UC Berkeley

Title
987-1-85604-647-3

Permalink
https://escholarship.org/uc/item/5sr8x968

ISBN
9781856046473

Author
Buckland, MK

Publication Date
2009

Peer reviewed

The Library Research Unit at the University of Lancaster, 1967-1972
A Memoir

Michael Buckland

Peter Brophy entered librarianship by a thoroughly unorthodox route. He was one of the first students to take the BSc. in Information Science developed by B. C. ("Bertie") Brookes at University College, London, graduating in 1971. He then moved into full-time research on library problems at the Library Research Unit at the University of Lancaster Library before moving on in 1973 to library automation and eventually library management. At the time both his undergraduate degree and the Library Research Unit were radical departures from conventional practice. This memoir, written mainly from memory, provides an account of the Lancaster Library Unit in which his professional career began.

The University of Lancaster was one of the "new universities" founded in the 1960s to help accommodate the rapid expansion of university education in the U.K. Charles F. Carter, the founding Vice-Chancellor, an economist and a Quaker, was concerned that the University address real-world problems as well as regional needs. Lancaster had the first department of Operational Research in the U.K., the first department of Marketing, and, also a first, a department of Systems Engineering with special interest in optimization in chemical industries. The ethos of the new university was very similar to that of the Land Grant universities in the United States. Currently, the University's website opens with the slogan "Learning for the real world" (www.lancs.ac.uk).

Among the very earliest appointments was the University Librarian, A. Graham Mackenzie, who had graduated in Classics from the University of Glasgow. His handle-bar moustache and his enthusiasm for machines were both attributed to his service in the Royal Air Force. He liked to recall how when he was interviewed he was taken south of Lancaster to a grassy, windswept hillside, the Bailrigg site, where he was abruptly asked what a first-rate university library would be like in twenty years. His interviewers said that they wanted one on this site and that the first students would be arriving in eighteen months. It was a challenge to which he responded with enthusiasm and boldness. It was clear that the planned library would have to developed quickly and be both economical and effective. Initially library service was provided in temporary quarters in Lancaster and the first phase of the new library building opened in January 1967. Mackenzie spent a large amount of time working with the architect on the design of the new building, which had a pleasant, functional, and economical design.

The "new universities" generated a pulse of new life and created opportunities for librarians like Graham Mackenzie to become library directors in their prime instead of having to wait for dead men's shoes. What was striking about the University of Lancaster library was the range of innovation. In addition to the new and well-designed library building, a novel three-part staffing structure was adopted: (1) Senior Library Assistants, professionally qualified librarians, were responsible for all professional tasks for which subject expertise was not necessary, such as acquisitions, cataloguing, and lending services. (2) Assistant Librarians, with academic qualifications in addition to professional qualifications, were responsible for liaison with teaching staff, collection development, bibliographic instruction, classification, and advanced reference; and (3) Support staff for clerical and technical activities.

Library automation was just beginning in the mid-1960s and was not yet cost-effective. A Friden Flexowriter, a punched paper-tape typewriter, was programmed to mechanize catalogue card production. The catalogue records were saved on punched paper tape for a future online catalogue. In the early 1970s, a computer was used to maintain a simple listing of books on reserve and a "hybrid" circulation system was implemented that combined a minicomputer at the service desk with overnight updating on a mainframe (Buckland and Gallivan, 1972; Gallivan, Bamber and Buckland, 1972).

Bibliographic instruction, relatively undeveloped in British university libraries, was emphasized and tailored guides were developed (e.g. Buckland, 1967, 1968). Meanwhile the new National Lending Library for Science and Technology (later the British Library Document Supply Center) was able to satisfy an increasing proportion of interlibrary loan requests overnight. The 1960s and early 1970s were a golden era for British academic librarianship. Other university libraries were also adopting these kinds of innovations, but Lancaster adopted them more completely than elsewhere. Even more unusual was Graham Mackenzie's push for the library to have a substantial research programme. In January 1965, he and Vice-Chancellor Carter submitted an ambitious grant proposal to the Department of Scientific and Industrial Research. It began "In considering future policy for the development of libraries and of library techniques, it seems to us that there is a serious gap in present knowledge. Not enough is known about the ways in which people use a store of knowledge."

The case for the research program was based on the argument that although much was known about the past and present of libraries the government's very large outlay in creating and maintaining new university libraries justified an investigation of how library services could be made more effective. Mackenzie and Carter asked for government funding for a large, multidisciplinary team, with a highly-paid project leader, for five years and funding was approved. It is hard, now, to appreciate how radical this initiative was in the U.K. in 1965. There was no tradition of serious research into practical library problems. Doctoral study related to libraries was rare and dealt with historical bibliography or library history. The main exception was Aslib's research and consulting service, concerned mainly with special libraries, science information, and information retrieval.

Since it was unclear what would be done or who could do it, an international competition, based

on architectural competitions for major building projects, was announced. Anyone interested in leading the project at Lancaster was invited to submit a proposal outlining what they thought should be done and why they were qualified to do it. Two applicants were commissioned to develop more detailed proposals, which were then reviewed by a jury of distinguished senior figures. At this point the scheme collapsed because the senior figures did not like either of the two commissioned proposals. There was some irony in this. If the leadership in academic librarianship had been engaging competently in such research, there would have been little need for a major new project.

The failure of the planned research programme was deeply disappointing, but the funding agency, the Office of Scientific and Technical Information (OSTI, which later became the British Library Research and Development Department) offered a small grant to fund 1.5 persons for a single year and a Library Research Unit was formed within the University Library. I had joined the library as an Assistant Librarian in July 1965 and was re-assigned full-time to the project. Ian Woodburn, an applied statistician, became the other half-person. The Department of Systems Engineering wanted to hire him as a lecturer, but could afford only half his salary. In this way Ian Woodburn was able to get the academic position he wanted, but at the price of having to work half-time with me on the library's new project.

The project was entitled "Systems Analysis of a University Library." The distant vision was clear: to find out what a really good university library ought to be in twenty years and show how to move to that state rapidly. It is fair to say that nobody involved had any real idea what would be done or how and I had a bad dream in which the final report was composed of sheets of blank paper. However, the direction was soon clarified: The development of mathematical models in order to understand and manage library services better. The first publishable idea was the insight that two well-known empirical patterns of the use of scholarly literature–obsolescence (the decline in use over time) and scattering (the skewed dispersal of articles on any topic across different journals)--could be combined to create theoretical "p% library" models of the optimal collection and retention policies for journals in any given subject area in any given situation (Buckland and Woodburn, 1968b). The approach was too idealized for direct application, but some intriguing aspects of these empirical patterns were later examined (Buckland and Hindle,1969b; Buckland, 1972a).

The central fact of library logistics is that the demand for books is highly skewed: A very few titles are in high demand, accounting for much of the actual book use, and very many titles are used little or not at all. Libraries tend to form hierarchical structures with heavily used books located near to users and the residual demand for rarely requested books absorbed by larger libraries (Woodburn, 1969). Prior quantitative research, especially in the U.S., had been heavily concentrated on how to deal with the many least-used books which dominate libraries' storage costs. The desire to reduce libraries' space costs had diverted attention from the management of the most-used books which necessarily dominate the quality of service for library users. Whatever else academic libraries do, they exist to make books available for readers and this is especially important when many students need the same text at the same time and the library has only one or very few copies. So the next investigation was a collaboration with the Service Desk

staff to examine the actual patterns of demand for, and the actual availability of books, placed in the short loan reserve collection. What were the relationships between the level of demand, the length of the loan period, the number of copies, and, as a standard of service, how often a copy was available when requested? These four factors are related like a cat's cradle: Each influences and is influenced by the other three. In the relatively simple situation of a reserve collection queuing theory could be applied and some practical guidance provided (Buckland and Woodburn,1968a, 1969).

These initial efforts justified an extension of funding at the same level for a second year. Full-time funding for Ian Woodburn's teaching appointment had still not been found, so he continued half-time in the Library Research Unit. By this time a member of the academic staff in the Department of Operational Research, Anthony ("Tony") Hindle had become increasingly involved. He was unusual in being interested in public services, in having a background in Industrial Psychology as well as Ergonomics and Cybernetics, and in having just the right aptitude for what needed to be done in the library.

An obvious next step would be to extend the examination of the availability of books in the short term reserve collection to the rest of the collection, but the dynamics of the use of the books shelved on the open shelves was little understood and too complex for queuing theory. There had been complaints that books were too often unavailable when needed despite the generous book budget and skilled selection. The Library Research Unit was mandated to investigate and to make recommendations if need be. During 1967 and 1968, a series of measurements were undertaken which showed that library users could find the books they were looking for about 6 times out of 10; that the major cause of non-availability was that the book was out on loan to someone else; that borrowed books tended to remain out for the full length of the loan period; that in practice a loan period was determined not by written policies but by when overdue fines began; that disappointed would-be borrowers did not often avail themselves of the procedures for recalling books back from loan; and that in-library book use tended to have a stable relationship to circulation in any given library (Hindle and Buckland, 1968). A Monte Carlo simulation was used to avoid the limitations of queuing theory. A flow chart of borrowing activities was programmed so that a computer could simulate the sequence of users seeking a single book, its repeatedly being borrowed and returned, and how often a copy was not available when sought. The simulation was flexible enough to show the effects of changes in the pattern and level of demand, in the length of the loan period, and/or of changing the number of copies of that book.

At this promising juncture, during 1968, disaster struck. The Lancaster Library Research Unit was not the only small library related research unit in Britain. There was the Project to Evaluate the Benefits of University Libraries (PEBUL) at Durham University led by John Hawgood and Richard Morley, and a group led by J. N. Wolfe at the University of Edinburgh interested in economic analyses. A misguided application of the "centres of excellence" principle induced the funding agency, OSTI, to discontinue support for small units and to concentrate their funding at a new and larger centre for library management research to be established at Cambridge University. To this end I received a personal telephone call from London asking me to agree to

transfer to Cambridge. I had no desire to leave Lancaster, I did not believe that Cambridge would be a suitable environment and declined. The funding went to Cambridge anyway for a Library Management Research Unit under Leonard Schofield and was later transferred to Loughborough University of Technology. Lancaster received a six month extension to complete and document its work.

For the Unit to survive, new funding was urgently needed and some was found in a pair of sub-contracts from the National Libraries APD Project led by Maurice B. Line. The degree of overlap in the titles in different libraries is important. A high degree of overlap is needed to make collaborative cataloguing cost-effective; a low degree of overlap makes union catalogues important for resource sharing. We took stratified samples of pre-1968 imprints from the catalogues of 23 different libraries, including all the largest, and edited the records into a consistent form with codings for date and language. Analysis of the samples gave us a profile of the collections by age and language. Then a sub-sample of records was searched for in the catalogues of each of eighteen of the libraries. It was a laborious exercise, but it enabled us to estimate the overlap between any pair of libraries or within any group of libraries. We projected how the cumulative number of different titles increased as libraries were added to a consortium in any given order and even to project an estimate of the total number of different titles in all British libraries combined (University of Lancaster. Library Research Unit, 1971b). A related study examined how far there was duplication in the current acquisition of foreign books (University of Lancaster. Library Research Unit, 1971a). Overlap has other important applications, for example, in examining the coverage of literature by abstracting and indexing services, so the numerous methodological problems were examined with some thoroughness and illustrated with some of our findings (Buckland, Hindle and Walker, 1975).

OSTI was almost the only U.K. source of funding for library research and development and more funding for library management studies was precluded by the Cambridge initiative. However, OSTI's funding program was compartmentalized, so could our work be considered in some other category than "library management"? Our answer was that mathematical models of library services could yield instructive insights even when not directly applicable. The "p% library" model was a good example. So pitching our work as a contribution to *library education* rather than *library management* allowed access to a different funding program within OSTI and resulted in grants in 1971 and 1972 to develop educational library management games. Two games were developed. A Library Technical Services Management Game was based on two trade-offs in library technical services. First, the balance in funding between the cost of the books and the cost of staff to process them. Second, the optimal deployment of labor of different kinds at each stage of acquisitions, cataloguing, binding, and preparation for the shelves. Outcomes include the number of books reaching the shelves and the length of time it takes them to get there. Insufficient and/or poorly assigned staff leads to chronic delays. Increasing staffing reduces the number of books that can be afforded. (The underlying model is given in Mackenzie (1970b)).

The second game drew directly on the book availability studies. Players had to choose and implement loan and duplication policies and the likely consequences in terms of costs and

demand predicted by the simulation. Realism could be enhanced by adding a concurrent in-tray exercise whereby players were subjected to the kind of memos, crises, and distractions that library managers receive. Evaluative workshops were held in Morecambe in 1972 and Bowness in 1973 and game kits were published. Teaching staff from seven different library schools were attached to the Library Research Unit for varying periods. (Buckland and Hindle, 1971; Brophy et al., 1972; Brophy and Buckland, 1972; Daly et al., 1976). This work was honored by the conferral by the [British] Library Association of the Robinson Medal "for invention in library technology or administration" in 1972.

As the work expanded. Eileen Morris provided secretarial support and two young researchers were hired, Peter Brophy, and Veronica Pogson (later Veronica Brett).

In the meanwhile, studies of the availability of books in the main collection had led to the adoption of two measures: *Immediate availability* (the chances that the next person to look for a book will find a copy on the shelf) and *collection bias* (the degree to which the most-popular books are available). The relationships between these two measures and different combinations of loan and duplication policies were quantified using computer simulations for different levels of demand. Then the number of books at each level of demand was estimated in order to calculate the immediate availability and collection bias for the library as a whole. The simulation also estimated the number of books out on loan at any given time, a figure which could also be calculated from the circulation system records. The close match found provided some assurance that the simulation results really did approximate reality. The analyses allowed us to provide detailed guidance to the Library Committee. The immediate availability was around 60%. Increasing it to 80% could be achieved either by spending the entire next year's book budget on duplicate copies of in-demand titles or by shortening the loan period for the 9% most-borrowed books to one week for all borrowers even if loan could be renewed or by a combined strategy (Buckland and Hindle, 1969, 1970; Buckland, 1972d, 1975). Further, since past use tended to predict future use and since demand for any title would be spread across all copies, specific recommendations for loan length and for duplication could be based on circulation data on a volume by volume basis. At the time, the number of dates stamped on any book's "date due" was counted. Later Peter Brophy, the head of the Service Desk, R. N. ("Bill") Bamber and others worked on deriving feedback from automated circulation systems (Brophy and Moorhouse, 1984; Richardson and Bamber, 1985). So any set of policies could be implemented swiftly and economically and, better yet, subsequent inspections could lead to further adjustments on a volume by volume basis thereby making library collection continuously and efficiently adaptive as demand changed. This adaptiveness proved to be even more important than expected. Per capita library use at Lancaster, already higher than at any other British university library, doubled in during the year after the new policies to increase availability were implemented. Of course, increased demand required increased response from a now-adaptive library. Library use was evidently far more sensitive to immediate availability than had been expected. Data from Lancaster and elsewhere suggested a homeostatic balance, with demand adjusting to 60% immediate availability. These issues were discussed more fully in a doctoral dissertation and eventually in a book (Buckland, 1972b, 1975).

Some overviews of the work of the Library Research Unit were published (Mackenzie, 1971) and a variety of other activities were undertaken more or less incidental to the funded projects. An international conference was organized (Mackenzie and Stuart, 1969); a tutorial on operations research for librarians was published in a reader (Hindle, Buckland and Brophy, 1976; Brophy, Buckland and Hindle, 1976); and some literature surveys were a by-product of research done (Mackenzie and Buckland, 1972; Buckland and Kraft, 1976; Buckland, 1978).

The Library Research Unit existed in two legal forms, as a department in the Library and also a division of Uldeco, the University's development company, which increased administrative flexibility. Also, we hoped to be the first library ever to confer a Ph.D. At Lancaster the Library was formally an academic department and so there were no obstacles when a very suitably-qualified candidate (Peter Brophy) was enrolled as a Ph.D student in the Library itself.

Our primary concern, however, was to understand the dynamics of library provision and use. In particular, the substantial increase in demand in response to improved availability revealed the need to investigate the dynamics of library user behaviour. We had modeled the response of the collection to demand, but now we knew that we also needed the model the response of the users to the collection. In 1971, the Council on Library Resources, Inc., of Washington, DC, generously provided funding for a project on "Fundamental research on factors affecting the use of library services." An early product was a major literature review (Ford, 1973). The idea was that demographics, personality traits, and task characteristics (such as time pressure) might yield a predictive model of user behaviour A stratified sample of students were paid to participate, their demographic characteristics were noted, and they were given a battery of tests for motivation, attitude to the library, the Terman Concept Mastery Test, and the Eysenck Personality Inventory. At intervals they were given a pair of forms to be completed on their next visit to the library. On arrival at the library they wrote down on one form what they intended to do in the library during this visit. On the other form they wrote a chronicle of what they actually did do. Qualitative analysis of these records yielded some interesting ideas about categorizing library users as "searchers," "workers,"and "shirkers," but the variety and fluidity of activities in the library defied reduction to quantitative models. A by-product of this work on task characteristics was an analysis showing that differences in the types of searches performed provided a plausible explanation of the substantial differences between public, special, and university libraries (Buckland, 1979) .

Eventually a new grant was received for a project entitled "Acquisitions, stock holding, stock control and discarding policy in libraries" which attempted to combine the work on book availability with models of acquisitions, book processing, and user behaviour (Buckland and Hindle, 1976; Hindle, 1977).

There never would have been a Library Research Unit without the imagination and determination of Graham Mackenzie, the University Librarian. Nor would it have survived without his strong protection. He was the Principal Investigator for all the grants. At the same time, he had neither the time nor the background to do the kind of research that needed to be done. Tony Hindle provided most of the methodological expertise, but he had limited time to

spare. I was in the middle, working in the Unit full-time, as so in a position to take care of the varied and often time-consuming tasks that needed to be done, including much of the writing. Each of us was entirely dependent on the other two--and knew it–and an exceptionally effective partnership resulted.

In March 1972, I left Lancaster and was succeeded by Geoffrey Ford. The Library Research Unit continued the work on library management games, the attempt to model user behaviour, and, later, another grant to develop more complete and integrated approach to library collection management combining acquisitions, stock control and discarding policies. Tony Hindle remained active at Lancaster. Graham Mackenzie moved to Saint Andrews University in 1976, retired in 1986, and died in 2005. All of us were grateful to Brian Perry and Sir Frank Francis and their colleagues at the British Library Research and Development Department (previously OSTI) and at the Council on Library Resources (now Council on Library and Information Resources) respectively for their willingness to support what was unconventional work.

Peter Brophy left the Library Research Unit in the summer of 1973 to become Systems Librarian at Strathclyde University. He responsibilities kept him too busy to become the first Ph.D (Library) graduate and his career showed that he did not need a doctorate. He paid tribute to his Lancaster years both in words (Brophy, 1986, ix) and, more importantly, in developing his own very active and successful research unit, CERLIM. It is very fitting that his distinguished career ended as it had begun, energetically engaged in a lively library research unit.

Bibliography

Brophy, P. et al. (1972) *A Library Management Game: report on a research project*, University of Lancaster Library Occasional Papers, 7, University of Lancaster Library. Available as ERIC Report ED 071 700. Also issued as *Computer-aided Instruction in Scientific and Technical Systems Management. Report to OSTI on Project SI/14/67.*

Brophy, P. and Buckland, M. (1972) Simulation in education for library and information science administration. *Information Scientist*, **6** (3), 93-100.

Brophy, P., Buckland, M. and Hindle, A. (eds.) (1976) *Reader in Operations Research for Libraries*, Information Handling Services.

Brophy, Peter and Pamela Moorhouse. 1984. The operation of a variable loan policy within an automated library system. *Program* 18, no. 2 (April 1984): 166-169.

Buckland, M. (1967) Sources of information for Operational Research studies, *Operational Research Quarterly*, **18** (3), 297-313.

Buckland, M. (1968) British sources of information for marketing studies. In Kelley, W. T. *Marketing Intelligence*, Staples Press.

Buckland, M. (1972a) Are scattering and obsolescence related? *Journal of Documentation*, **28** (3), 242-46. Also at http://www.sims.berkeley.edu/~buckland/obscat.html

Buckland, M. (1972b) *Library Stock Control*. Ph.D thesis. Faculty of Social Sciences, Sheffield University.

Buckland, M. (1972c) Library systems and management studies at Lancaster University. In

Proceedings of the 35th Annual Meeting, Washington, 1972, American Society for Information Science.

Buckland, M. (1972d) An Operations Research study of a variable loan and duplication policy at the University of Lancaster. In Swanson, D. R. and Bookstein, A. (eds.) *Operations Research: implications for libraries. 35th Annual Conference of the Graduate Library School, August, 1971*. Chicago University Press. Also in *Library Quarterly* **42** (1), 97-106.

Buckland, M. (1975) Book Availability and the Library User, Pergamon Press.

Buckland, M. (1978) Ten years progress in quantitative research on libraries, *Socio-Economic Planning Sciences* **12**, 333-39.

Buckland, M. (1979) On types of search and the allocation of library resources. *Journal of the American Society for Information Science* **30**, 143-47.

Buckland, M. et al. (1970) *Systems Analysis of a University Library: final report on a research project*, University of Lancaster Library Occasional Papers, 4, University of Lancaster Library. Available as ERIC Report ED 044 153.

Buckland, M. and Gallivan, B. (1972) Circulation control: Off-line, on-line, or hybrid, *Journal of Library Automation* **5** (1), 30-38.

Buckland, M. and Hindle, A. (1969a) Loan policies and duplication. In Mackenzie, A. G. and Stuart, I. M. (eds). *Planning Library Services: proceedings of a research seminar*, University of Lancaster Library Occasional Papers, 3, University of Lancaster Library). Available as ERIC Report ED 045 173.

Buckland, M. and Hindle, A. (1969b) Library Zipf: Zipf's law in libraries and information science. *Journal of Documentation*, **25** (1), 52-57. Also letter **25** (2), 154.

Buckland, M. and Hindle, A. (1971) The case for library management games. *Journal of Education for Librarianship*, **21** (1), 92-103.

Buckland, M. and Hindle, A. (1976) Acquisitions, growth and performance control through systems analysis. In Gore, D. (ed.) *Farewell to Alexandria: solutions to space, growth, and performance problems of libraries*, Greenwood Press, pp. 44-61.

Buckland, M., Hindle, A. and Walker, G. P. M. (1975) Methodological problems in assessing the overlap between bibliographical files and library holdings, *Information Processing and Management*, **11** (3/4), 89-105.

Buckland, M. and Kraft, D. H. (1976) *A bibliography on Operations Research in libraries*. In Brophy, P., Buckland, M. and Hindle, A. (eds.) (1976).

Buckland, M, and Woodburn, I. (1968a) *An Analytical Approach to Duplication and Availability*, University of Lancaster Library Occasional Papers, 2, University of Lancaster Library. Available as ERIC Report ED 022 516.

Buckland, M, and Woodburn, I. (1968b) *Some Implications for Library Management of Scattering and Obsolescence*, University of Lancaster Library Occasional papers, 1, University of Lancaster Library. Available as ERIC report ED 022 502. Revised as Buckland and Woodburn (1969).

Buckland, M. and Woodburn, I. (1969) An analytical study of library book duplication and availability. *Information Storage and Retrieval*, **5** (1), 69-79. Revised version of Buckland and Woodburn (1968b).

Daly, J. et al. (1976) *The Use of Gaming in Education for Library Management: final report on*

a research project, University of Lancaster Library Occasional Papers, 8, University of Lancaster Library.

Ford, G. (1973) Research in user behaviour in university libraries. *Journal of documentation* **29**, 85-106.

Gallivan, B., Bamber, R. N. and Buckland, M. (1972) *Computer Listing of a Reserve Collection*, University of Lancaster Library Occasional Papers, 6. University of Lancaster Library.

Hindle, A. (1977) *Developing an acquisitions system for a university library*. BLR&DD report 5351, British Library.

Hindle, A. and Buckland, M. (1976) *Towards an adaptive loan and duplication policy for a university library*. In Brophy, P., Buckland, M. and Hindle, A. (eds.) (1976).

Hindle, A. and Buckland, M. (1978) In-library book usage in relation to circulation. *Collection Management*, **2** (4), 265-77.

Hindle, A., Buckland, M. and Brophy, P. (1976) The Techniques of Operations Research. In Brophy, P., Buckland, M. and Hindle, A. (eds.) (1976).

Mackenzie, A. G. (1970a) Bibliotheconomics: or, Library science revisited. *An Leabharlean* 28(3): 97-105.

Mackenzie, A G. (1970b) Systems analysis of a university library. In: *Library Systems and Information Services; Proceedings of the Second Anglo-Czech Conference of Information Specialists*. Ed. by D. J. Foskett, A. de Reuck, H. Coblans, Archon Books, 35-43. Reprinted in Brophy, Buckland and Hindle (1976), 293-306.

Mackenzie, A. G. (1971) Library research at the University of Lancaster. *Library Association Record* 73: 90-92.

Mackenzie, A. G. (1973) Systems analysis as a decision-making tool for the library manager. *L:ibrary Trends* 21, no. 4 (April 1973): 493-504.

Mackenzie, A. G. and Buckland, M. (1972) Operational Research. In Whatley, A. H. (ed.), *British Librarianship and Information Science, 1966-70*, Library Association. Reprinted in Brophy, Buckland and Hindle (1976), 349-354.

Mackenzie, A. G. and Stuart, I. M. (eds.) (1969) *Planning Library Services: Proceedings of a Research Seminar*, University of Lancaster Library Occasional Papers, 3, University of Lancaster Library. Multiple pagination. Available as ERIC Report ED 045 173.

Richardson, I. S. and R. N. Bamber. (1985) Variable loan policy at University of Lancaster Library. *Program* 19, no. 2 (April 1985):176-180.

University of Lancaster. Library Research Unit. (1971) *Foreign Books Acquisitions Study: report to the [British] National Libraries ADP Study*, University of Lancaster Library.

University of Lancaster. Library Research Unit. (1971) *National Catalogue Coverage Study: report to the [British] National Libraries ADP Study*. University of Lancaster Library.

Woodburn, I. (1969) A mathematical model of a hierarchical library system. In: Mackenzie and Stuart (1969).