Automation at the New University of Ulster

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ABSTRACT
One of the first university libraries to employ the Plessey 'library pen' system, a recent convert to MARC, and a prolific user of tape typewriters for the production of machine-readable bibliographic records, the Library of the New University of Ulster has become deeply committed to automation. This paper describes the nature and development of this commitment and outlines the methods that were employed to automate 'housekeeping' routines between 1972 and 1975.

INTRODUCTION

A programme of automation was initially launched with the essentially practical object of improving and rationalising 'housekeeping' routines which had developed somewhat haphazardly in the early pioneering years of the Library. Before automation was introduced the library's acquisitions system was based on 5 in. x 3 in. hand-written proposal cards which served not only as the index of books on order but also, batched in photocopied form on A4 paper, as the actual orders sent to booksellers; cataloguing was based on a data worksheet prepared by a cataloguer as a source document from which a flexowriter operator punched a paper tape which was fed back through the flexowriter to produce multiple sets of catalogue cards; and circulation was based primarily on the traditional duplicate issue slip system and supplemented by Browne and a local card index system in the case of two special collections of books. None of these routines could be shown to be satisfactory when a systematic appraisal of them was made after they had been in operation for two years. Only the simplest information could be obtained easily from the acquisitions system and more complex items of information like total expenditure in a certain fund or details of outstanding orders could be obtained only with an enormous consumption of staff time and effort. In the cataloguing system the use of a worksheet to record the bibliographical data was satisfactory enough but the use of a flexowriter for producing multiple sets of catalogue cards was inefficient because it was slow and very wasteful of precious machine time. The circulation system suffered not only from the well known hazards of relying on the ability of a borrower to write bibliographical details legibly and correctly but also from the existence of two different sub-systems which created a situation that was confusing both for borrowers and library staff. The best remedy for all these shortcomings was considered to lie in the gradual computerisation of all the individual 'housekeeping operations with the ultimate aim of drawing them together into an integrated system at a later date. With the installation of the University's computer in 1972 and the appointment the same year of a Senior Computer Officer employed to design systems for both Library and Administration, a start was made on automating the Library on these lines. In chronological order of their introduction automated systems relating to acquisitions, periodicals, circulation, and cataloguing were each individually established between 1972 and 1975 and the first step was made towards an integrated system for monographs with the development in early 1975 of a considerable degree of linking between the acquisitions, cataloguing and circulation systems. Other aspects of the historical background to the development of automation at NUU are described elsewhere (1).

ACQUISITIONS

The system employed is substantially the one developed by Southampton University Library but with the incorporation of certain modifications designed to take advantage of the disc drives available to the Library at NUU, minor alterations to the types of listings normally produced, and the addition of a local listing relating to standing orders. The adoption of this system was to a large extent influenced by the fact that the Library at NUU possessed two BCD-coded Friden flexowriters which were almost identical to those employed in Southampton for the production of the punched paper tape used as the means of inputting acquisitions data into the computer. Access to the same type of computer as used in Southampton was another important influence. With extremely helpful guidance and advice from the staff at Southampton the system was absorbed at NUU with few real difficulties and after a remarkably brief period of testing and preparation it was possible to substitute it for the manual system completely.

The system as developed at Southampton has been described elsewhere (2, 3) and is also to be the subject of a full system report (2) but, nevertheless, it is relevant here to enumerate below the listings produced by it at NUU in order to provide a context for the references which are made to some of them later on in this paper and at the same time to demonstrate the far greater variety of information obtainable in comparison with the original manual system (see Appendix 2 for flowchart).

1. Alphabetical list of books still on order, including an indication of those supplied in the current week. (Weekly).
2. List of books ordered during the current week in order number order. (Weekly).
3. List of books received during the current week in accession number order. (Weekly).
4. 'Daybook' of books received during the current week in bookseller order. (Weekly).

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5. Retrospective cumulative file listing books received in accession number order. (On demand).
6. Retrospective cumulative file listing books still on order as well as books received in alphabetical order. (On demand).
7. Retrospective cumulative file listing books still on order as well as books received in order number order. (On demand).
8. Lists of donations and important purchases. (On demand).
9. List of outstanding items by fund. (On demand).
10. Booksellers' chasers. (Monthly).
11. Alphabetical list of standing orders, including standing orders received. (Monthly).
12. Fund expenditure and commitment statistics.   (Weekly)

CATALOGUING

The cataloguing system is based on MARC. Weekly BNB MARC tapes are taken and data extracted from them in accordance with local cataloguing practice is added to a cumulating Potential Requirements File (PRF) held on disc. To keep this file within proportions which are manageable in the computer configuration that exists at present it is intended to weed this file periodically so that it contains only the latest three years of BNB records. Each week the ISBN's of books received, input from the acquisitions system, are run against the PRF. Matched items are added to a disc file of items awaiting cataloguing and also printed out as diagnostic records for insertion in the appropriate books. Cataloguers amend these diagnostic records where necessary to conform to local cataloguing practice and add local information such as the shelf number and location. These amendments and additions are punched on an ICL coded flexowriter and matched in weekly batches, by means of the accession number, with the relevant records held on the disc of items awaiting cataloguing. This matching process produces a magnetic tape of completed catalogue records for the week. Items which are not found on the PRF are catalogued from scratch in the MARC format with the aid of specially designed input sheets. These local MARC records are punched at the same time as the amendments and additions to the BNB MARC records and processed in the computer for incorporation in the weekly catalogue tape.

The weekly catalogue tape containing edited BNB MARC records and local MARC records is input to various programs (see Appendix 3) to produce:

1. Catalogue cards generated from the line-printer on continuous card stationery in alphabetical and classified sequences.
2. A weekly arrivals list.
3. An updating of a Short Title File (STF) of the Library' s catalogue used as a back-up for the circulation system.
4. An updating of a full-scale MARC magnetic tape file version of the Library's catalogue, possibly the basis of a COM catalogue of the Library's holdings at some future date but employed mainly at present to produce select listings such as catalogues of books in special collections.
5. Reminders about books still to be catalogued.

An average of about 20% of the weekly intake of books is successfully matched against the MARC PRF. It is intended to investigate the possibility of utilising the British Library's Selective Tape Service for items not covered by the PRF in order to increase this percentage. In the meantime the proportion of unmatched books that have to be recorded in the MARC format locally remains high. While cataloguing books in MARC format is slower and more complex than cataloguing in conventional fashion, it has been found here, as it was in Southampton University Library (4), that cataloguers learn to handle MARC with increasing skill and speed as they become more and more familiar with the MARC tagging structure. Any reduction in the cataloguing rate which may have been occasioned by the introduction of MARC has been amply compensated by the increased rate at which catalogue cards are now produced as a result of being able to utilise the computer and its line-printer for this purpose. Back-logs of catalogue card production that were common in the past no longer occur and the time which elapses between a book being received and an entry for it appearing in the catalogue has been considerably reduced.

CIRCULATION

A Plessey 'library pen' system was installed in October, 1974. At present there are six pen terminals (four of them situated in the Main Library and two in a branch library housed in the Education Centre) and a keyboard terminal is located in each library mainly for the purpose of inputting book and borrower numbers in connection with reservations and renewals but also for creating issue and discharge transactions in circumstances when it is not possible to use the pen terminals. All of the terminals are linked to a multiplexer, trapping store, and data capture unit located at the issue desk in the Main Library. Issue, discharge and other transactions are written throughout the day to a cassetted magnetic tape that is taken to the Computer Centre after the Library closes for conversion early the following morning to paper tape, which is in turn converted to the computer-compatible magnetic tape used to update the loans file and produce the various print-outs for distribution to the Issue Desks. A flow-chart of the suite of locally designed programs and its outputs is provided in Appendices 4 & 5.

The basic data captured in the Plessey system are purely in the form of book and borrower numbers transmitted by reading bar-coded labels representing these numbers with a light-sensitive pen. It was considered necessary that on some of the

print-outs (eg. on the main loans files, and on recall and overdue notices) book numbers, and in some cases borrower numbers as well, needed to be expanded so as to be more meaningful for readers and useful to library staff. It has accordingly been arranged that the author, title and shelf number are added to the book number and the name and address to the borrower number when these supplementary details are required. In the case of the borrower number this is achieved (when, for example, overdue, recall, and overborrowing notices are printed) by matching the number against a magnetic tape file containing full details of all borrowers, including their names and addresses (see Appendix 4). This file is produced from the student and staff records held in the computer for administrative purposes and from additional records of external readers provided by the Library from its flexowriters in the form of punched paper tape.

Expansion of the book number to include author, title and shelf number is achieved by means of a file of mini-records of the Library's stock held on disc, the Short-Title File (STF) previously referred to in the section on Cataloguing. When full details are required the book numbers processed in the computer are compared with the contents of the STF and when a match is found there the bibliographical description is extracted and added to the number (see Appendix 4). About half the book stock is so far contained on the STF. Currently received books are added to it automatically via the cataloguing system (see Appendix 3). Books received in earlier years and not as yet on file (identifiable by virtue of the fact that they were never previously accessioned and therefore have no accession number contained in them) are being added to the STF, gradually as they are borrowed or in batches taken from the open shelves during slack periods, by means of the pieces of punched paper tape that were obtained and stored as a by-product of the original system of typing and reproducing cards on a flexowriter. These pieces of punched paper tape are duplicated by flexowriter on amalgamated reels which are processed in the computer under the control of a format recognition and truncation program which abbreviates the entries and adds them to the STF. Retrospective items are also added to the STF via punched cards prepared from data input sheets filled in by library staff when appropriate punched paper tapes are missing or unsuitable for input (see Appendix 5).

If a book not previously recorded in the STF is presented for borrowing at the Issue Desk it is allocated the next available accession number on the spot in the form of an adhesive bar-coded label which is attached to the book immediately. This enables the book to be issued by the 'library pen' in the normal way but in this case the borrower has to fill in the bibliographical details, including the new accession number printed above the bar-coded label, on an issue slip which is used to identify the relevant piece of punched tape that has to be input to the computer for the purpose of updating the STF. As the STF is only updated once a week this book and others like it initially appear on all the bibliographical print-outs merely as numbers which are not expanded to include author, title, and shelf number until they are matched with the updated STF during a weekly run (see Appendix 5).

COM

An alphabetical author cumulation of the STF on magnetic tape is produced each month for conversion to COM by Comco Micro Systems Ltd. of Glasgow. The main purpose of this COM catalogue is to provide rapid access to accession number information when it is not available from the public catalogues, in which many of the earlier cards did not have book numbers typed on them. This facility has several valuable uses but it is particularly important in connection with the trapping of reserved books on their return from loan as this is dependent on a book number being keyed into the trapping store. For this reason the Planet microfilm reader used by the Library for reading COM material is kept in a strategic position at the Issue Desk. The acquisitions system's weekly author listings, which provide the accession numbers of the most recently acquired items, are also kept at the Issue Desk to serve as supplements updating the latest monthly COM cumulation.

COM has proved a very convenient and swift way of checking and, when necessary, editing the data which is input to the STF. To increase the usefulness of this particular application of COM, a listing of the STF in accession number order has now been added to the alphabetical version to enable queries relating to accession numbers to be solved more easily. This listing is cumulated for conversion to COM at three monthly intervals and is kept up to date between cumulations by means of the weekly accessions lists which are obtained as print-outs from the acquisitions system.

PERIODICALS

At NUU periodicals are treated quite separately from monographs in the sense that they are budgeted and ordered independently, are not allocated accession numbers, and are not borrowable (except in exceptional circumstances). This line of approach has operated satisfactorily and it was, therefore, felt unnecessary to depart from it by attempting to design a periodicals system geared to integration within the system of linking contemplated for monographs. As dovetailing with the other automated systems being developed was not critical it was decided to save precious programming effort locally by importing Loughborough University Library's Periodicals Data System (PDS), a well documented package, developed by Loughborough over the years, that proved in practice to be very easily assimilated (5).

At present PDS is run in parallel with a local system which has been in operation for several years. In this local system punched paper tapes of periodical holdings are obtained from a flexowriter and read back for the purpose of producing catalogue cards, current accessions lists, and occasional catalogues in book form (6). Since 1973 PDS has also been in operation and, by means of the gradual transfer of holdings and related data via punched card input to magnetic tape and disc, is being used at NUU to produce an alphabetic holdings list, a list of titles arranged alphabetically by sponsoring body, a shelf list, and a subject index listing titles under descriptors. To this array of print-outs will eventually be added 'wants' lists and detailed financial statistics. When all the Library's holdings have been punched for the PDS system (about a half

have been recorded so far) the aim is to phase out the flexowriter system completely as PDS is capable of producing all the outputs obtained from the original system and a great deal more, as is shown by the rich variety of print-outs enumerated above. PDS will also be adapted to produce catalogue cards as it is intended to file these in the Main Library's general card catalogues as well as producing all the normal PDS listings for distribution to the various sections of the Library.

SDI

Two types of current awareness services have been developed, one providing information about recently published British books, the other listing the books that have been recently received in the Library.

The provision of information about recently published British books is a 'spin-off' from the weekly BNB MARC tapes to which NUU subscribes. The programs employed were originally developed by BLCMP to exploit MARC for SDI and book selection listing and amended and adapted for operational use by Queen's University, Belfast (7), from whom NUU acquired them for incorporation in its own suite of MARC programs. The basis of this use of MARC as it currently exists at NUU is a file of user profiles which are matched against the Dewey Decimal Classification field of the MARC tape, matching entries being printed out in profile order. A profile is composed of a general topic divided into subject areas within which there are a range of Dewey classification numbers, each representing a specific subject sub-division. Each subject sub-division within this range is expressed as a pair of Dewey numbers and is interpreted as all Dewey numbers between and including this pair (see Appendix 6). At present each general topic is restricted to six subject areas and six sub-divisions per subject area but it would be possible to amend the program to cater for a wider range of subjects if the restriction was felt to detract from the value of the resulting print-outs. So far profiles have been created for the staff of the Library and of the Chemistry, Mathematics, Physics, and Education Departments. The profiles used by teaching staff are constructed in liaison with the appropriate subject specialist librarian whose advice is particularly necessary in relation to the use of Dewey numbers. All profiles are run against the currently received BNB MARC tapes and distributed to their originators. Apart from its use as an aid to private research, this current awareness service provides useful, sifted bibliographical records which teaching and library staff use as one basis for selecting currently published books to be purchased by the Library. It is hoped eventually to have some evaluation of the service from feedback provided by profile users.

The other current awareness service provided by the Library is derived from the cataloguing information input weekly to the computer on paper tape punched from MARC worksheets and amended diagnostics prepared by the cataloguers. From this is produced, among various other outputs, a classified list of recent accessions which is duplicated for distribution to School Departments and various sections of the Library. Apart from their use as a current awareness tool, these lists also serve the very useful purpose of providing library staff and readers with shelf location information about books for which catalogue cards have not yet appeared in the public catalogues.

FUTURE DEVELOPMENTS

Now that the Library is storing most of its bibliographical data on magnetic tape files it is intended to examine the ways in which maximum use can be obtained from them. In particular, an effort will be made

(i) to categorise precisely the sort of bibliographical information that is required in relation to the needs of readers and library staff and to develop standard procedures for retrieving it;
(ii) to define the nature and the range of the statistics which should be collected from archival files in the area of management information and to design programs for extracting and analysing these statistics.

Extension of the use of COM will also be investigated. With the price of catalogue card stationery and card cabinets escalating steeply every year and staff time required to file cards becoming increasingly difficult to spare because of acute shortage of staff, serious consideration will be given to the possibility of converting the main catalogues to COM. The conversion of the MARC magnetic tape catalogue which is being stored at NUU would present few difficulties once the methods required to reproduce local filing practice as closely as possible in the computer had been satisfactorily programmed. This catalogue, however, only contains items added to the Library since the beginning of 1975. Ideally, it would be more desirable, although considerably more difficult, to undertake a retrospective conversion of the rest of the Library's catalogue to COM via MARC than to produce a COM catalogue as a supplement to a card catalogue either left in its original form or photographed on microfilm. The various alternative approaches to catalogue conversion have been discussed elsewhere (8, 9) and as a prelude to any decision being made it is intended to investigate all these approaches very carefully in the light of the costs involved and the special circumstances which exist at NUU.

CONCLUSION

Over a period of three years (1972-1975) considerable progress has been achieved at NUU in the major 'housekeeping' areas of library automation. An advanced stage in this particular sphere of automation has been reached in a relatively short time and with a minimum amount of staff because it has been possible to utilise a number of existing library programs (including the ICL MARC handling software package), around which all new, locally produced and, in the case of monographs, integrated programs could be designed. In this respect, the debt to Southampton, Loughborough, and Queen's University Libraries is acknowledged with gratitude. Particular acknowledgement must be made of the contribution of Southampton University whose Library Automation Research Group provided valuable guidance and assistance as well as programs and, when the first tentative steps were being made, helped to launch NUU Library firmly on the path to automation.

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APPENDIX 1

**Computer facilities, programs, library equipment and staff**

The computer configuration at NUU is an ICL 1903A comprising the following: 64K words of core store, 1200 cpm card reader, 100 cpm card punch, 1000 cps paper tape reader, 110 cps paper tape punch, 13501pm line-printer, 4 x 20 kc/s magnetic tape decks, 3 exchangeable disc transports (2 x 8m and 1 x 6m), 10 teletypewriters, 6 ICL Type 72 keypunches, and 1 graph-plotter.

The Plessey Data Capture System equipment consists of 6 'library pen' terminals, 2 keyboard terminals, an ancillary equipment cabinet (housing a multiplexer, power supply units, transmitter, and trapping store), a branch library receiver, a data capture unit, a branch library transmitter, a bar-code label printer, and a cassette to paper tape converter (kept in the Computer Centre).

The Library employs a Senior Computer Officer (shared with Administration) and a Programmer. Apart from using the card punching services provided by the Computer Centre, the Library itself possesses two BCD-coded Friden 2201 and two ICL-coded 2305 paper tape typewriters (the latter on loan from the Computer Centre), for the operation of which the Library employs three punch operators (one of whom is part-time).

The Acquisitions programs are written mainly in COBOL with a few in PLAN. Use is also made of the NCC FILET AB package for accessions and bookseller list's. The Cataloguing system is mostly programmed in PLAN, including a locally amended version of the ICL MARC program XDME to use disc files. The Circulation system is programmed in COBOL with some listings being output by FILET AB.
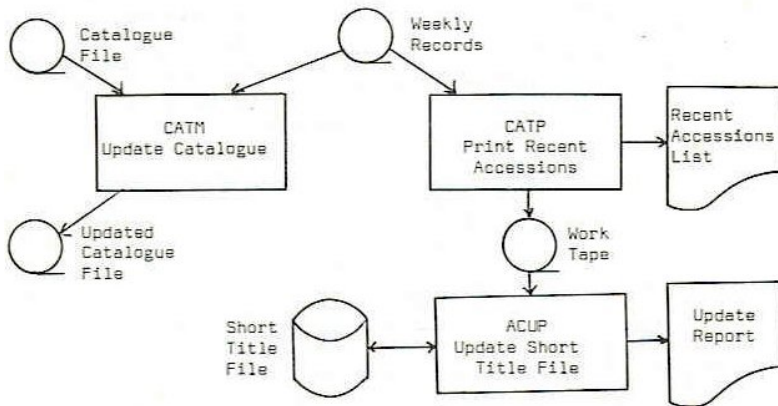
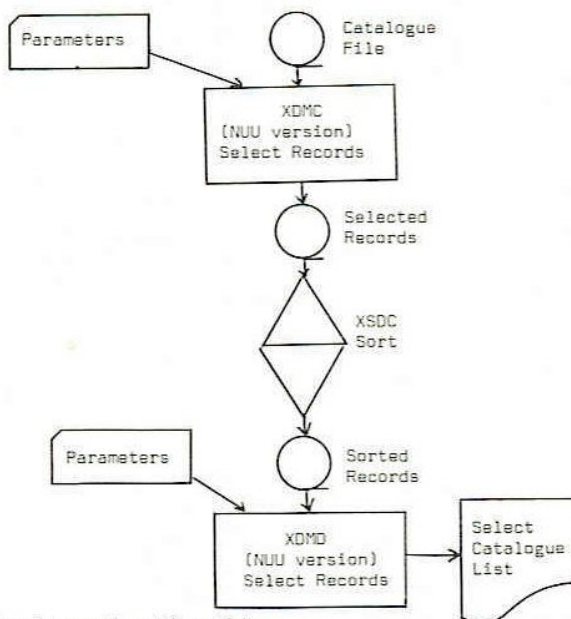**APPENDIX 2**
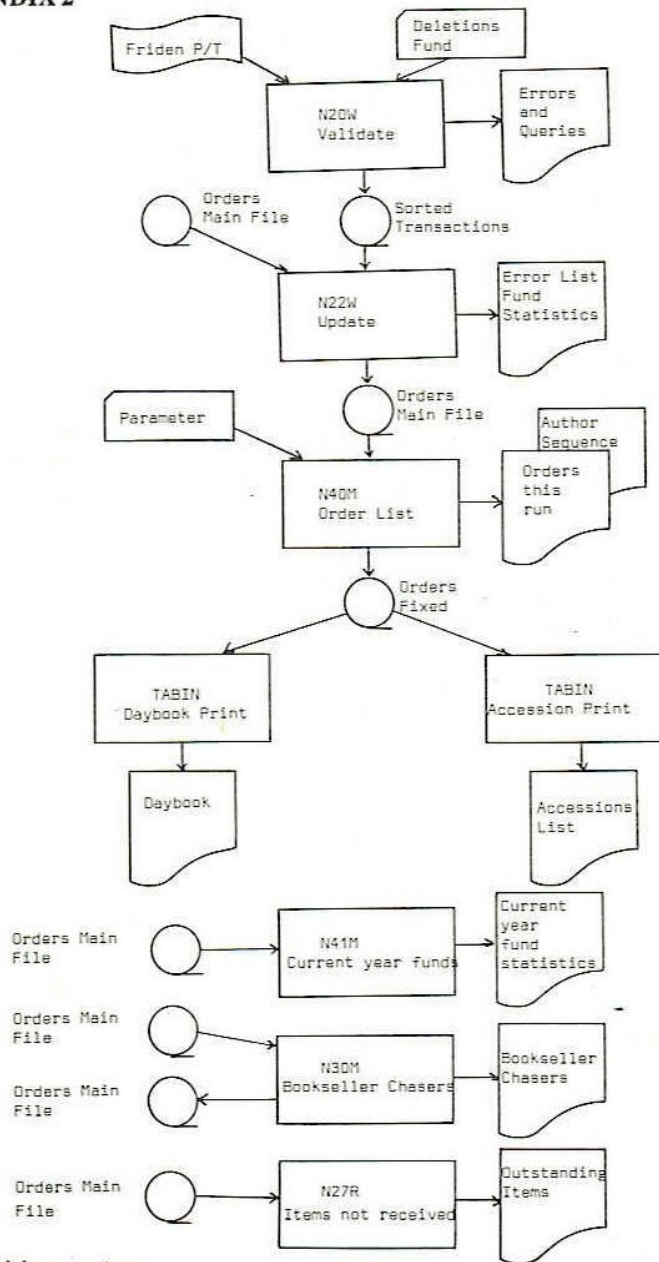
Acquisitions system
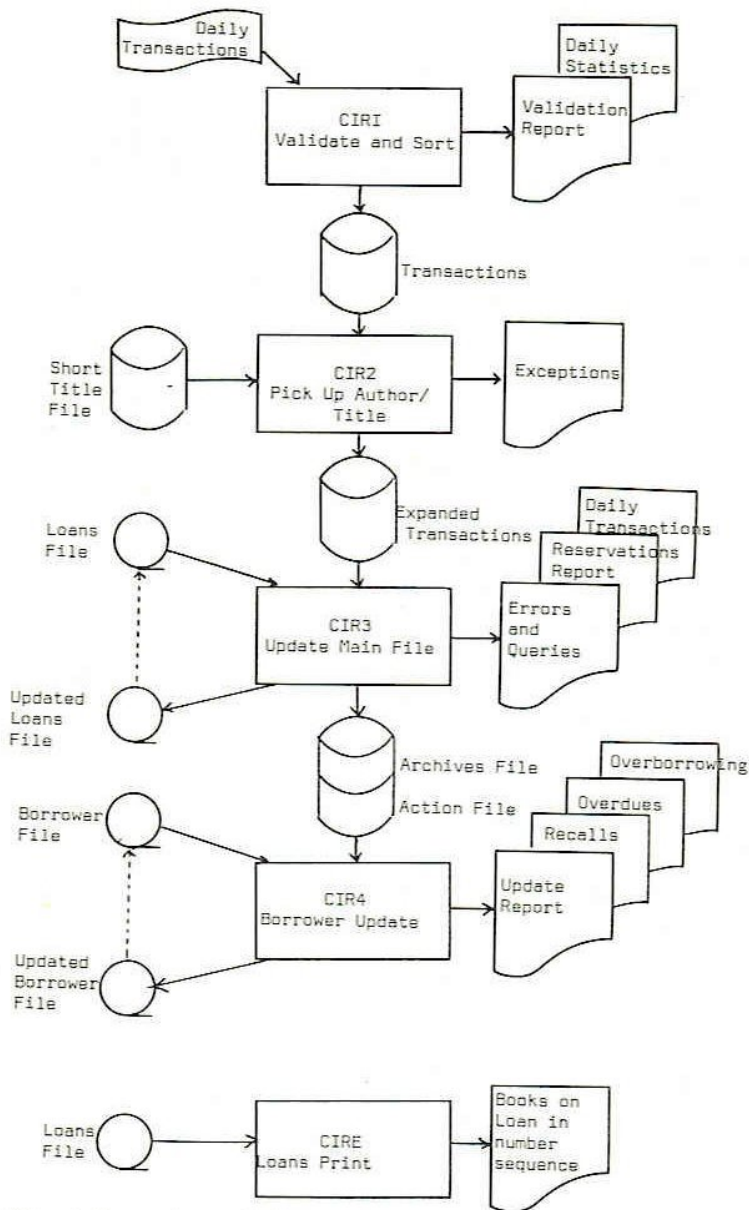
APPENDIX 3
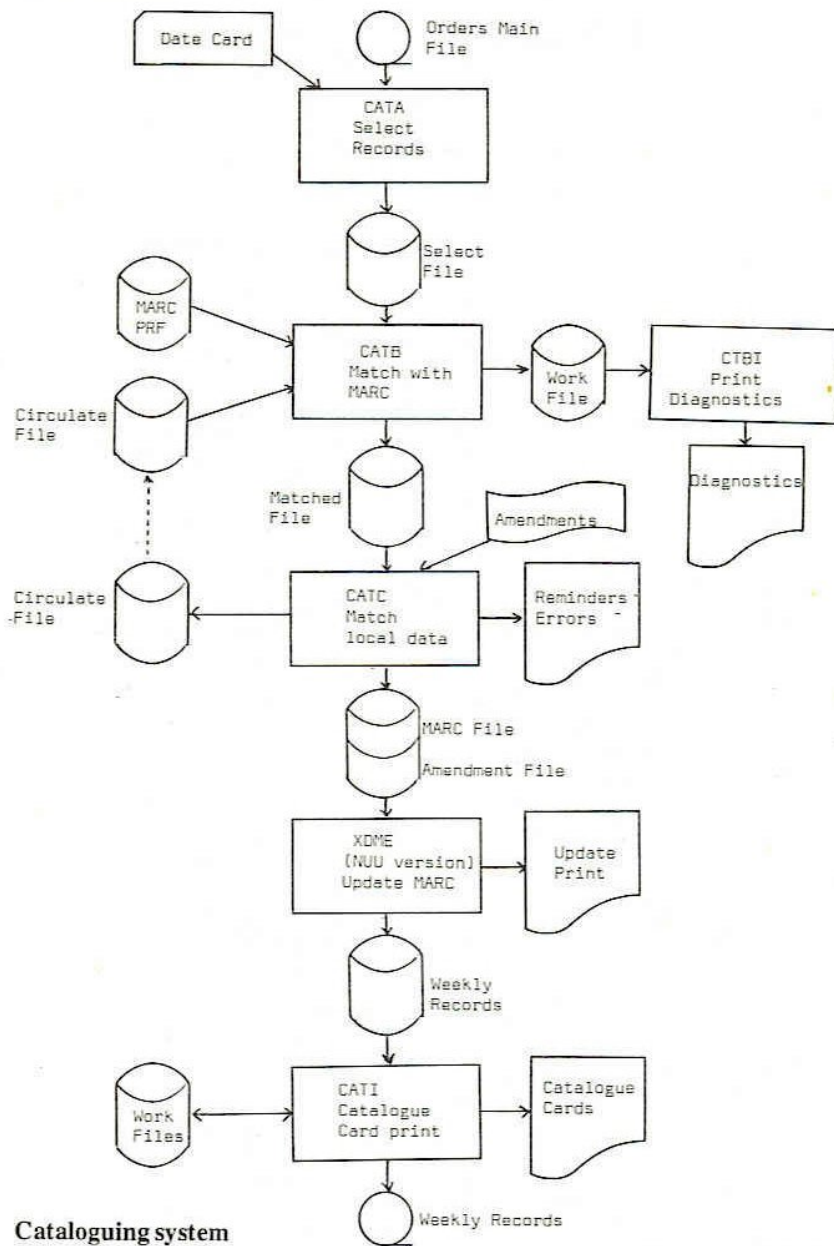
Cataloguing system

APPENDIX 3 (Contd.)

SELECT CATALOGUE LISTING

Cataloguing system (Contd.)

APPENDIX 4

Daily Transactions

Daily Statistics

CIRI
Validate and Sort

Validation Report

Transactions

Short Title File

CIR2
Pick Up Author/ Title

Exceptions

Expanded Transactions

Loans File

Daily Transactions

Reservations Report

CIR3
Update Main File

Errors and Queries

Updated Loans File

Archives File

Action File

Overborrowing

Overdues

Recalls

Borrower File

CIR4
Borrower Update

Update Report

Updated Borrower File

Loans File

CIRE
Loans Print

Books on Loan in number sequence
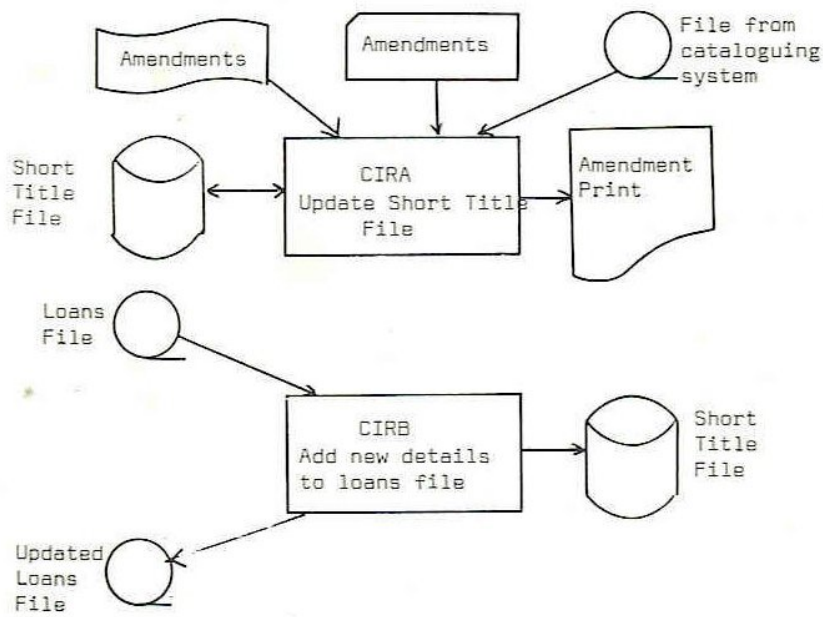
Circulation system—daily runs

APPENDIX 5
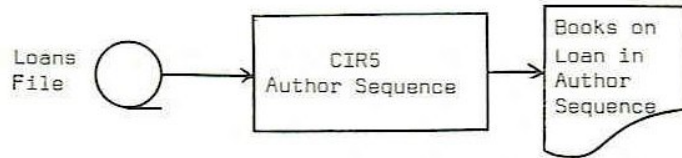
WEEKLY RUNS

Circulation system—twice weekly runs

APPENDIX 6

ECONOMICS

Subject area 1:   GENERAL WORKS, ECONOMIC HISTORY, SYSTEMS

330.01-330.09   General Works, Economic History
330.9-330.9   Economic conditions in particular countries
330.1-330.7   Systems, Theories
334.0-335.9   Co-operative systems, Socialism

Subject area 2:   FACTORS OF PRODUCTION

331.0-331.8   Labour
332.0-332.8   Money, Banking, Finance
336.0-336.9   Public finance Taxation
333.0-333.9   Land, natural resources

Subject area 3:   PRODUCTION, ECONOMIC ORGANIZATION

338.0-338.09   General
338.1-338.4   Specific industries: Manufacture trades
338.5-338.5   Prices, Business cycles, Fluctuation
338.6-338.8   Industrial organization
338.9-338.9   Economic Planning
339.0-339.4   Distribution-consumption: National Income

Subject area 4:   COMMERCE, TRADE

381.0-381.4   Domestic trade
382.0-382.9   International trade

M ARC SDI profile