiring currently, its older volumes ought to be prime candidates for disposal.

For both deselection and disposal, citations *can* be used as surrogates for uses, but not safely, and not in an institution's specialist areas - and less safely for disposals than for deselection. Libraries with sizeable budgets, or with no time to collect local use data, may consider their approximation to uses close enough to risk using them. For positive selection they can identify candidates for acquisition about as well as alternative measures.

Other Methods of Obtaining Data on Use

In fact, decisions on selection do not need to be made on most titles. In most university libraries doubts can be confined to at most a third of the serials it acquires, and data need be collected only on these. Data collection can be by one of the various methods suggested in the literature (see Ford, 1990, and Poll, 2000), of which the following are a selection:

- borrowing records
not usually possible because few libraries permit recent issues to be borrowed; do not cover in-library use
- slips in current issues for users to mark when they consult them: they may forget or not bother - or mark it more than once if it is of special interest to them; and as noted earlier
unreliable and subject to forgetfulness and false reporting; can easily be 'fiddled' by users wanting to keep a particular journal; cannot indicate whether the consultation is a quick look, a full reading of an article, or something in between, though the slip can ask users
- putting a thin strip of gum over the fore-edge of each current issue, so that it is clear when it is opened (needs to be checked and if necessary re-gummed three or four times a day)
reliable; quite staff-intensive if checks are made often enough; open to some 'fiddling'; same problem as above with regard to type of use

- asking users not to re-shelve issues used, and frequent checking of issues left on tables
unreliable; open to some 'fiddling'; same problem as above with regard to type of use
- photocopying records
of very limited use, because they are only a partial record of use, even if copying records are complete
- closed storage for a limited period of recent volumes or current issues, with markers in their place saying that they are available on request.
very reliable, and not time-consuming; does not indicate type of use, but there is a strong presumption of full reading; has to be handled carefully in order not to antagonize readers, but it can be done a few journals at a time.

The last seems to me by far the best on almost every count.

However, a warning note must be sounded. Whatever rank list emerges from whatever method of collecting data on use or surrogates for use, selection can not be optimized unless the costs of purchase are compared with those of remote access, whether by traditional document supply mechanisms or by online access (see e.g. MacDougall and Woodward, 1988). This is not a straightforward issue, since (as noted above) use of stock on site cannot be compared directly with remote use. Nevertheless, efforts should be made, and they too rarely are. Some recent estimates are summarized in Spiller (2000, chap. 9).

The Electronic Future

Most of the above discussion assumes a traditional library, with hard copies of journals on (or off) the shelves. But the traditional library is turning into a 'hybrid' library with more and more journal articles accessible remotely by electronic means. Is the debate going to become irrelevant when the emphasis is on articles rather than journals?

Just as there are large differences between journals in the uses they receive, so there are large differences between the number of uses received by articles within journals. The most used and cited journals are almost all the biggest ones, at least in science, technology and medicine; but 90 percent of use falls on a small minority of articles (the distribution is wider in the humanities and social sciences). This means that libraries that acquire the most used journals are nevertheless acquiring more waste paper than they are in the case of smaller and cheaper journals with a similar (or even greater) concentration. For example, of 400 articles in a high-ranking physics journal, fewer than forty might account for 90 percent of use in a given library, leaving 360 articles not earning their keep (and probably at least 250 altogether unused); whereas a middle-ranking history journal with forty articles of which only two were used would leave thirty-eight unworthy of retention. If the cost of the first journal was GBP 4,000 and of the second GBP 20, the 'worthy' articles would cost GBP 100 in both cases - but the non-purchase costs of the first would be far higher. This problem - a very expensive one - of waste paper acquisition ought to be one of the first to be solved by the electronic era.

I argued many years ago (Line, MacGregor and Sandison, 1972) that this concentration of use within journals presented an opportunity for publishing a collection of key articles more than, say, five years old from a given journal. This would benefit users, libraries (which could buy it instead of an entire set, if indeed one could be bought, or discard a large run if they already held it), and the publishers who would sell it. Here citations could be used to identify the key articles, since their selection would have to be made on a universal basis, without regard to any individual library. The suggestion was never taken up, and it is now presumably irrelevant in the age of instant(?) access to individual articles. It is also doubtful if key articles selected on aggregate citation

data would represent local use; the probability that any article used locally once will be asked for again seems to be surprisingly low, to judge from a study in one medium-sized university in the UK (MacDougall, Woodward and Wilson, 1986). These results need to be tested against similar studies in a few institutions of different sizes.

In an online world, citation data could easily list the most cited articles in given subject fields. This would however be of potential use only if libraries were able to acquire these articles and store them locally for subsequent use; and it makes the assumption that the most cited articles as listed by ISI would be very similar to those most wanted in an individual library: a much more doubtful assumption than that the most cited journals would be wanted. Also, the probability that publishers would permit local storage for subsequent use is very low. It would be equally easy to identify the articles that were most often accessed worldwide, but it is unlikely that this information too would be made available; and there would be the same problem of local relevance.

In both the above cases the information would often not be available in time before the articles were wanted locally (if they were wanted at all). It might be more useful for libraries to collect and store for future use articles as they were actually demanded locally, but unless such demand were channelled through the library comprehensive data collection would be difficult, and in any case storage of articles for this purpose would certainly not be permitted by commercial publishers. However, the most telling argument against any of these solutions is the apparently low probability of repeated use (see above).

Although the practical value of identifying heavily used or cited articles by discipline may be questionable, intellectually it would be of considerable interest. If this were done, the use curves over time of the articles in question should also

be calculated. One article might receive a great many uses in the two years after publication and few thereafter, while another article might receive fewer uses over a much longer period; it would be much more useful to store the second than the first.

Conclusion

Decisions on journal selection and disposal should be made on as rational grounds as possible. However, 'ideal' solutions are virtually ruled out by the time, effort and cost involved in collecting the necessary data on use. In practice, the effort can be much reduced. For about two-thirds of the journal titles taken by most libraries, there is so little doubt that it is not worth collecting any data at all. For the rest, temporary closed access is a relatively cheap and simple method of obtaining data on demand, and it is not very difficult to add cost data. Back runs of titles that are discontinued can nearly always be disposed of. It is not clear that citation data are useful surrogates for use data, but in any case they do not need to be used except in the case of potential new candidates for purchase, where other reliable data are very hard to collect.

Is it worth pursuing the quest for surrogates for good use data? I believe it is, since while it is doubtful if the quest would give us a definitive answer there is always the possibility that it may; and if the certainty of useful results were used as a criterion little research would ever be done. So I would like to see comparisons between rank lists of journals in order of:

- citations received as recorded in ISI
- local uses received
- local citations received
- purchase cost
- size (number of pages)
- local uses per unit of cost
- local citations per unit of cost
- informed guesswork by academic staff
- informed guesswork by library staff.

It should go without saying that the cost of applying each of these methods would be calculated, and subtracted from any savings made in comparison with other methods.

I recognize that having *all* of these comparisons done is altogether too much to ask for; but surely comparisons could be made between some at least of these? And - who knows? - it might turn out that intelligent guesswork, informed by experience, is as good as any of the other methods; certainly it is the cheapest.

As for articles rather than journals, it would be interesting to compare:

- aggregate uses (i.e. articles accessed) with aggregate citations
- aggregate citations with local uses
- aggregate uses with local uses
- local citations with local uses.

Finally, I would like to see book reviews - number received, nature and strength of recommendation - compared with use of the books in libraries. One would expect good reviews to influence use for a year or so, but this influence should gradually fade gradually after that.

It is rather absurd that arguments about the some of above issues have gone on for two or three decades when research could help to answer them. As always, statistics rarely provide definitive answers to any question, but they can narrow down the area of uncertainty, in many cases to negligible proportions.

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The New German National Statistics for Academic Libraries

Roswitha Poll

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In Germany nationwide statistics for academic libraries started in 1902. The yearly overview began with seventy-nine categories, which by 1985 had expanded to 448. Until 1998 the statistics were published annually in paper form by the German Library Institute, Berlin; year 1999 is available in electronic format.

In 1999 a working group started to revise the statistics. This revision is now finished, and data collection in its new form will start in 2002.

The main reasons for the revision were:

- to move from collection-oriented measures to use-oriented data
- to include the services and products of the 'digital library'
- to reduce the statistics of traditional resources or services, or to make them optional.

The goal was to make the national statistics an instrument:

- for internal library management (setting priorities, allocating resources, optimizing services)
- for the justification of costs
- for benchmarking on a regional, national and international scale.

The working group relied very much on the new ISO draft for

International Library Statistics. It also took into consideration all the suggestions and problems concerning statistics over the last four years. In addition to electronic products and services, other areas had been found missing or under-represented, e.g.

- cataloguing data
- preservation
- a differentiated listing of income and expenditure
- forms of use other than circulation.

Sampling

The old library statistics contained no sampling procedures: all data had to be collected over the full year. Data were collected from different sources:

- manually (collection, weeding, seats)
- turnstile count, electronic counter (visits to the library or to certain library areas)
- automated system (issues, additions to stock, cataloguing records).

As one of the main goals was to include all forms of use in the statistics, it was deemed necessary to allow sampling procedures in order to keep the amount of effort reasonable. Sampling is now allowed for counting:

- library visits (if counted manually)
- reference questions
- inhouse use.

The working group was especially concerned to include a count of inhouse use in the national statistics. As yet not many libraries count this form of use; but in open shelf areas it may come out even higher than circulation, and the need to justify library costs makes it vital to include such an important service in the statistics.

Optional Data

In the old statistics all categories were compulsory for libraries - as far as the topic was relevant to them.

As many new categories had to be introduced in the context of electronic services, the group tried to 'slim' the questionnaire by making some questions optional. One example is the collection. The questionnaire asks for:

- bound volumes (with some differentiations)
- other print material.

A library may stop here, but it can differentiate 'other print material' as to:

- cartographic documents
- printed music documents
- single sheet material
- patents
- standards.

This differentiation follows the old statistics, so that libraries with many types of document in this sector can continue to count them.

Cataloguing Data

Cataloguing was not represented at all in the old statistics. As it constitutes a considerable part of the background services, the most important data are included in the new statistics as follows:

- cataloguing of new titles in the collection
 - of these copy-cataloguing
- retro-cataloguing (titles)
 - of these copy-cataloguing
- corrections, revisions of titles
- subject-cataloguing (titles)
 - of these new subject headings in the standard list
- systematic cataloguing (titles)

Library Area

This is another issue that had been missing in the old statistics. It was deemed important to include the main data for the space available

for library functions. The questionnaire asks for the net area as to:

- user services
- acquisition/cataloguing of media
- administrative functions
- stacks (open access areas are counted in 'user services').

Income and Expenditure

The library's budget and its expenditure had been counted in broad categories in the old statistics. Libraries today - like other institutions - are forced to look for additional funding and self-generated income, and to make their expenditure transparent. The new statistics ask for a detailed overview of income and expenditure.

Income

- from the library's funding authority
- from other sources.

Special grants are distinct from income generated by the library.

Expenditure

- acquisition costs
 - on print material
 - on electronic media
 - on binding
- operating costs
 - on computer systems (hardware and software)
 - on document delivery
 - on preservation (restoration, de-acidification, digitization, microfilming)
- on premises
- staff costs
- capital expenditure
 - buildings
 - other.

Document delivery costs are explained as costs for delivery by commercial suppliers (including pay-per-view) for the library's clientele.

The Electronic Collection

In a traditional library it was easy to differentiate the library's collection from resources elsewhere. For the electronic collection this differ-

entiation could be a problem. Short-time licenses, purchases or licenses in consortial agreements, access rights to remote resources, pay-per-view agreements - what can be counted as 'collection'?

Following ISO DIS 2789, the working group set up criteria for what constitutes an electronic collection:

- deliberate selection of a document for the collection
- securing access rights, at least for a certain period of time
- inclusion in the OPAC or other databases of the library.

In the new German statistics, the electronic collection is counted as to:

- single documents (e. g. doctoral dissertations, monographs, textbooks, patents)
- databases (collections and compilations of data, facts, bibliographical records or text that are offered under a common retrieval interface).

Both categories are split up into documents on physical carriers (e. g. CD-ROM for lending) and networked documents.

Electronic periodicals are counted in the category 'periodicals'. It was deemed necessary to have the total number of periodicals, whether print or electronic, as this is an important figure for describing the library's services. The statistics separate print/microform and electronic journals and in each case ask for:

- current subscriptions (+ costs)
- new subscriptions (+ costs)
- cancelled subscriptions (+ savings).

These are data that are often used to show the development in information provision for universities.

The Use of Electronic Services

This was, of course, one of the difficult points in the new statistics. Several German libraries had cooperated in the European Union pro-

ject EQUINOX and had tested possible measures of use. The tests showed that there are still difficulties in counting use of electronic services. Data of use must be collected:

- from the library's own servers
- from consortial servers
- from external suppliers

and, thus, may differ considerably.

The group decided to count above all the number of 'accesses' (page hits, log-ins, sessions) to electronic services, differentiated as to access on:

- local OPACs
- electronic periodicals
- databases
- single digital documents
- the library website.

'Access' is defined as connecting to a web based document.

A second category counts the full views of documents or records. Viewing a document or record means the full text uploading of an electronic resource, or a catalogue record/database entry fully displayed. Lists of titles or tables of contents are not counted as full views.

Views are counted for:

- local OPACs
- databases
- electronic journals.

This second category for 'use of electronic services' assesses the cases when users find something relevant for them. Users may access electronic services without finding what they are seeking. If they deem a document or a record worth of full display, they have potentially found items of interest.

The group considered other data like 'cases of downloading' and 'search time spent on an electronic service'. But cases of downloading proved too difficult to count, and the search time might be affected by user skills and technical problems so that it would not give reliable data for the amount of use.

Hopefully, the two data chosen - accesses and views - will be collected by many libraries. At least, they have already been counted for OPAC use.

Assessing the use of electronic services is a problem that cannot always be solved by the libraries themselves. Information suppliers and vendors of automated systems must be told what data the libraries need for their statistics. Defining such data in the national library statistics will help to stress their importance.

The 'Core Data' Project

The new German library statistics comprise 265 categories. This detailed analysis is invaluable for local and national planning, but much too broad to be presented to the public or to funding authorities. The university libraries in Nordrhein-Westfalen, the region with the most university libraries in Germany, have defined a set of ten 'core data' that could be used for a concentrated view of the single library or groups of libraries.

Most of these core data are not simple statistics but combined measures (performance indicators) setting statistical input and output data in relation to costs or to the population served. The core data are grouped as to input, services and usage.

Input: What do Information Services Cost?

1. Acquisition expenditure per capita (members of the population served)
 - *This indicator assesses the university's engagement in information services.*
2. Proportion of acquisition expenditure spent on electronic documents
 - *The indicator assesses the transition to electronic collections.*
3. Library costs per capita
 - *The overall costs of the library are compared to population size.*

Services Offered: Which Services does the Library Provide?

4. Opening hours per week
 - *This data assesses the accessibility of the library.*
5. Immediate availability of loan collection (= immediate loans as percentage of all loans (including reservations and ILL))
 - *The indicator shows whether the collection covers all topics asked for by users, and whether there are sufficient copies.*
6. Percentage of PC-places of all user working places
 - *This indicator assesses the transition to electronic services.*
7. Processed accessions per employee man-year (= the number of media acquired (excluding electronic subscriptions) as compared to staff resources in the Acquisition Department.
 - *This is the only indicator showing the efficiency of background processes.*

Usage: How are the Services Accepted?

8. Market penetration (= active users as percentage of the members of the population)
 - *The indicator assesses how well the library reaches the population that it serves.*
9. Loans per capita
 - *The number of loans is taken as an example to show how intensely the library is used by its population.*
10. User satisfaction rate (This is user satisfaction with the library services on a five point scale)
 - *The university libraries in Nordrhein-Westfalen will start a common project of user surveys in summer 2001, all using the same questionnaire. The results will allow benchmarking on user satisfaction data for a complete 'Land'.*

A similar project with a core set of data was started in Great Britain. Such core data may be used in

addition to the general statistics in order to give a short and easily comprehensible overview of the libraries' effectiveness and efficiency.

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To Describe and Measure the Performance of North American Research Libraries

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Historical Introduction¹

One of the longest-running and most recognizable activities of the Association of Research Libraries (ARL)² is the statistics program. Quantitative and descriptive



statistics have been collected and published annually by ARL since 1961-62. The publication *ARL Statistics* describes the collections, expenditures, staffing, and service activities of the member libraries of ARL. Before 1962, annual statistics for university libraries were collected by James Gerould, first at Minnesota and later at Princeton. These data cover the years 1907-08 through 1961-62 and are now called the Gerould Statistics. The whole data series from 1908 to the present represents the oldest and most comprehensive continuing library statistical series in North America.

The *ARL Annual Salary Survey*, first published for 1972-73, currently compiles data for over 12,000 professional positions. Published annually since 1992-93, *ARL Academic Law and Medical Library Statistics* reports data on collections, expenditures, staffing, and user services in the law and medical libraries of ARL university members. *Preservation Statistics*, pub-

lished annually since 1988-89, includes data tables on personnel, expenditures, conservation treatment, preservation treatment, and preservation microfilming, as well as an in-depth analysis of data by size of library.

In 2000 *ARL Supplementary Statistics*, with data on the size and kind of members' electronic resources, was first made available to the public, after being used since 1983 as a test for collecting information on new measures in libraries. *Developing Indicators for Academic Library Performance: Ratios from the ARL Statistics*, which presented thirty selected ratios that describe changes in internal library operations as well as resources per faculty and per student for the ARL university libraries over a two-year period, was published for the years 1992-99. Those ratios can now be generated from the interactive website: <http://www.arl.org/stats>.

For many years the traditional statistics projects, *ARL Statistics* and the *ARL Annual Salary Survey*, were supported through volunteer efforts from member institutions. Kendon Stubbs, of the University of Virginia, served as the consultant for the main statistics and Gordon Fretwell, University of Massachusetts at Amherst, was the salary survey consultant. They were instrumental in establishing the data-collection activities and ensuring the consistent high quality of the data. In 1994, the program was expanded to include a full-time program officer and the data-gathering activities were transferred in-house. Activities increased substantially: additional surveys were undertaken; the statistics were made available over the web; more extensive custom reports were made available to members; and the Association became ever more active in other national library and higher education data gathering efforts.

A timeline of program activities (<http://www.arl.org/stats/program/timeline.html>) highlights the Association's interest in statistics and descriptive data about research libraries. These data have been used both for comparative purposes and also to track the trends of investment in research libraries for the best part of the 20th century. The timeline also demonstrates the attempt by ARL over the years to respond to a need to look at more than descriptive data. In the early 1980s, the Statistics Committee began to look for ways to measure organizational performance objectively and began to collect supplementary statistical data to provide information on a variety of measures including those addressing access to information resources.

In 1999 the ARL Statistics and Leadership Committees and other interested members began what has become the ARL New Measures Initiative. This aims to develop methods to assess how well libraries meet institutional and user needs, and how well libraries use their resources and services. One area of interest focuses on how to measure user expectations and perceptions of library services. The history of the 1999-2000 LibQUAL+ pilot project and subsequent work is described by Colleen Cook and others elsewhere in this issue.³

Another area of interest is how to measure the collection and use of electronic resources. The goals of the ARL E-Metrics Project are to develop, test, and refine selected statistics and performance measures to describe electronic services and resources in ARL libraries; to engage in a collaborative effort with selected database vendors to establish an ongoing means to produce selected descriptive statistics on database use, users, and services; and to develop a proposal for external funding to maintain the development and refinement of networked statistics and performance measures.

These and other new projects focus on higher education outcomes assessment, including the role that the library plays in support of

learning, teaching, and research, identification of cost drivers, and applying the results of the ILL/DD Performance Measures cost study. Their progress can be followed at: <http://www.arl.org/stats/newmeas/newmeas.html>.

From Statistics to Analysis

In the 1990s, many of the annual surveys evolved into analytical products and services in unforeseen ways - primarily due to the use of new technologies ranging from innovations in data collection to electronic publishing of datasets, as well as derivative print publications. Probably the biggest challenge for any organization, including ARL, is the attempt to bring disparate web products and projects together in a way that complement and build on each other so that users can get maximum benefit.

An example of analytical work based on the *ARL Annual Salary Survey* includes a study of the age demographics of librarians published in 1996. Part of the analysis was revisited in 1999 and, with new data collection in 2000, work in this area continues with the purpose of developing retirement projections later in 2001.⁴ The longitudinal

data on salaries from ARL is also being further analyzed to give insights into the rate of salary increases in relation to various demographic characteristics of the population of librarians.⁵ Since 1980 the *ARL Annual Salary Survey* has been a scalable survey: it is managed in a rather centralized fashion collecting a few basic variables for professionals and coordinated through library personnel offices that return to the ARL offices the data in standardized Excel spreadsheets.

Additional analytical work has grown out of the *ARL Statistics*, a historical series of data on North American libraries describing major trends.⁶ The *ARL Statistics* products are available to readers in three different basic forms:

- a) the printed publication, which includes an analytical introduction with a series of important and popular graphics describing major trends in libraries;
- b) the machine-readable version of the data, which comes in the form of two Excel files that users can download for their own use;⁷ and
- c) the interactive WWW edition of the *ARL Statistics*, a set of highly functional interfaces for manipulating interactively on the Web

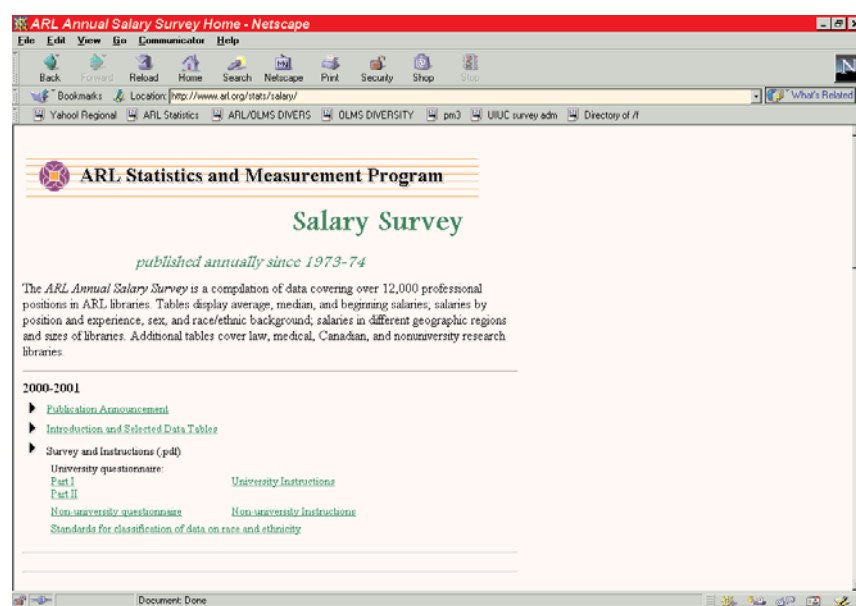


Figure 1. ARL Annual Salary Survey Home Page.

the rich database that underlies the ARL Statistics.

Interactive Statistics

The *ARL Statistics Web Interactive Edition*⁸ was one of the first electronic interactive products ever to appear on the Web. It is supported by one of the well-known electronic centers of the University of Virginia Library: the Geostat Center. (The former Social Science Data Center has now been folded into the new Geostat Center.) The first interactive edition of the *ARL Statistics* was created in 1994 by Kendon Stubbs and Paul Begen, and became publicly available in the early part of 1995. As one of the first interactive data analysis products it was presented at the National Center for Educational Statistics Summer Data Conference in Washington DC in June 1995 where Kendon Stubbs and Martha Kyriillidou talked about 'Interactive Statistical Analysis on the WWW'. A number of annual editions were supported by Patrick Yott as Director of the Social Science Data Center at the University of Virginia.

In 1994 with the advent of web browsers, the thinking was that books were being re-invented by transforming them from static objects into 'books as performance' with the integration of existing media and the creation of dynamic publications. Every reader was viewed as an actor participating in creating information and unique experiences. Since then the interactive edition of the *ARL Statistics* has gone through a variety of enhancements; every year the availability of new data presented new opportunities to improve the interface by providing additional features. The 1999 edition is the brainchild of Spencer R. Graf, who worked on the interactive *ARL Statistics* while completing his PhD in Economics at the University of Virginia. In the meantime, the evolution of the web since 1994 has transformed not only electronic publishing but also many aspects of the daily work environment which

are gradually being translated into web performances.

The *ARL Statistics Interactive Edition* is an interface that builds upon the client/server architecture of the WWW and the strengths of various software applications. It currently runs on a Unix server, utilizing protocols such as HTML and SGML, perl and shell-scripting languages for submitting queries and building statistical programming code that can run a variety of statistical applications such as SAS, SPSS, and STATA in the background. The major challenge for the forthcoming web interactive editions of the *ARL Statistics* is to transfer this environment into an XML protocol and create a seamless process from data entry into data publishing.

The current interface has five top-level menu options for interactive data analysis:

- a) Institutional data that allows selection of up to seven institutions for peer group comparisons and download the data in a comma-delimited format for every year separately since 1963 (Figures 2 and 3). Figure 2 shows the institutional and variable data selection interface and Figure 3 is an example of the output derived from that interface.
- b) Descriptive statistics which allow the retrieval of summary statistics on any one of the forty-eight variables - or a ratio formed by a combination of any two of these variables - for every year separately since 1963. Descriptive statistics are available for either all libraries or for a user-defined peer group, the latter selected through the 'Advanced Descriptives Form' (Figures 4 and 5). Figure 4 shows the descriptive statistics interface and Figure 5 a sample output from the interface on Figure 4.
- c) Ranked lists of institutions based on any one of the forty-eight variables or any ratio formed by any two of these variables for every year separately since 1963 - with the option of placing a specific library in bold. Ranked lists are available for either all libraries or

for a user-defined peer group selected through the 'Advanced Listings Form' (Figures 6 and 7). Figure 6 shows the interface that is used to create customized rank order tables and Figure 7 the output from the interface in Figure 6.

- d) Membership criteria, a set of options for displaying individual institutional data and graphs on the five variables comprising the ARL membership criteria dating back to 1986 when the index became available, as well as ranked lists of the variables comprising the ARL membership criteria index (Figures 8, 9 and 10). Figure 8 shows an interactive map of all ARL libraries throughout North America. Figure 9 lists the output produced by clicking on one of the dots that represent libraries in Figure 8. And Figure 10 lists the data produced for the library selected in Figure 9.
- e) Interactive graphics for individual libraries or groups of libraries plotting data on a time series from 1963 to 1999, or other user-defined timespan, for up to six variables or ratios formed by two of these variables are also available (Figures 11 and 12). Figure 11 presents the output from a graph presenting summary data for many variables for one library and Figure 12 presents a graph of serial unit costs (one ratio variable) for three ARL libraries.

Many library directors and survey coordinators use the *ARL Statistics Web Interactive Edition* to analyze the data for peer group comparisons and special data extractions for local budget justification purposes. In addition to this primary use, faculty and researchers have used the interactive edition for teaching purposes. ARL itself has built workshops and training opportunities related to Electronic Publishing of Datasets, a workshop offered once a year on how to publish numeric datasets on the WWW. The workshops are expanding with an offering on an introduction to

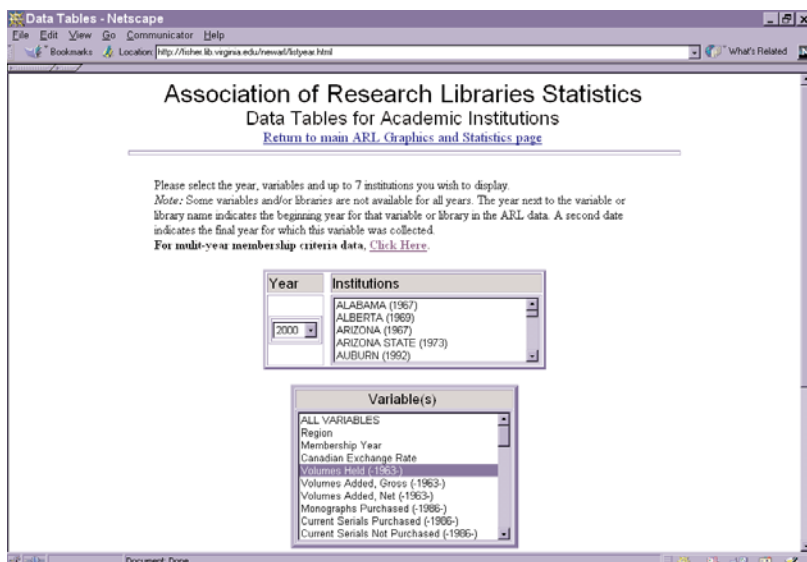


Figure 2. Institutional Data Selection for User-Defined Libraries and Variables.

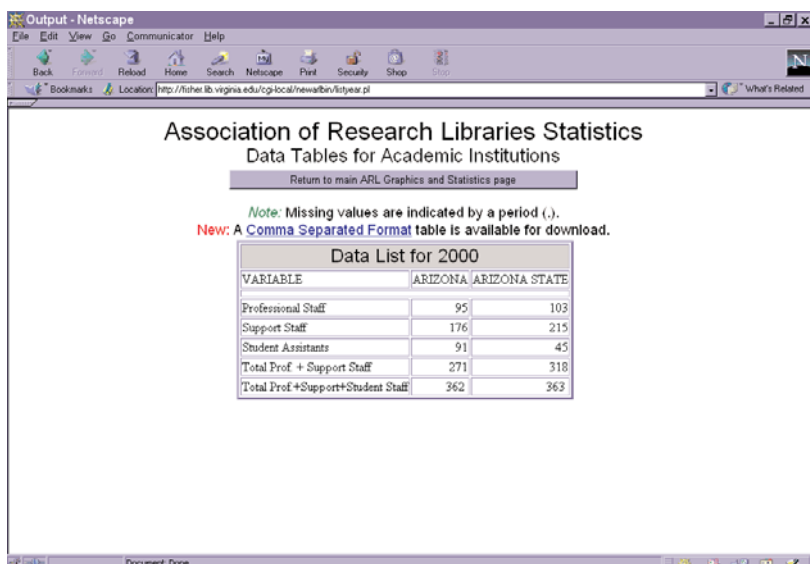


Figure 3. Output from Institutional Data Selection for Two ARL Libraries from Figure 2.

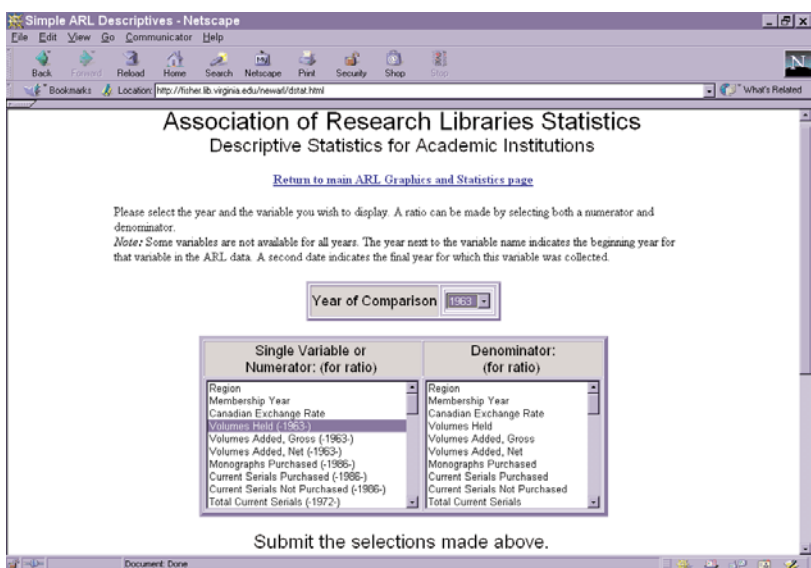


Figure 4. Descriptive Statistics for User-Defined Variables.

XML as gradually options for integrating the variety of applications through XML are explored.

Issues Outstanding

Major challenges that have arisen since the first electronic interactive edition of the *ARL Statistics* and are not yet resolved include:

- What should be printed?
- What should be made available electronically and in what format?
- How do we leverage the production costs for printed and electronic publications?
- What should we charge for and what should we give away? What is the value to the customer?
- Who buys the printed publication vs. who uses the machine-readable datafiles vs. who uses the electronic interactive edition?
- How can we integrate the qualitative information that accompanies the printed publication in the form of footnotes into the various electronic editions?
- How can we move towards a seamless and automated approach from data entry to data production and publication?

Data Collection

In 1997 the annual ARL institutional data collection was done via the web for the first time. Although electronic means of data collection were utilized before, they were diskette-based. The annual surveys were marked up in HTML and mounted on the web through an interface that was built on behalf of ARL by the Library Research Center at the University of Illinois at Urbana-Champaign. The web data entry interface has a perl-scripted administrative interface that allows the survey administrator to mount new surveys, set up a password-protected environment, and edit the data using web forms. It has been used successfully to collect data and various enhancements have been added but still it is lacking live data editing capabilities.

Scalable Web Assessment Tools

As described in the paper by Colleen Cook and others,³ LibQUAL+ is an R&D project that attempts to assess the performance of research libraries as it is perceived by the user and is attempting to build a scalable web interface for user-based assessment.⁹ The technology infrastructure used in LibQUAL+ is a database-driven design that relies on Cold Fusion and an SQL database that in turn interacts with analytical software such as SPSS. The technical process is described in a paper by Russell Thompson, one of the developers of the infrastructure currently located at Texas A&M.¹⁰ The Spring 2000 pilot experience showed that technology is indeed maturing fast enough to allow libraries to build robust assessment mechanisms that move beyond the basic descriptive institutional assessment frameworks that have been so popular among libraries ever since 1908. The LibQUAL+ pilot proved that large-scale user-based assessment is a reality for libraries.

At an international symposium held in October 2000 experts discussed the various theoretical frameworks as well as the practical implications of user-based assessment in libraries.¹¹ Phillip Calvert said that, from a theoretical perspective, user based assessment has important and interesting international applications - as he had discovered from work done in comparing user perceptions between library users in New Zealand and China. Exploring the applicability of LibQUAL+ in the international library environment beyond North America is one of the next steps.

Conclusion

Looking backward through the 1990s, it seems clear that technology improvements in data collection, analysis and publishing have moved libraries much closer to the user. Yet the more knowledge expands, the more its limitations

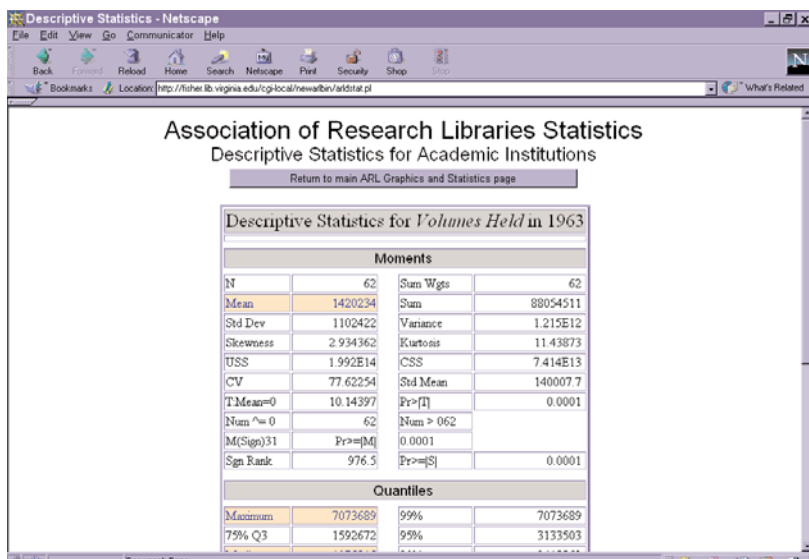


Figure 5. Descriptive Statistics Output for Volumes held in 1963 for all ARL Libraries from Figure 4.



Figure 6. Ranked Lists for UserDefined Variables.

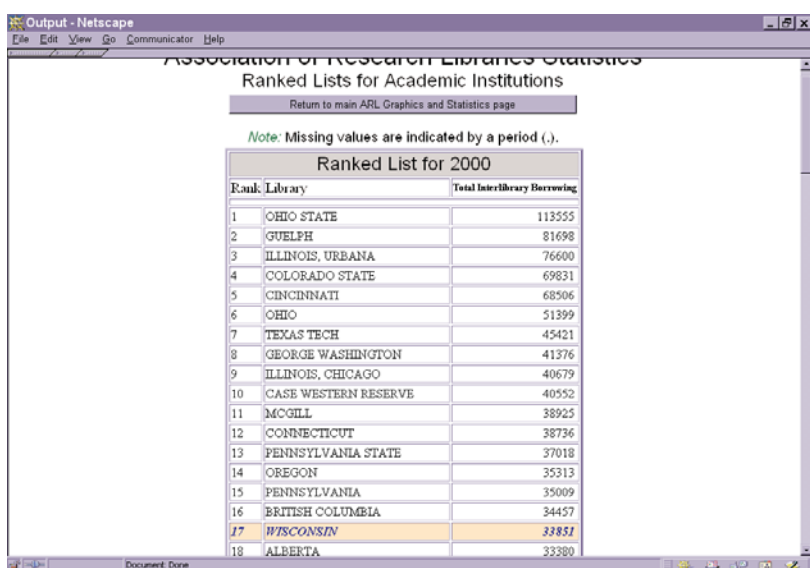


Figure 7. Output from Ranked Lists Interface for Total Interlibrary Borrowing in 2000 with a Library placed in Bold Typeface from Figure 6.

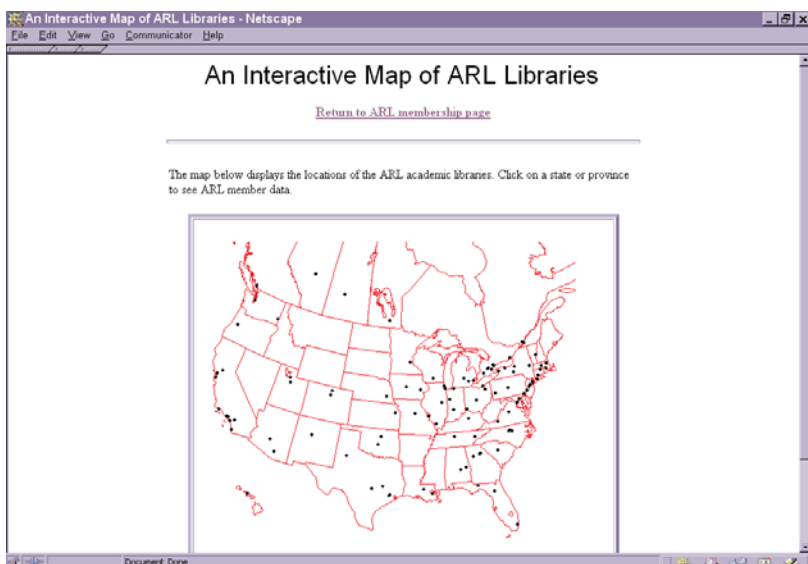


Figure 8. An Interactive Map of ARL Libraries.

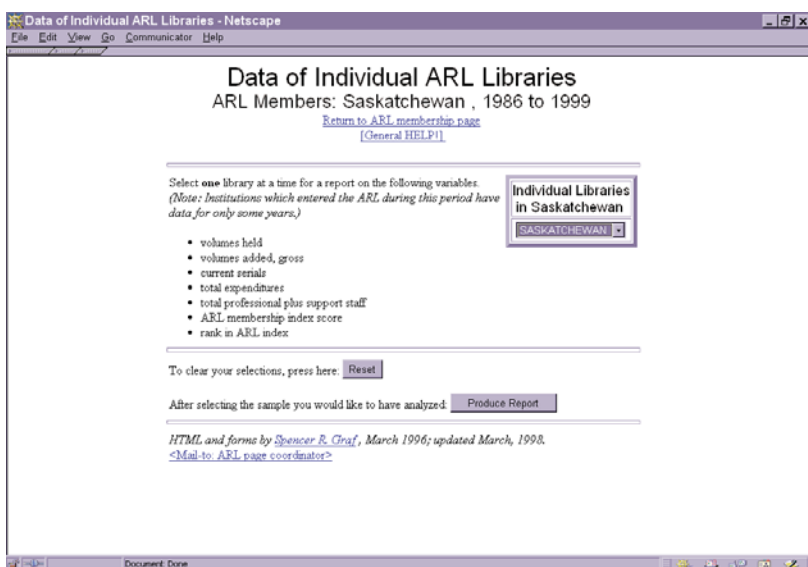


Figure 9. Output from Selecting One ARL Library from the Map Listed in Figure 8.

Year	Volumes Added Gross	Volumes Held	Total Current Serials	Total Prof+ Support Staff	Total Library Expenditures	Index Score	Index Score Rank	
1986	47900	1253984	10118	151	5241180	-1.96	101	
1987	48877	1300773	10092	163	5619647	-1.9	101	
1988	50674	1360380	9689	165	6416001	-1.83	99	
1989	52592	1372707	10748	165	7358922	-1.71	98	
1990	60519	1404391	10689	167	7847548	-1.72	97	
1991	65368	1459334	13700	171	8631855	-1.59	92	
1992	63094	1502554	13851	167	9268557	-1.64	91	
1993	60922	1547741	13820	167	8389785	-1.73	96	
1994	65113	1594201	13912	160	7789282	-1.79	98	
1995	47900	1648536	13555	162	7646012	-1.94	101	
1996	50654	1664881	13816	159	8771183	-1.85	98	
1997	52217	1698690	14179	155	8741818	-1.87	98	
1998	52923	1736771	13087	155	8354725	-2.592	105	
1999	45753	1762898	12482	152	8094695	0.937	-2.05	106

Figure 10. ARL Membership Index Data for the Library Selected in Figure 9.

appear. Tying institutional assessment to user-defined outcomes is going to be a major challenge for most organizations, libraries and educational institutions in the digital, self-empowering environment created at the dawn of a new century. Issues related to the privacy of institutional and user records will become more prevalent as the development of pervasive infrastructures that may infringe upon user privacy appear. The real challenge for libraries may be indeed whether they can recognize their users and users their libraries, and, if so, in what ways. Will users at the end of the next century still recognize that it is at the library where they find valuable resources?

Resources and services provided will be difficult to describe and assess as the information environment of users becomes increasingly complex. Both new and old assessment methods will have to be utilized in creating ways to describe multiple user and library realities. The more virtual and complex the environment becomes, the more pervasive and systematic assessment efforts need to be. The various avenues of development at ARL provide a promising springboard to prove how much such measures matter for the future of libraries.

Notes and References

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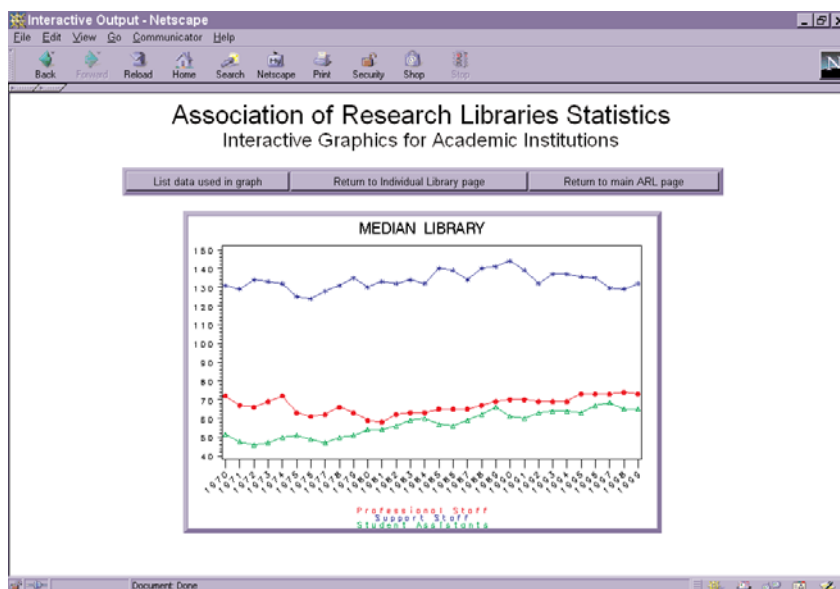


Figure 11. Output from the Interactive Graphics charting Student Assistants (bottom line), Professional Staff, and Support Staff (top line) for the Median ARL Library from 1970 to 1



Figure 12. Output from the Interactive Graphics charting Serial Unit Cost for Three ARL Libraries from 1987 to 1999.

LibQUAL+: Service Quality Assessment in Research Libraries

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Introduction

In October 1999, the Association of Research Libraries (ARL) approved a membership-centered effort to develop a new tool that would enable research libraries to measure service quality delivery to their constituents. The initiative was in response to rising demands for accountability in the public service sectors generally and to the Association's New Measures Program specifically. The New Measures effort represents a collective determination on the part of membership to move beyond the input measures that undergird the *ARL Index* and the accompanying comprehensive statistical database, the most important assessment metric heretofore available. [The preceding article by Martha Kyrillidou has already provided information on the ARL role, examples of LibQUAL data input forms, and web site references.]

This new instrument, trademarked by the Association of Research Libraries under the name LibQUAL+, traces its origins to service marketing research and the pioneering work of Berry, Parasuraman and Zeithaml. Their SERVQUAL protocol has been accepted as a standard of service quality assessment in the business world since the mid-1980s. LibQUAL+ is a derivative of that protocol, rigorously re-grounded through both qualitative and quantitative means for the research library sector in North America. It undertakes to measure library users' perceptions of service quality and identifies gaps between desired, perceived, and minimum expectations of service. The project will continue as a research and development endeavor based at ARL in collaboration with the Texas A&M University Libraries through 2003, by which time LibQUAL+ will evolve into an ongoing service quality assessment program at ARL. Adhering to its SERVQUAL origins, LibQUAL+ proceeds from the same principle: "...only customers judge quality; all other judgments are essentially irrelevant." Given that perspective, it should be remem-

bered that there are many ways of assessing an organization. A. Parasuraman identifies at least eleven ways, including transactional surveys; mystery shopping; new, declining and lost customer surveys; focus group interviews; customer advisory panels; service reviews; customer complaint, comment, and inquiry capture; total market surveys; employee field reporting; employee surveys, and service operating data capture. An organization should effectively employ multiple assessment methods in order to ensure effective service quality delivery. At least three assessment methods, including total market surveys are considered essential. LibQUAL+ is designed as a total market survey. Slowly, other instruments are being developed for libraries. The transactional survey model being developed by Danuta Nitecki and Peter Hernon, recently tested at Yale, is a promising entry in the field.

with sixty-eight faculty, graduate students and undergraduates at ten participating institutions.

Affect of Service essentially collapses three of the service dimensions identified by SERVQUAL into one:

- *Assurance*, the knowledge and courtesy of employees and their ability to convey confidence and trust;
- *Empathy*, the caring, individualized attention provided to customers by employees; and
- *Responsiveness*, the ready willingness to help customers and provide prompt service.

Reliability, or the ability to perform promised or expected services dependably and accurately, was found through qualitative assessment to be as important in the library environment as it was in previous sectors assessed by SERVQUAL.

Library as Place is reflective of a concept transcending the SERVQUAL *Tangibles* dimension. The original concept had defined rather traditionally the appearance of physical facilities, equipment, personnel and communication materials. The concept of Library as Place assesses the ability to meet community requirements for utilitarian space for study, collaboration, or rendezvous, oftentimes especially important for undergrad-

The Dimensions of LibQUAL+

LibQUAL+ is an effective total market survey for the research library context that assesses service quality across several dimensions. Figure 1 below provides a graphic summary of the dimensions LibQUAL+ assesses in its current iteration. These dimensions have been identified through interviews conducted

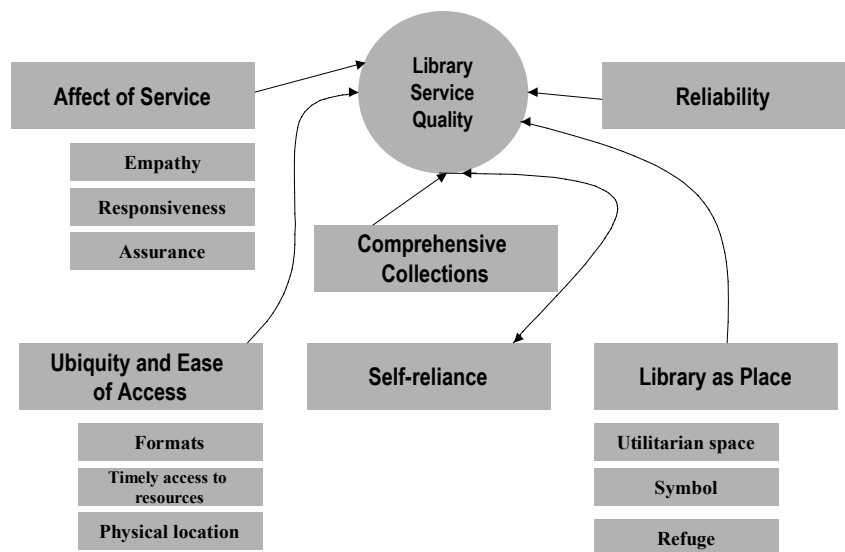


Figure 1: Dimensions of Library Service Quality

uates whose options are more limited than graduate students and faculty. However, the qualitative process also revealed that Library as Place was sometimes valued as a contemplative environment where the essential work of scholarship and creativity could take place. For that reason, interviews revealed that some valued the availability of aesthetically pleasing library space as emblematic affirmation of the centrality of the life of the mind in the university setting.

Access to Information was another dimension surfaced through the interview process. Access was ensured through the provision of *comprehensive collections* at the local level, collections sufficient to attract scholars and sustain graduate study. Increasingly, however, the emphasis is on *ubiquity of access* or the provision by all means possible of barrier-free access to information at the time of need. In that context, *information format* begins to lose its relevance. A rich array of full-text deliverable to the desktop, strong local collections available in easy-to-reach physical locations, and timely access to distant resources through effective document delivery are all components to the Access to Information Dimension.

Each of these dimensions was tested and retrieved during the first iteration of the pilot survey, administered during Spring 2000 to twelve participating research libraries. The results of that iteration were reported at the IFLA conference in Jerusalem in August 2000, as well as elsewhere in the literature.

Not tested during the initial pilot phase was the concept of *self-reliance*. The interviews with users of research library collections - undergraduates, graduate students, and faculty alike - captured a desire to be self-reliant and confident in navigating the library. Self-reliant information-seeking behavior is achieved in many ways, but from the interviews two methods dominated responses. Self-reliant users are forged formally through biblio-

graphic instruction or informally through mentoring relationships and through simple trial and error. Although inefficient, independent trial and error seems to be the most commonly followed strategy. In the second iteration of the LibQUAL+ pilot, now underway, the ability of the research library to foster self-reliant information-seeking behavior through instruction, mentoring, signage and other means is being assessed as a component of service quality.

tor at several levels. First of all, the carefully grounded questions that comprise the survey yield data of sufficient granularity to be of considerable local use. Because each question is administered across three scales, of *minimum*, *desired*, and *perceived* performance, it is possible to derive rich information. With responses measured on a 9-point scale, a *zone of tolerance* or acceptable performance is established with the minimum scores describing the lower acceptable level and desired scores setting the upper boundary. Optimally, perceived performance scores would float comfortably within this zone of tolerance, the closer to the desired boundary the better. It can be a simple matter mathematically to derive *gap scores* or deficits

The Applications of LibQUAL

Information obtained from the LibQUAL+ total market survey can be useful to the library administra-

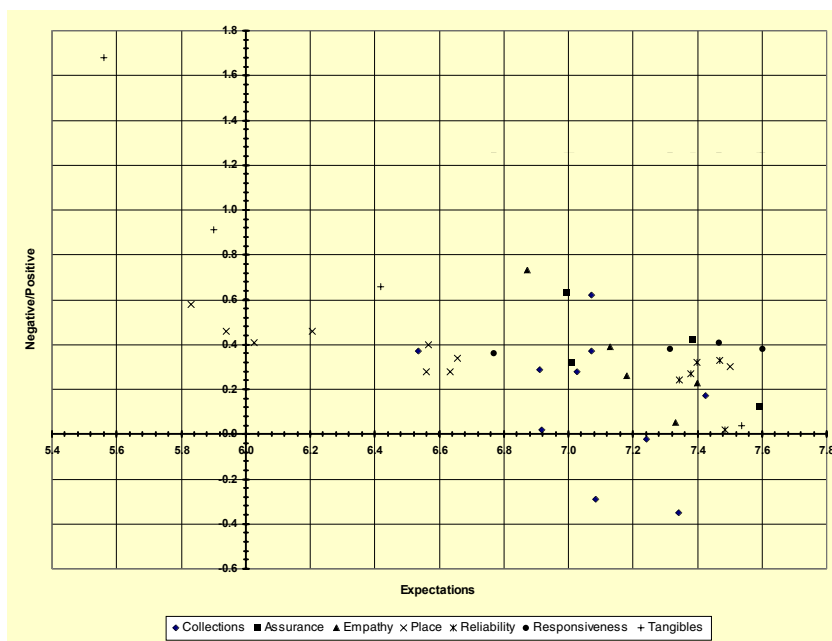


Figure 2. LibQUAL+ Summary Aggregate

Note: An aggregate average of minimum + desired scores for each of the LibQUAL+ questions is plotted on the x-axis. Aggregate gap scores (Perceived - Minimum Expectations) are plotted on the y-axis. Thus the higher the x-axis score, the more important a quality represented by a question was considered by respondents. The higher the score on the y-axis, the better the perceived performance on that question. It is noteworthy then, that the data suggests a trend that those questions deemed most significant to respondents generally received relatively lower ratings. The outliers are particularly interesting. Two Access to Collections issues were considered very important to users by virtue of their high x-axis score, and received negative gap scores meaning that perceptions fell lower than minimum expectations. In contrast, a tangibles question concerning the personal appearance of library employees was considered least important to users and received the highest gap score.

where perceived performance falls below acceptable norms. LibQUAL+ allows administrators to discern deficits in service performance across dimensions and allocate resources to identify the causes of lagging performance and to correct them. Periodic administration of LibQUAL+, biennially for example, permits administrators to watch for falling trajectories and develop intervention strategies *before* performance levels fall outside the zone of tolerance.

Secondly, it is possible to obtain normative data across a cohort group from multiple perspectives, e.g. by individual question or from first or higher order factor. Factor analysis from the first pilot study has shown that various dimensions or factors are correlated and aggregate at the second-order level into a single over-arching perception factor of *service quality*. In order to fully understand user perceptions it is necessary to derive both the dimension scores and the higher order score. Such normative information might enable library administrators to place local data in context. For example, as Figure 2 indicates, two *Collections* or *Access to Information* issues earned negative gap scores (see the lower right quadrant) across all twelve participating institutions in the initial pilot. Normative data permits each institution to place its performance in the context of the entire cohort.

Equally importantly, LibQUAL+ abets the New Measures goal of surfacing best practices in librarianship. For each dimension, it is possible to identify the normative performances of each of the libraries in a cohort. Problems in the Affective Dimension, for example, might indicate issues with staff training or development. As focus groups and other measures of institutional assessment are being undertaken locally to understand causality, it may also be desirable to visit members of the cohort who have demonstrated stronger performance on that dimension in order to learn from their example.

Additionally, LibQUAL+ is an effective response to the growing pres-

ures for accountability. In the United States all institutions of higher education are assessed by Regional accrediting societies. Those in Texas are evaluated by SACS, the Southern Association of Colleges and Schools, Commission on Colleges. It is the largest of the US regional accrediting societies and their procedures are similar to other regionals. Criteria are shifting quickly from quantitative indices to requirements for ongoing self-assessments of institutional effectiveness. Historically, standards are driven by a series of MUST statements in the Criteria for Accreditation. (The process is undergoing transformation, but this aspect will survive in some form.) Section 5 of the *SACS Criteria for Accreditation* treats Educational Support Services, and the majority of the MUST statements relate to libraries. The following statement is relevant here:

The library and other learning resources **must** be evaluated regularly and systematically to ensure that they are meeting the needs of their users and are supporting the programs and purposes of the institution.

An ongoing biennial program of web-based assessment through LibQUAL+ represents a painless, effective and inexpensive response to these requirements. Without doubt similar accountability issues are encountered by most of the IFLA membership.

Phase II

The first round of the LibQUAL+ pilot involved twelve research libraries selected from among thirty North America universities that volunteered for the effort. The second round was launched in 2001 with more than forty participants from Canada and the United States. The majority of the universities are again ARL libraries, but eleven non-ARL organizations (other types of research libraries and some smaller institutions) are included. The reasons for this are explained in the FIPSE section below.

In January-February 2001 the survey was reformatted to accommodate the findings of the first iteration and to test additional constructs. The instrument remains a web-based, three-scale survey designed to be administered to a random sample of users at each university. In order to test new constructs, the number of questions was expanded from approximately forty to approximately sixty. The survey was administered in Spring 2001 to selected respondents at the forty-three participating sites. When the survey was shut down in early May, over 34,000 had responded to the survey, and some six million data points relating to library service quality have been obtained. In early summer the data was analyzed and the preliminary results will be presented to the participants at the annual meeting of the American Library Association in June 2001. In August, a more in-depth look at the results will be presented at the 4th Northumbria Conference in Pittsburgh, Pennsylvania. The large-scale administration has served to demonstrate the efficacy of large-scale administration over the web, and the huge database should provide psychometrically sound observations about library service quality and should permit thorough assessment of demographically-based differences in user perceptions.

FIPSE

There are even more far-reaching plans ahead for LibQUAL+. In September 2000, the Association of Research Libraries (ARL) was awarded a USD 500,000 grant by the United States Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE) to develop tools for and establish a service quality assessment program not only for research libraries, but for post-secondary education generally. The goals of the project include:

- development of tools and protocols for evaluating library service quality
- development of effective web-based delivery mechanisms

- identification of best practices; and
- establishment of a service quality assessment program.

The anticipation of the FIPSE grant led to the inclusion of a select number of non-ARL libraries in the second round. In this way it will be possible to test the ARL-specific instrument for its applicability in other environments.

Prospects

The year ahead promises to be busy. Over the latter half of 2001 the LibQUAL+ instrument will continue to be qualitatively re-grounded through a series of interviews at other types of libraries, and in November-December 2001 participants in the third round of LibQUAL+ will be selected. With the efficacy of large-scale administration across the Web now demonstrated, and with a mandate to develop instruments that are applicable in a variety of post-secondary settings, it is anticipated that between 100 and 200 libraries will be selected to participate. Building upon the research of Philip Calvert and others the feasibility of including research libraries from other regions will also be studied. Preliminary conversations have begun with libraries in the United Kingdom and New Zealand.

Conclusion

The real contributions of LibQUAL+ lie ahead. Two more pilot iterations remain before schedules call for the instrument to be standardized and turned over to ARL for on-going maintenance and administration. The gap analysis work of Rowena Cullen has promising application to institutional risk assessment, and should be assessed for its applicability to the LibQUAL+ model.

However, LibQUAL+ has already had an impact on library assess-

ment. In the first place, LibQUAL+ has helped to shift the focus of assessment from mechanical expenditure-driven metrics to user-centered measures of quality. Secondly, it has re-grounded gap theory and service quality constructs for the library sector, especially research libraries. Its results can be subjected to rigorous psychometric analysis and replication, and can be continuously re-grounded qualitatively to take into account evolving library environments. Because of the rigor and the size of the database, it should be possible to determine the degree to which information derived from local data can be generalized, providing much-needed best practices information. Finally, it has demonstrated conclusively the effectiveness of large-scale administration of user-centered assessment transparently across the web. Its almost limitless scalability and the minimal demands for survey or statistical expertise at the local level are especially appealing attributes.

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Book Review

Neil Jacobs, Anne Morris, Julie Woodfield and Eric Davies. **Planning document access: options and opportunities. Based on the work of the eLib project FIDDO.** London [etc.], Bowker Saur, 2000. pp. viii, 272.

Reviewed by **Maurice B. Line**, *Consultant, Harrogate, UK.*

There is now an abundance of information about the uses made of journals and the preferences of users for different forms and formats, while library management occupies an increasing proportion of the literature. A good deal of work has also been done on document access and supply. This book, based on research carried out in the United Kingdom for a project funded by JISC (Joint Information Systems Committee) under the eLib programme, brings these three areas of study together. (FIDDO stands for Focused Investigation of Document Delivery Options). In doing so it confirms existing knowledge and adds significantly to it. While the research was concerned specifically with academic institutions, a whole chapter is devoted to its implications for other types of library and information service. Although the book is aimed at a British audience, it has a relevance well beyond the UK.

Document access and supply have undergone huge changes in the last forty years. First there was the use of xerographic copiers to make photocopies of documents, then the use of telefacsimile to transmit documents, then the use of computers to search for and request them, then the incursion of the private sector, then the biggest development of all: the combined use of electronic document storage and communications technology to transmit documents. Users with the right equipment can request and receive many of the documents they want in their own offices or homes, or in libraries. It is easy to forget what a very long way we have come in a few decades from

'interlibrary lending' between libraries.

For all the new technology, the old system still exists, albeit modified by electronic searching and requesting; material is still borrowed by one library from another, and in the case of books looks like being so for some time ahead. For journal articles, whole issues of journals are still borrowed on occasion, fax is still sometimes used, and photocopies are still sent in very large numbers by mail. Above all, most journal use takes place by consultation of the users' own library's collections. Incidentally, the book under review should make it more obvious that it is concerned solely with journals.

All the 'old' methods have serious disadvantages. They require busy researchers to travel to the library to use its journals, sometimes finding that the wanted issue is not on the shelves, or to file a remote document request. In the latter case, delays occur in the processes of requesting, handling in the library approached, transmission and internal library mail (possibly followed by the user having to go and fetch the item). They are therefore time-consuming and disruptive of other work; and thinking and writing can be hindered by the delays.

Everyone accepted this until recently, because they had no choice. Indeed, they appreciated the fact that they could get almost any document within a few days. Now, with a prospect of something better, they are less satisfied with the old systems. This book examines some of the main issues created by the changed situation, aiming to

- provide managers with up-to-date information on types of service available
- develop and apply criteria for their performance
- examine the cost benefits of different services

- examine routines and methods of identification, ordering and receipt of documents
- assess various technical factors, and
- ensure that the findings had portability across systems.

The actual research was in two main parts: a study of the ability of alternative document suppliers to provide material wanted by researchers; and interviews with researchers. Three disciplines in five Midlands universities were chosen for study: business studies, geography and manufacturing engineering. The reasons for this seemingly rather odd selection were that they were all (with one exception) common to all five universities, that they all use journal articles heavily, and that they should all have an element of interdisciplinarity. (In practice, three other departments could not be interviewed, so that in the end only eleven were covered.) The absence of any humanities topic ('humanists' too read journals), and even more of any pure science, is a major limitation of the study. It is far from certain that the findings apply to other subject areas.

Within limitations (see below), the methodology is sound, and the research has been thoroughly executed. We are not told whether differences were found between researchers in the five universities, which differ in the nature of their campuses (not all centralized) and the size and quality of their libraries. If there were, what were they? If there were not, this is surely a useful finding, suggesting that academic environment has no significant effect on the behaviour or attitude of researchers. Nor can I find any figure for the number of researchers interviewed. Although the interviews are not claimed to do more than produce an impressionist picture, if we are not told how many there were we are bound to suspect that they were very few - which may well explain why the data was not broken down by university. It looks

as if the impressions are based on a very small number of people.

The alternative document suppliers studied were: the British Library Document Supply Centre (BLDSC), 'specialized collection-based suppliers' (e.g. Ei), 'non-collection-based suppliers' (brokers between requesters and document sources), CAS-IAS suppliers (e.g. Uncover), and publishers. It identifies management criteria for selecting systems - nineteen criteria in all. Some (e.g. cost, coverage/fill rate and response time) are familiar;¹ others, such as mediated versus unmediated access, standards compliance, and vendor stability, are new, and entirely due to the aforementioned recent developments. The access systems studied were: local library collection, ILL-BLDSC (BLDSC's regular service), BL Inside, ProQuest Direct, SearchBank, EiText, and Geo-SL-BL; the last three are subject-based.

The study of the coverage of the alternative systems uses researchers' citations to represent their requirements; I have reservations about this but I understand why it was done. The conclusion of this part of the project is that (no surprise) BLDSC had far the best coverage, followed by BL Inside and then (remarkably closely) by the combined holdings of four libraries (the fifth could for some reason not supply a list of its holdings). The subject-specific systems, tested only in their own fields, were far behind.

Although the findings show such big differences that greater sophistication would probably not have changed them much, this part of the FIDDO project should be regarded as a pilot survey. Further studies of the ability of alternative systems to meet user needs are needed; in particular, the performance of JSTOR, which some see as the system of the future, needs to be evaluated. However, more subjects should be covered, better surrogates for needs than citations should be sought, and larger samples should be used. In fact, there ought ideally to be an ongoing series of such studies, to keep up to date in an ever-changing

situation. This would cost money, but the importance of the information would justify its expenditure.

In the next two chapters (which confusingly have the same running heading) the questions of time and technical infrastructure are examined. I cannot understand why chapter four, which is concerned solely with time, is titled 'The context of academic researchers: the local organization'. A valuable distinction is made between *actual time* (the time necessary to use a system as measured experimentally), *effective time* (as perceived by researchers), *dedicated time* (that devoted exclusively to using the system), and *delivery time* (the delay between requesting and receiving a document). There are often differences between the first two.

Delivery times for SearchBank and ProQuest Direct were faster than BL Inside (though the actual difference was only two minutes), while EiText was very slow. But delivery time is only one element; once received, an electronic document has to be downloaded, and is usually printed out (in 70 percent of cases in the FIDDO study). Also, since coverage of the specialized services is poor, it can save time if all requests are sent to one source that has excellent coverage. Similarly, researchers preferred to have all the papers they wanted in their own library, but they almost always copied them: more time and cost. Until there is a supplier with the holdings of BLDSC and the ability to supply them in electronic form, there is no perfect solution. (This suggests, incidentally, that journal publishers and the BL ought to get together to provide just such a solution, which neither can do alone.) A 'perfect solution' would deliver all articles required to the researcher's desk, wherever it is. Whether this would make local library collections unnecessary depends on the value attached to browsing; some researchers attached a good deal to it.

The technical infrastructure needed to support traditional, let alone electronic, access is quite extensive. In a library, photocopiers are needed,

including some with colour (a point not made in the book); wherever electronic access takes place, computers and printers are required. Prints of good quality are also desired; in some cases (e.g. biological illustrations) they are a necessity. Often (usually?) there are not enough copiers, or the quality is not good enough. Internal mail can be slow, and networks are not always reliable. Nor is the management infrastructure consistently adequate. Other problems for the library manager, and therefore indirectly for the user, are the different requirements for authentication and access - another argument for a single efficient system, or for processes that are standard across all systems. The first would constitute an effective monopoly, and thus inhibit competition and progress; and the second is hard to imagine, since processes are an integral element in the systems, which will inevitably seek advantages over other systems. So users, or managers, or both, have to learn and cope with a variety of access processes. As stated on p.113, "Some systems place heavy demands on local libraries whereas others are relatively straightforward. Unfortunately, the relatively straightforward ones do not necessarily offer the best service to end-users, particularly those wanting to use the systems away from campus." The study found that user support in the library was preferred to the helpdesks of the systems, good though some of these (notably the BL) were. This is understandable, but the aim must surely be to enable the user to manage easily without the library's help. As an independent user who is a member of no research library (one of a growing species), I can manage, but there is quite a long way to go before I shall be able to manage easily.

The chapter on budgeting mentions *inter alia* the problem of controlling budgets when users have direct access to document supply systems, particularly in the case of devolved budgets. One point is not made. Users want to go seamlessly from looking for relevant references to locating them and requesting them, and systems are increasingly mak-

ing this possible. In practice, some hurdle ought to be placed between locating and requesting; documents are far more costly to supply, whatever system is used, than they are to identify, and somehow users need to be made aware of this, especially if they do not bear the cost; otherwise a great deal of money will be wasted.

Chapter 9, which updates and extends the FIDDO report to eLib, makes sixteen 'key points' arising from the research, which are so important that they ought to appear near the beginning of the book. They include valuable proposals for improvement, both short-term and longer-term. Some are obvious: for example, the delays that occur with getting documents to requesters once they arrive in a library need to be eliminated, and users should not

have to go to libraries every time they want an article it possesses.

The main text ends with a chapter relating the FIDDO research to initiatives and research in the UK and other countries. There follow four Appendices, respectively a list of suppliers (as at December 1999, but kept up to date at www.aslib.co.uk/fiddo), the research methodology toolkit used, a glossary of technical terms, and a set of guidelines for library managers.

As noted above, the whole sequence of activities involved in document access and supply is converging into an integrated process. This implies that future discussion of document access should extend back into bibliographic control, which has its own deficiencies. In this context, the implications of the FIDDO research

for bibliographic access would make a useful study.

This book is more than a good (and well written) report of research; it is a major contribution to an area that might have been thought well worn. Although the project was completed in 1999, the book will not be outdated for some years, because some of the issues it raises are ones that will not be resolved quickly. Indeed, it is the discussion of the issues rather than the research that is of lasting value. The book is of wide interest and should be widely read.

Reference

1. Line, Maurice B. *Measuring the performance of document supply systems*. Prepared by the IFLA International Office for UAP. Paris: UNESCO, 1987. (PGI-87/WS/21).

