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TECHNICAL SYSTEMS AND INNOVATIONS IN PUBLIC LIBRARIES

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SUMMARY

The extent of use of twenty innovations in the operation of public libraries is examined in 31 large public library systems across the country. The innovations include the use of computers in ordering, cataloging, and circulating materials. The pattern of diffusion of the innovations across the systems is explored using contingency tables and discriminant analysis. All the large library systems seem to participate in early adoption of some innovations; none seem to be pace-setters for all innovations. The extent of diffusion of some innovations may be reduced by the development of successive innovations that replace them. Only some of the innovations seem to be climax technologies that are likely to persist for longer periods of time.

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Most libraries divide their operations into two parts: public services and technical services. Public services deal directly with users in operating facilities and giving advice. Technical services deal with preparing and maintaining materials for use. While the specific functions may not be divided in exactly the same manner in every library, technical services generally involve the selecting, ordering, cataloging, and processing of materials for use in the library system. On average, the large public library systems assign 12.8 percent of their staffs to technical services. This essay will be concerned with technical systems in public libraries including selection,cataloging and circulation control.

Technical services are concerned with the flow of newly acquired materials into the library. The main difference between a warehouse stacked with books and a library is the character of technical services applied. Technical services give order to the materials so that they can be matched to users as directly as possible. The selection of materials puts emphasis on getting materials that will be used. The cataloging enterprise gives a shelf number to each item so that the materials will be shelved near related material. The catalog itself gives reference to the shelf number in a variety of ways so that a user can find materials based on titles, authors, or subjects. Technical services may put labels, covers, bindings, or anti-theft devices on materials before placing them on shelves. Older materials may also get preservative treatment, but that is a secondary function of most technical service operations.

Several other activities will be discussed here even though they are not normally performed by technical service divisions of the libraries.

These activities, however, are of a technical character and are important areas for innovation. The control of circulation records is of particular importance because circulation control is necessary if materials are to be located for use and if theft is to be curtailed. Anti-theft activities also influence the preservation of library materials. Other services concern the use of microfilm materials and the availability of photocopying services.

Technical services are defined and possible criteria for evaluation of technical services are discussed in a general way. The main emphasis of the essay is on the pattern of use of particular techniques. How rapidly are particular innovations diffused over all public libraries? What features of the public library systems are associated with early adoption of innovations?

The Quality of Technical Services

The quality of technical services is an important consideration in evaluating alternative techniques. Some ideas about judging quality are presented here as the different technical activities are described.

Selection

A first problem of technical services is material selection. In some libraries book selection is performed by individual unit librarians, say a branch librarian or a subject specialist in a central library. Selection aids may include Publisher's Weekly, a periodical that lists new titles with brief descriptions, and other book review media. Single copies of new titles may be received by libraries on approval from publishers under an arrangement called the Greenaway Plan. Under this regime, the books themselves may be examined before acquisition decisions are made by the individual library units. Eight-one percent of 31 large public library system surveyed currently use the Greenaway Plan as indicated in Table 1.

Table 1
Selection and Cataloging Activities
Means and Standard Deviations by Geographic Type

	City	Metropolitan	Suburban	All	F or Chi^2
Selection					
Greenaway Plan (binary)	13 of 15 86.7%	8 of 9 88.9%	4 of 7 57.1%	25 of 31 80.6%	3.217
Approval Plan (binary)	1 of 15 6.7%	1 of 9 11.1%	3 of 7 42.9%	5 of 31 16.1%	4.857*
Acquisition Lag in weeks	13 of 23 (9.58) 13	11.00 (17.01) 8	7.60 (4.04) 5	11.46 (11.51 26	0.421
Computer Based Ordering (binary)	5 of 15 33.3%	3 of 9 33.3%	4 of 7 57.1%	12 of 31 38.7%	1.295
Cataloging					
LC-MARC Based Computer Produced Catalog (binary)	6 of 15 40.0%	1 of 9 11.1%	5 of 7 71.4%	12 of 31 38.7%	6.049**
Network cataloging information used (binary)[a]	11 of 15 73.3%	5 of 9 55.5%	0 of 7 0.0%	16 of 31 51.6%	3.724
Cataloging Lag in days	77.83 (82.32) 12	38.33 (29.37) 9	19.17 (20.62) 6	51.63 (61.93) 27	2.319
Libraries Surveyed	15	9	7	31	

Source: the author's survey of large public library systems.
For binary variables, the number using the technique of those responding is indicated with the percentage given underneath. The chi-square statistic is reported to test for significant variation across the geographic types.

For continous variables, the mean is reported with standard deviation in parenthesis. If not all libraries responded the number responding is indicated below the standard deviation. An F-statistic from an analysis of variation is reported to test for differences in means across the geographic types.

Statistical significance is indicate: *** .01 level; ** .05 level; * .10 level.

a. OCLC, the Ohio College Library Center, is used for cataloging information in most cases. The San Francisco Public Library uses Stanford University's BALLOTS system and The San Antonio Public Library uses TRINCO. BALLOTS and TRINCO are similar to OCLC and are treated here as if they were OCLC.

Some libraries have abandoned the Greenaway Plan. Book selection may be centralized. In St. Louis County Library, the same books are ordered for each branch with selection a central responsibility. A substantial effort is made to order books requested by users of the library.

Some libraries use an approval plan such that a profile describing the reading needs of the library is prepared in substantial detail and a jobber ships books that fit the profile without individual titles having been ordered. For example, in the fiction area a library might specifiy 10 percent science fiction, 20 percent mystery, 10 percent romance novels, 20 percent westerns, and so on. Similar specification may be made for each subject area. A variety of language and quality stipulations may also be made. The bookjobber makes a detailed classification of each new title that is announced, and sends books that match the library's profile within the constraints of the library's budget. The library is free to reject books received under the approval plan and it can order books outside the plan. Five of the 31 large public libraries use some form of approval plan as indicated in Table 1. Approval plans maybe more widespread among academic libraries.

The Brooklyn Public Library works closely with a bookjobber in selecting books. The jobber, Bookazine, prepares a list of new titles with descriptions several weeks before publication date. Unit librarians in the Brooklyn system select books from the list. The jobber orders the books and makes them available before publication date. This arrangement allows the bookjobber to order materials prepublication from the publishers on the basis of the library's orders. The library gets faster service while retaining control of selection in the library.

The quality of book selection may reflect errors in acquisition, the timing of acquisition, and the cost of selection. Two kinds of errors can occur

in book selection. The library can fail to buy material that would have been used—a type I error. Alternatively, the library can buy materials that are little or never used—a type II error. A most successful book selection system would buy only materials that are most used and avoid buying books that are little used. One might want to assign different values to different uses, for example, reflecting the intensity of use or the value of use to the user as Newhouse and Alexander propose.[1] Because selections must be made before use occurs, selections are made on the basis of expected use. Consequently, both type I and type II errors will occur. Alternative selection methods, however, might be evaluated ex post in light of the actual type I and type II errors observed. A circulation control system that tracked use by title might indicate how many new titles had not been used within the first year of acquisition, an indicator of type II error. An accounting of requests for materials not acquired might indicate the degree of type I error. (Of course, most users will be unaware of materials the library did not acquire.) Current library record keeping does not measure these errors nor would such recordkeeping be justified for this purpose alone. More sophisticated control systems may generate such information as a byproduct. Alternatively, sample studies might be made at moderate cost for the purpose of comparing alternative selection systems.

A second dimension of the quality of technical services is the speed with which materials become available in the library. New materials are in high demand in public libraries; new acquisitions are more important in generating use than the size of the stock of materials.

The average length of time a book spends on the best seller list is six months.[2] The half life for new fiction--the length of time in which half of all readers who will ever read the book have read it is about one year, and somewhat longer for non-fiction. Books obsolesce. Some books have advertising campaigns keyed to their publication date. Others have ties to movies or television. Interest in such materials falls rapidly after an initial boom. Demand for books at the library may fall when a paperback edition becomes available. The value of materials falls with age, especially after the publication date. Therefore, a library that succeeds in making materials available to users quickly will be more valuable than a library that takes six months from publication date to select, order, catalog, and process new materials.

Of 26 large public libraries willing to estimate the length of time from publication date until a book is available on the shelf in the library on average, the mean lag was 11 weeks. Thirteen central city libraries averaged 13 weeks; five suburban systems averaged eight weeks. The estimates ranged from 52 weeks in Birmingham to zero in Brooklyn. There are important differences in the acquisition lag across public libraries, and differences in selection techniques may play a role.

The public libraries may have automated ordering systems that perform the accounting functions of keeping track of orders and payment. Such systems may lower costs and increase the accuracy of order record keeping. Thirty-nine percent of the 31 libraries surveyed had automated ordering systems in 1978, as reported in Table 1.

Cataloging and Processing

Once materials enter the door of the library, they must be made accessible to users. The first step is assigning each item a place on a shelf and the second step is creating references to the item by title, author, and subject so that users can easily find materials they are interested in. The first step is accomplished by assigning each item a unique catalog number that indicates where the item will be located on the shelf. The second step is accomplished by inserting suitable reference to title, author, and subject for the new material in a master list of materials called a catalog. The physical catalog may be a printed book (dictionary catalog), a card file, or microfilm. The new book or other material will be processed by the labelling of the spine, the insertion of a mark of ownership, and perhaps a pocket and card for circulation control purposes.

The quality of the shelf arrangement will influence the ease with which users may browse in hopes of locating materials of interest. The grouping together of books on similar subjects facilitates browsing. The basic choice in shelf arrangement is between the Dewey decimal system and the Library of Congress system. Most public libraries use the Dewey system.

In the Dewey decimal system, each digit is an appropriate aggregation of each subsequent digit: a one digit code given a gross indication of subject matter; a two digit code is somewhat more specific; and so on up to a full six digit number. For a relatively small, general collection of materials, the Dewey shelf order will put like materials together very successfully.

For a large research collection of materials, the Library of Congress method may be preferred. When a new topic develops, the Library of Congress may introduce a new label not in sequence with previous labels, thus certain

new books may not be placed near other related materials. Users of research libraries will welcome the narrower definitions of subjects and have less concern for proximity of materials not very closely related in subject. That is, the heirarchical nature of the Dewey system may be less important while the better definition of individual subjects may be more important in a large research library. The LC system fractures a small or moderate size general collection because it is not especially heirarchical. Thus, the Dewey system is used in all but the Boston Public Library among the 31 large public library systems surveyed. The Dewey arrangement serves public libraries well.

The maintenance of a physical catalog once required that each book be examined by a skilled cataloger for the purpose of identifying subject. Investigations may have been required to identify the author in more detail than given by the title page so that authors with similar names were not confused. In the first decade of this century the Library of Congress began selling copies of its catalog cards.[3] A library ordered the cards of books it purchased and inserted them in its card catalog. Both Dewey and LC numbers are printed on the card. In this way, a library could rely on the author, subject and numbering designations of the Library of Congress. Cards are also prepared by bookjobbers. A library can buy books from some bookjobbers with catalog cards and labelling already performed to local specifications.

In 1968, the Library of Congress began Machine Readable Cataloging (MARC) in a form usable by other libraries.[4] The information available on cards

are entered into computer readable form in a standard format. For about $2,000 per year, a library can subscribe to the LC-MARC service and receive bi-weekly tapes reporting the latest LC cataloging. (A Dewey number is included.) For less than $200 per year a library can receive bi-weekly microfilm copies of the LC cataloging from private firms. Because the microfiche comes automatically as soon as LC information is available, cataloging information is available locally much faster than if cards are ordered. Seven of the 31 libraries depend on the microfiche as the basic source of cataloging information as reported in table 2. Two of the seven create computer based catalogs locally.

Once a computer readable cataloging information base for local holdings is available, a library can have a computer generated catalog at low marginal cost. While computer based cataloging can produce dictionary catalogs, computer output microfiche (COM) are lower in cost. The computer can sort new entries into a catalog much faster and more accurately than new cards can be entered into a card file by hand. Periodically, the computer file is used to produce a new physical catalog reflecting holdings at a particular date. Computer output microfiche catalogs (COMCAT's) can be produced in multiple copies at very low cost; consequently, copies of a system catalog could be made available in each branch and outside the system. The cost of updated catalogs must be balanced against the value of having public access to current information about holdings. Many libraries produce revised catalogs quarterly.

Table 2

City	Cataloging Technique: Network	Jobber	Fiche		Circulation Control Method
Boston	OCLC				computer
Brooklyn			manual		microfilm
Chicago	OCLC	Brodart			manual
Cleveland	OCLC				microfilm
Dallas	OCLC				computer
Denver		Auto			microfilm
Houston	OCLC	Brodart			computer
Milwaukee	OCLC				computer
Minneapolis	OCLC	Blackwell			computer
New Orleans	OCLC				microfilm
New York		Own-NYPL			microfilm
Philadelphia	OCLC				microfilm
San Antonio	TRINCO	Baker			microfilm
San Diego			manual		microfilm
San Francisco	BALLOTS				manual
Metropolitan					
Atlanta	OCLC	bid 78			computer
Birmingham		Baker			microfilm
Buffalo	OCLC				microfilm
Cincinnati	OCLC				computer
Indianapolis			manual		microfilm
Jacksonville	OCLC				microfilm
Nashville			manual		manual
Pittsburgh	OCLC				computer
Sacramento		bid 78	manual		microfilm
Suburban					
Contra Costa Co.		Auto			microfilm
Fairfax Co.		Auto			microfilm
Hennepin Co.		Own-NYPL			microfilm
Montgomery Co.		bid 78	computer		microfilm
Prince Geo. Co.			computer		computer
St. Louis Co.		Bordart			microfilm
San Diego Co.		Auto			microfilm

Source: Author's survey in 1978.

OCLC: Ohio College Library Center; Auto: Autographics; Baker: Baker and Taylor

Not all computer circulation control systems are system wide. Microfilm and manual methods may also be in use in these systems.

The use of the computer as an aid in cataloging has been many years in coming. In the early 1950's, computer cards were used to sort cataloging information. Computer cards are limited to 80 characters of information, not enough to hold even the full catalog number, author's name and title. Thus, such systems were of limited usefulness because full catalog information files were not maintained. The Milwaukee Public Library pioneered in the use of such a card based file, but has not moved to more complete use of the computer for cataloging.

In the mid-1960s more sophisticated systems developed, capable of handling more complete cataloging information files. One such system, the Ohio College Library Center (OCLC), began batch processing Library of Congress cataloging data files in 1968. Currently, OCLC makes cataloging information available via computer terminals and telephone lines. Library participants can search OCLC files for cataloging information, and purchase catalog cards published on demand. Participating libraries can enter original cataloging information for materials not located in the OCLC files. In this way, original cataloging from a variety of sources can be shared. Sixteen of the 31 libraries use such networks as sources of cataloging information as indicated in Table 2.

Individual libraries developed improved systems internally. More complete cataloging information is maintained in computer managed data files, such that a variety of formats of catalogs can be produced. Some such systems have limited usefulness. The Dallas Public Library, for example, maintains a Master Bibliographic Data Base. The Base is in a format that does not allow sorting by subject, however, so the Data Base can not produce a public use catalog. The card catalog must continue to

be maintained.[5] The Data Base is used to produce spine labels and book pockets.

More recently the Prince George's County Public Library in Maryland developed an internal computer produced cataloging capability. The local catalog data base, however, is not compatible with Library of Congress MARC formats so that the catalog information must be manually entered into the Prince George's system rather than simply being copied from LC-MARC tapes. The Prince George's system is remarkable because it was developed in 1972 after the availability of the MARC system tapes. Montgomery County has a similar system but developed it in 1963 before MARC was promulgated.

In 1969 the New York Public Library froze their card catalog and began producing dictionary catalogs of new acquisitions using locally developed computer software. The format of the computer based catalog information files, however, is compatible with the Library of Congress' MARC tapes. Thus the New York Public System can locate Library of Congress cataloging information by searching computer tapes, and copy the information for locally acquired material into computer files representing the local collection. The computer file of catalog information of locally owned materials is flexible enough to allow production of a full catalog description of each item complete with author, title and subject references. The computer programs developed at the New York Public Library were transported to Hennepin County in Minnesota and are used there. The Bibliotheque Nationale, housed in the Pompidou Center in Paris, is also making use of the New York Public's computer programs.

The nature of the costs of operating a computer generated cataloging capability, however, militate against a library developing and

implementing in-house systems. The costs of maintaining the capability of searching LC-MARC tapes for cataloging information and generating a computer file of catalog information of locally held materials is substantial. The marginal cost of processing an additional hundred titles, given that several hundred are already being processed is quite small. The fixed costs of the computer based catalog operation can be spread over many libraries by private contractors producing the catalogs for many libraries.

The catalog contractor receives a list of titles ordered or received by its client library. The library may search LC-MARC microfiche and locate an LC-MARC number for each new book. If the microfiche do not contain the material, the cataloging information may be produced locally. The catalog jobber then searches the LC-MARC tapes and copies the full LC cataloging information for each item the library has acquired. Local cataloging may be introduced. Dewey numbers prepared by LC may be used and fiction,biography, and local materials may be handled in a variety of ways according to local specification. The jobber then produces a computer output microform catalog reflecting the holdings of the local library. Perhaps ten firms offer catalog jobber services including Autographics, Brodart, Blackwell NA,and Baker and Taylor. A comparative review of their services is available.[6]

Twelve of 31 large public library systems surveyed currently have computer generated catalogs with cataloging information copied directly from LC-MARC tapes and three more were seeking contractors in 1978 as indicated in Table 2. Except for the New York Public Library and

Hennepin County, catalog jobbers are used by all of these. Computer produced catalogs are also generated in Prince George and Montgomery Counties in Maryland, but catalog information is manually introduced into these systems rather than being copied from LC-MARC. Partial bibliographic data files are manipulated on computers in Dallas, Milwaukee, and elsewhere, but these files are insufficient to produce a computer based catalog.

The computer generated catalog using LC-MARC tapes as the basic source of information appears to be the climax technology. That is, other cataloging techniques are likely to be replaced by the catalog jobbers using LC-MARC tapes as sources. While more sophisticated use of computers integrating circulation control with the catalog function are conceivable, they are likely to be built on the LC-MARC produced local catalog rather than replacing it. In particular, the use of catalog cards for new materials is declining and cataloging services that are linked to cards seem likely to be replaced. The OCLC is basically a card-oriented service and its value may decline.

> The online network systems are primarily designed to support the production of current cataloging materials, not the conversion to machine readable form of cataloging already in existence. The charges and system features of these systems are oriented toward the production of catalog cards and other printed products.[7]

The conversion of existing manual catalogs to machine based catalogs is costly, and may never take place in the largest libraries. Manual catalogs can simply be frozen, and the machine based catalog begun with materials acquired after a particular date. The cost of converting a manual catalog to a machine catalog may run between $1.06 and $3.28

(in 1978 prices) per title depending on the number of characters of information included in the machine based catalog.[8]

The success of the LC-MARC based jobber produced catalog depends in part on the breadth of coverage of Library of Congress cataloging and the speed with which LC cataloging information becomes available. For most standard materials acquired by public libraries Library of Congress cataloging is available in a timely manner. Prepublication cataloging is often published in books under the Library of Congress' Cataloging in Publication program. The Cataloging in Publication information may change somewhat after the book is actually published--titles, author's names, and even subjects may have been misspecified. Therefore, most libraries insist on ultimate LC-MARC cataloging for their catalogs. The libraries acquiring less than 10,000 titles annually typically find a very high proportion, say over 85 percent, of the titles available on LC-MARC at the time material is to be cataloged.[9] The main deficiencies are in foreign materials--the Boston Public Library delays cataloging such materials until LC information is available--government documents and music, both recordings and sheet music. The delay in foreign materials may continue, but the Library of Congress has undertaken ambitious programs to catalog both government documents and music.[10] If successful, the scope of LC-MARC information may cover the acquisitions of a

very high proportion of most public libraries.

The success of the catalog might be measured by considering the length of time users take to locate materials, and by considering their success rate in finding materials, given that the materials are in fact referenced in the catalog.[11] The quality of the catalog is apparently substantially influenced by the consistency of treatment of materials as their references are entered into the catalog. While skill on the part of cataloging librarians in applying standard rules may be important in maintaining consistency, another procedure may also be important. Cataloging systems may maintain authority files. Authority files are independent lists of names of people and subjects, for use in cataloging. Considerable effort may be put into maintaining the veracity of the authority file. New materials to be cataloged may, then, be checked against the authority files to assure consistency in names and subjects. In this way, materials on South America can be kept together and referenced together whether called Latin America, South America or something else. Materials by or about Muhammad Ali can be referenced together whether he is referred to as Muhammad Ali or Cassius Clay. The quality of the catalog will reflect the effort put into maintaining consistency.

The creation of local computer based catalogs from LC-MARC tapes may be enhanced if authority files for the local catalogs are maintained. The software developed by the New York Public Library included automated authority file checks from the late 1960's. In the late 1970's the Library of Congress is automating its authority files. An important difference among catalog jobbers may be the extent of local authority file checks included in the service. Among the jobbers, Autographics

and Library Interface Systems include both subject and name authority file maintenance. Brodart and Blackwell include only subject authority file checks. A major complaint with the service of OCLC and a similar catalog information service based at Stanford called BALLOTS is the lack of any authority files.[12]

The quality of the cataloging operation may also be indicated by the length of time required to catalog an item. The length of time from when an item is delivered to the library until it is ready for use was estimated by 27 libraries. On average 52 days elapsed from delivery to shelving as indicated in Table 1. The suburban libraries, however, average just 19 days compared with the 78 days required on average in city libraries. The substantial variance in the cataloging lag in each group, however, means that the differences in means is not statistically significant across the geographic types.

The cataloging lag may be shorter for libraries using catalog jobbers because the request for cataloging can be made when the book is ordered, a possibility that is examined below. Thus, the cataloging may be available at the time the book is delivered. The cataloging lag will then be just the time required to process the book, entering labels and the like.

A central difficulty with the use of a catalog jobber is the problem of hiring, monitoring, and replacing the contractor. Many public library systems are required to accept the lowest bid for a contract and to rebid contracts every three years. It is difficult to include all the dimensions of service quality in the contract. The library will be concerned with the speed of receipt of the catalog, with the error rate

in cataloging materials, and with the skill of authority file maintenance and checking. Because contract termination for cause will invite heavy legal expenses and possible chaos if catalog materials cannot be retrieved in usable form from the jobber, libraries will be understandably reluctant to terminate contracts before they expire. Therefore, it may be appropriate for the contracts to include penalties for slow delivery, for high error rates, and for inadequate authority file maintenance. When the contract is rebid a different jobber may win the contract. The transition from one jobber to another may be difficult and expensive. One jobber's computer files may not be compatible with another's. The library may want to specify formats for the catalog and authority files so that they can be easily transported to other jobbers. Perhaps a transition period of a few months should be included in the contracts so that the old and new jobbers can be brought together. When contracts are rebid, a locality may want to allow the library board to choose among the three lowest bidders both so that the contractor need not be changed unless the gains are significant, and so that a contractor can be dismissed for poor performance even if it is the lowest bidder. Sophisticated management is required of the library if contracting services are to yield high quality services over a long period of time.

Serials

Technical service operations will also handle serials. Serials include periodicals (annual or more frequent regular appearance) as well as other serials (items published in sequence, not necessarily with regular periodicity). Libraries typically maintain subscriptions to serial publications. The library must keep track of subscriptions, payments, receipt of materials, alerting publishers when materials are

not received, and the cancellation of subscriptions no longer wanted. Many libraries use computer based systems for keeping track of serials. This study has not examined the use of computer serials control systems in public libraries.

Alternative Materials

The public library can avoid cataloging and processing costs by buying paperback books and by renting books. For popular titles in substantial demand, all of the 31 large public library systems surveyed except the Boston Public Library buy substantial numbers of paperback books. About 28 percent of the books purchased by the Branch Libraries of the New York Public Library are paperbacks. The library systems averaged 40,000 paperback volumes as indicated in Table 3. Paperbacks are usually shelved in wire racks without being cataloged. Since many paperback titles will be of little interest after a year or two and multiple copies will not be retained by the library, the library can lower costs by buying paperbacks, even though they assume the books will have disintegrated or been lost within two years. Paperbacks are less expensive than hardbacks, and paperbacks are handled in a way that avoids the expense of cataloging. Many are shipped directly to branches from jobbers.

Twenty of the 31 large public library systems surveyed rent books as indicated in Table 3. Josten's and McNaughton's are the two principal firms that rent books to libraries. The libraries can contract for the maintenance of a rental collection of a particular number of volumes in a location, say 480. One hundred and twenty new volumes may be received each month. The library can either select titles it wants, or it can specify a profile of interests, say 40 percent best sellers in

Table 3

Materials Alternatives and Circulation Control Activities
Means and Standard Deviations by Geographic Type

Materials	City	Metro	Suburb	All	F or Chi^2
Volumes of Paperbacks Acquired Annually	51269.25 (45079.97) 12	14751.00 (17152.73) 4	35971.57 (15714.37) 7	40262.43 (36246.97) 23	1.693
Rental Books Uses (binary)	10 of 15 66.7%	8 of 9 88.9%	2 of 7 28.6%	20 of 31 64.5%	6.316**
Percent of Branches with Microform Readers	21.17 (32.56)	26.36 (29.44)	40.26 (28.98)	26.99 (30.86)	0.910
Percent of Branches with Photoduplication services	91.49 (9.04)	69.21 (28.52)	85.73 (21.18)	83.46 (21.18)	3.647**
Circulation Control					
Manual System Used (binary)	2 of 15 13.3%	1 of 9 11.1%	0 of 7 0.0%	3 of 31 9.7%	0.912
Microfilm System Used but not the computer (binary)	8 of 15 53.3%	5 of 9 55.5%	6 of 7 85.7%	19 of 31 61.3%	2.285
Computer Based System Used in Part or All (binary)	5 of 15 33.3%	3 of 9 33.3%	1 of 7 14.3%	9 of 31 29.0%	0.954
Anti-theft Systems					
Guards and Parcel Checks (binary)	12 of 15 80.0%	5 of 9 55.6%	0 of 7 0.0%	17 of 31 54.8%	12.336***
Electronic Security Checks (binary)	10 of 15 66.5%	5 of 9 55.6%	2 of 7 28.6%	17 of 31 54.8%	2.799
Either guards or electronic security (binary)	15 of 15 100.0%	7 of 9 77.8%	2 of 7 28.6%	24 of 31 77.4%	13.930***

source: author's survey of library systems.

For binary variables, the number using the technique of those responding is indicated with the percentage given underneath. The chi-square statistic is reported to test for significant variation across the geographic types.

For continuous variables, the mean is reported with standard deviation in parenthesis. If not all libraries responded, the number responding is indicated below the standard deviation. An F-statistic from an analysis of variation is reported to test for differences in means across the geographic types.
Statistical significance is indicated: *** .01 level; ** .05 level; * .10 level.

multiple copies, 20 percent mysteries, 10 percent science fiction, and so on. In the later case, the rental firm will track the best seller lists and monitor new titles and ship rental volumes according to the profile of the branch. The rental volumes will be shipped directly to the branch already jacketed, processed, labelled and ready for use. The branch library returns rental books it no longer wants, even those in the current shipment if they are not suitable. The cost for a 480 volume rental collection with 120 new volumes replaced each month is about $200 per month (in 1978).[13] Lower cost plans including used books are available. A certain fraction of the used books may be retained by the library, and others may be purchased at low cost. The books returned to the rental company may be rented to other libraries as used books or may be sold in second hand book markets.

The Fairfax County Public Library uses a book buyback service of the Ingram Book Company in Nashville. Ingram agrees to buyback books within a specified period of time. The main difference between the rental and buyback services seems to be that lost books are absorbed by the rental firms while their cost is born by the library with the buyback service.

The rental-buyback services allow a library to acquire multiple copies of popular books while incurring relatively low processing-cataloging costs and with a regular procedure for weeding out unneeded books. In this way the handling of books acquired for popular use can be kept separate from more permanent acquisitions. The expense of processing and cataloging materials with short usefulness are reduced by using the preprocessed books of the rental firm.

Libraries can also make microform materials available to users. While microform materials are more difficult to use because they require a device to project the film, the cost per page of materials is much lower than with print. Therefore, the same funds devoted to microform will buy more pages than if devoted to books. Microforms also require less storage space. The use of microform materials in public libraries is limited, however, to large facilities. All the systems have microform readers in the system. Among 30 public systems reporting this information, however, only Houston has microfilm readers in all its branches, and only Fairfax, Montgomery, and Prince George Counties have microform readers in over half of their branches. Microforms must be used in the library, are inconvenient, are more difficult to read than print and so their use seems to be limited to materials that are not widely used. Thus, it is not surprising that microforms are in use in less than a third of the branches of public libraries.

Many public libraries offer photoduplication services to patrons. Seven of 30 systems reporting this information have photoduplication available in every branch, as indicated in Table 3. All but three have photoduplication in over half of the branches. The New York Public Library does not have the service in a few older branches that have direct current wiring (duplication machines require alternating current). While changes in the copyright law may discourage the use of photoduplication to some extent, such services seem to have found wide acceptance in the public libraries. Because the use of the machines is paid for by patrons--coin operated machines are common--the equipment may generate some revenue for the library. Photoduplication may reduce the theft and vandalism of materials.

Circulation Control

Libraries try to keep track of their books instead of simply giving them away. Circulation control systems note materials that are charged out of the library, check those that return, and send notices to borrowers with materials overdue. Some circulation control systems may be able to inform a patron when an item is already borrowed, and establish a queue of future borrowers for material currently on loan. The system may also identify maerials that are lost. Some circulation control systems generate summary information on the circulation of materials: for example, the number of materials circulated by type of material.

The conventional circulation control system was a manual system. The borrower fills out a card, the card is filed and recalled when the material is returned. Three of the 31 library systems surveyed continue to use the manual system of circulation control. The specific systems are indicated in Table 2. Summaries by geographic type are given in Table 3. Beginning sometime in the early 1950's some libraries began substituting microfilm records for the manual card system. A picture is taken of the borrower's card and a book card together with a unique transaction number. Photography is faster than writing, and the microfilm systems apparently speeds up check out and possibly reduces the clerical staff needed for circulation control. When the book is returned, the card with the transaction number at charge-out is matched to the charge-out transaction numbers. Cardsorters or computers may be used for this matching. Those books for which no charge-in number is matched to the charge-out are overdue. The microfilm record is searched for the overdue transaction numbers. Overdue notices are produced manually from the information available on the microfilm. Nineteen of the 31 library systems report

using the microfilm circulation control system.

Nine of the 31 systems use more computer intensive circulation control systems. At charge out a computer readable book card and borrower card are read by machine, creating a computer manipulable record of the charge out. At charge in, the book information is again entered in computer readable form. The computer can match charge ins with charge outs, identify overdues, and print overdue notices using information in a computer file on borrowers. In this respect the computer based circulation control can duplicate the microfilm systems output with substantially less labor effort.

The capability of the computer based systems exceeds that of the manul and microfilm systems, however. First, the computer can check the borrower's card against a list of borrowers with overdue materials. Such a credit check can be used to deny library privileges to persons who seldom return materials. Second, the computer can check the book against a list of requests. A renewal, for example, can be made with the assurance that no one else is waiting for the item. Requests anywhere in the system can be honored by materials available anywhere else in the system. The sophisticated handling of requests is given as an important advantage of computer based circulation control. Third, a computer may be the base for a self-charge system with consequent reduction in clerical staff.

Computer based circulation control can produce very sophisticated information about circulation as a by-product. The books can be characterized in substantial detail by subject, level, language, and age, for example. The monitoring of requests might also be detailed by subject, level, and language. Such information might be used to evaluate acquisitions policies, for example, the acquisition of multiple copies, the use of rental materials, the length of the loan period, the type I

and type II errors in book selection. While I doubt that any library currently uses its circulation control system in this way, it may be that as such systems develop their value as management tools will increase.

The quality of the circulation control systems might be evaluated by considering the shrinkage rate for library materials. Shrinkage can occur through the non-return of charged out materials and through the theft of materials without being charged out. Twenty library systems were willing to speculate about the proportion of charged out materials that were not returned. The non-return rate varied from less than a tenth of one percent to eight percent, with a mean of 2.4 percent. The theft of materials without charge out can be detected by inventorying the stock. Inventories are expensive, however, and thus are rarely undertaken. Of 15 libraries that had undertaken an inventory, the mean latest year of an inventory was 1968, ten years before the interview. While full inventories are undertaken too infrequently to give a consistent guide to theft, sample inventories might be undertaken more often in order to evaluate the circulation control and anti-theft systems.

Anti-theft Systems

An effective circulation control system can discourage the charging out of materials by patrons who do not intend to return them. Such patrons may be led to steal the materials they want unless measures are taken to discourage theft. The conventional method of theft control is guards checking parcels at the exits of the libraries. Seventeen of the 31 large library systems reported guards checking parcels somewhere in their systems. Most have such checks only in a few locations. The use of guards and parcel checks is concentrated among central city and

metropolitan systems and is not found in any of the suburban systems surveyed.

In the last few years electronic systems have become available to discourage the theft of materials. A magnetic strip is placed in each book or other material. If the material is taken through the exit check, a tattle-tale sounds off. Some systems are designed to have the material passed around the check at exit. Others are demagnetized at check-out and remagnetized on return. The electronic theft systems are relatively inexpensive. The tattle-tale leases for less than a thousand dollars a year. The magnetic strips can be inserted in the books for 25 to 30 cents by book jobbers; in-house processing costs may be less. The strips cost less than 10 cents per item. The theft detection strips need not be put in the full collection. Insertion in new materials will capture the most valuable materials. Reference and especially valuable materials might be retrofitted. Electronic security devices are in use in 17 of the 31 library systems, including 10 that have guards and parcel checks somewhere in the system. Seven use the electronic system but do not use the guards. Seven have guards but no electronic system, and seven have no anti-theft system. The low cost of the electronic systems should make an anti-theft system appropriate for libraries that previously had no anti-theft system. And the electronic systems should replace the guards and parcel checks in most situations, except where guards are required for personal security reasons whether they search parcels or not. The effectiveness of anti-theft efforts might be judged by taking sample inventories to measure the shrinkage rate. One librarian commented that employee theft may be significant. Neither the guard nor electronic systems seem likely to affect employee theft.

Reference Activities

While reference services are the purview of the public service division of most libraries, several technical arrangements are available to support reference activities. A variety of large bibliographic reference files have been entered into computer storage. The computer can be used to search for key words to select items for a bibliography. Chemical Abstracts, for example, can be searched in this way. A variety of vendors provide this service via telephone lines and computer terminals including Lockheed, Bibliographic Retrieval Services, and Systems Dynamics Corporation. The user need pay only for the connect time (a monthly minimum may be required), say $25 per hour, and two to five cents per citation printed out. The service is most useful to research scholars in science and medicine. Ten of the 31 library systems offer access to such computer bibliographic search services. (See Table 4.) Most of the participating public libraries are central city systems.

Some public libraries have developed their own computer based information retrieval systems. The New York Public Library has an index of community service information, a file of agencies indexed by the problems and persons they are prepared to help. The Public Library of Nashville indexes the local newspapers because a high proportion of their reference inquiries concern the local newspapers. Six of the 31 library systems maintain some form of local index on a computer. (See Table 4.)

Reference services may require information not available in the local library. Twenty-six of the 31 systems have teletypes for use in requesting materials via interlibrary loan. Eleven have wide area telephone service for use in inter-library loan. Only four libraries,

Table 4

Technically Based Reference Activities
Use by geographic type

	City	Metropolitan	Suburban	All	Chi-square
Reference Service					
Computer Base Bibliographic Reference (binary)	7 of 15 46.7%	2 of 9 22.2%	1 of 7 14.3%	10 of 31 32.3%	2.875
Computer Based Index--locally operated (binary)	4 of 15 26.7%	2 of 9 22.2%	0 of 7 0.0%	6 of 31 19.4%	2.241
Wide-area Telephone Service (binary)	3 of 15 20.0%	4 of 9 44.4%	4 of 7 57.1%	11 of 31 35.5%	3.321
Teletype for inter-library loan (binary)	13 of 15 86.7%	6 of 9 66.7%	7 of 7 100.0%	26 of 31 83.9%	3.402
Electronic Accounting					
Payroll (binary)	15 of 15 100.0%	9 of 9 100.0%	7 of 7 100.0%	31 of 31 100.0%	---
Personnel Records (binary)	7 of 15 46.7%	6 of 9 66.7%	6 of 7 85.7%	19 of 31 61.3%	3.222
Budget System (binary)	9 of 15 60.0%	6 of 9 66.7%	5 of 7 71.4%	20 of 31 64.5%	0.298

source: author's survey.

The number using the technique relative to those responding is indicated with the percentage given beneath. The chi-square statistic is reported to test for significant variation across the geographic types.

Denver, Cleveland, Indianapolis, and Atlanta, indicate having neither teletype nor wide area telephone service for use in seeking materials or information via interlibrary loan.

Electronic Accounting Functions

Data processing is used in the public libraries for routine accounting functions. Payrolls may be prepared, personnell records may be maintained, and budget records may be processed by computers. These activities may be moved to computers on a city-wide basis. That is, the city or county government may introduce computer based payrolls for all employees, including those in the library. Thus the decision to adopt computer based accounting systems may be made outside the library. The use of these activities is considered here so that the possible interaction between library specific data processing activities and city-wide data processing activities can be considered. Autonomous library systems, however, may act alone in adopting electronic accounting functions. The payrolls of all the public library systems surveyed are prepared electronically, as indicated in Table 4. Personnell and budget records are handled electronically in over 60 percent of the library systems.

Rates of Diffusion of Innovations

The above descriptions of technical services indicates that substantial technological change is occurring in the public libraries. Innovations have appeared in a wide variety of areas of library activities; some are related to the use of computers while others are not. It may be appropriate to examine the pace of technological change. How rapidly do innovations spread from the time a first library begins a new practice

until all similar libraries are using the practice? Are there easily recognizable characteristics of early adopters that might indicate the motivation for technological change? Answers to these questions may suggest policies that might promote useful technological change.

Diffusion Paths

When a library evaluates a new practice, it must decide on the basis of limited evidence whether the benefits of the new practice will justify the costs. Until the library has experience with the practice itself, it will not know for certain its benefits and costs. A library that picks up every possible new practice will incur substantial costs in discovering practices that are worthwhile because many practices will fail. A library that always delays the adoption of innovations will incur the costs of maintaining expensive antiquated systems when cost saving, output enhancing new practices are available. The optimal innovation strategy involves some balance between picking up untried practices quickly when they work, and avoiding costly failures. Because the adoption decision must be made on limited evidence, this balance may not be easily struck.

From an industry point of view, some libraries must be willing to experiment with new practices. Once a few libraries have found success with a new practice, other libraries can act more confidently in mimicking the new practice. The pattern of the diffusion of innovations from early to later adopters generally traces a sigmoidal curve.[14] That is, cumulative percentage of libraries that have adopted will grow slowly at

first during a trial period. If the innovation is successful, the pace of diffusion will accelerate. Once most have adopted the pace will decelerate again.

The patterns of diffusion of twenty innovations across the 31 large public library systems surveyed are described in Table 5. The year of first use indicated by any of the surveyed systems is reported in the first column. The proportion of systems currently using the practice is reported in the second column. Only three of the 20 innovations began before 1950, thus only recent innovations are being considered. Only three of the innovations are currently used in all the surveyed library systems, suggesting that on average over thirty years are required from first use by a system until a practice becomes universal. This conclusion may be unwarranted, however, for several reasons.

The diffusion rates are explored further by noting the year when half of the systems were using the technique, reported in the third column of Table 5.[15] The number of years from first use to 50 percent use is reported in Column 4 of Table 5, with linear extrapolations in parentheses for practices that have not yet reached 50 percent use. (The linear extrapolations will overstate the time to 50 percent adoption if the diffusion path is sigmoidal.) Of the twenty innovations, nine took more than 15 years to reach 50 percent adoption. But of these nine, four

Table 5

SUMMARY OF DIFFUSION PATTERNS

	Year of First Use in surveyed libraries	Percent of systems currently using	Year when 50 percent were using innovations	Years from introduction to 50% (b)	Number of Libraries Using but no year give (c)
Acquisitions					
Greenaway Plan	1954	80.6[a]	1963	9	5
Approval Plan	1972	16.1	--	(16)	0
Computer Based Ordering	1965	38.7	--	(17)	0
Cataloging					
LC-MARC Based Catalog	1969	38.7	--	(12)	0
Cataloging Network	1973	51.6	1978	5	0
Materials					
Paperbacks	1958	96.8	1970	12	4
Rental Books	1957	64.5[a]	1974	17	3
Microform Readers	1939	100.0	1949	10	13
Photoduplication	1954	100.0	1964	10	5
Circulation Control					
Microfilm	1948	61.3[a]	1964	16	2
Computer based	1972	29.0	--	(10)	0
Anti-Theft Systems					
Guards and Parcel Checks	1892	54.8[a]	1978	86	4
Electronic Security Devices	1969	54.8[a]	1978	9	1
Reference Service					
Computer based information retrieval	1967	32.3[a]	--	(17)	1
Computer based local index	1969	19.4	--	(23)	0
WATS line	1968	35.5	--	(14)	0
Teletype	1960	83.9	1969	9	3
Electronic Accounting Functions					
Payroll	1960	100.0	1968	8	3
Personnell	1960	61.3	1977	17	1
Budget	1966	64.5	1975	9	1

Source: author's survey

a. The technique may have been abandoned by some library systems.

b. Linear explorations are given in parenthesis for innovations that have not reached 50 percent diffusion.

c. A count of the respondents using the technique, but who could not indicate when first use occurred. These are assumed to be among the first 50 percent adopting.

have been abandoned by some library systems. Thus it seems the average time to full diffusion for innovations that will be universally adopted is somewhat less than thirty years (assuming symmetry between the first 50 percent and the second 50 percent of adoption). Overall the pace of diffusion of innovations in libraries is faster than in urban fire departments and compares favorably with the pace elsewhere in the economy.[16]

The process of the diffusion of innovations may be slowed by the complex interaction among innovations. In particular, we observe new innovations becoming available to replace older innovations before the older innovations are fully diffused. Thus, a late comer may leapfrog certain technologies and move directly to the most recent technology. For example, a library currently using a manual cataloging system could now move directly to using a catalog contractor to prepare computer based catalogs. Such a library may never make use of intermediate computer based bibliographic files such as those in Milwaukee and Dallas. Moreover, such a library might never make use of the cataloging networks, such as OCLC. For another example, a library using a manual circulation control system might move directly to a computer based circulation control system without ever using the microfilm systems. Security is a third area where the electronic systems are being adopted by libraries that never used guards and parcel checks.

Technologies may have finite lives defined by the introduction of subsequent techniques. Innovations might therefore be classified by the likelihood of their obsolescence. An innovation that seems likely to become obsolescent might be termed an intermediate technology. An innovation that seems likely to persist for a long period

of time might be called a climax technology. The extent of diffusion of a particular innovation is likely to be influenced by the likelihood that the technology will become obsolete. A climax technology is likely to be diffused more widely than an intermediate technology. The fact that only three of the twenty innovations studied have reached universal application among surveyed libraries reflects the fact that many of the innovations studied are intermediate technologies. Newer technologies dominate the intermediate technologies for many libraries.

The pattern of diffusion will also be influenced by the extent of local development required to make a technique useful in an individual library system. Modular innovations that can be introduced immediately into a library with little modification of existing programs and procedures will be expected to be adopted more quickly than innovations that require the development of new procedures, and substantial adaptation to local circumstances. A coin-operated photoduplication service can be plugged in (where alternating current is available) and the service provided with very little local development expense and little impact on other library operations. The use of a cataloging network like OCLC can be introduced with little modification in cataloging practices. The local card catalog remains intact, and control of the cataloging function is retained in house. In contrast, the use of an approval plan relocates the responsibility for selection and may change the activities of most of the professional library staff. Use of a catalog jobber to produce a computer output microfiche catalog replaces the card catalog, potentially a significant part of the cataloging staff (at least compared to manual cataloging). Much of the control of the catalog passes to the jobber. This may explain why the use of the catalog network has diffused much

more rapidly than the use of the LC-MARC computer generated catalog even though the LC-MARC catalog may be a climax technology.

The pace of diffusion may also reflect differences in the services public libraries seek to provide. A system with no central library, concentrating its resources on the current demands of readers may be more interested in approval plans to get books quickly, paperback books to make more current materials available, and jobber cataloging to reduce catalog lags. Such a library may never adopt computer based information retrieval. A system with more commitment to research support services with a large central library may adopt microform readers, and a WATS line more quickly. They may be more reluctant to give up the decentralized management of selection, cataloging, and circulation control that computer based systems threaten.

Overall the patterns of diffusion reported in Table 5 reflect characteristics of the innovations--how quickly will they obsolesce and how easily are they adapted to a local library--and characteristics of the libraries--how well does the innovation meet the particular objectives of the library? Given these factors, the pace of innovation among the large public libraries seems reasonably swift.

Early Adoption

The process of innovation may be explored by looking for patterns among early adopters of innovations. One issue is whether the same libraries tend to be early adopters of a variety of innovations, or whether most libraries participate in early adoption of some innovations. A second issue is whether libraries that are among early adopters of particular innovations are different in obvious ways from later adopters.

These issues are explored by classifying each library as either an early or late adopter. For innovations that have not reached 50 percent diffusion, all current users are treated as early adopters. For innovations that have exceeded 50 percent diffusion, all systems who adopted through the year when 50 percent diffusion was reached are treated as early adopters. The number of libraries treated as early adopters is indicated in the first column of Table 6. In some cases a substantial number of libraries adopted the innovation in the year the 50 percentile of diffusion is reached, thus the number of early adopters exceeds 50 percent in several cases.

The interdependence of early adoption is examined to determine whether early adoption of one innovation is related to early adoption of others. Contingency tables are constructed for each pair of innovations. An individual library can be classified in four ways: adopted both innovations early; adopted neither innovation early; adopted innovation A early and B late; adopted B early and A late. The contingency tables for each pair if innovations are summarized in Table 6.The first number is the number adopting both innovations early; the second is the number of libraries adopting either or both innovations early. Random distribution of the 31 libraries over the four cells of the contingency table should put about 8 libraries in each cell when 15 or 16 are treated as early adopters. In this case the first number in Table 6 should be near 8 and the second number should be near 24. If the adoption of one innovation is a necessary first step to adoption of another, or if circumstances that lead to the adoption of one also lead to the adoption of another, then early adopters of one innovation should be early adopters of the other. The first number indicated in Table 6 should be large and the second number should be relatively small. Very few such circumstances

Table 6
Early Adoption Comparisons

	Number in Early Adopter Group	Greenaway	Approval Ordering	LC-MARC Network	Paper Rentals	Microfilm Photodup	Circ. Micro	Circulation Computer
Approval Plan	5	4/15						
Computer Ordering	12	5/23	3/14					
LC-MARC based catalog	12	5/23	3/14	6/18				
Cataloging Network	16	7/25	1/20	6/22	4/24			
Paperbacks	22	11/27	4/23	9/24	8/26	10/28		
Rental Books	17	11/22	4/18	6/23	5/24	9/24	13/26	
Microform Readers	17	11/22	4/18	6/23	5/24	11/22	12/27	12/22
Photoduplication	17	9/24	2/20	6/23	8/21	11/22	9/30*	10/24
Microfilm Circulation	16	10/21	4/17	8/20	5/23	9/23	11/27	9/24
Computer Circulation	9	4/21	2/12	5/16	3/18	8/17*	5/26	4/22
Guards	17	10/23	2/20	5/24	5/24	12/21*	9/30*	8/26
Electronic Theft	17	7/26	2/20	7/22	5/24	11/22	12/27	9/25
Information Retrieval	10	7/19	2/13	5/17	4/18	6/20	6/26	7/20
Local Computer Index	6	3/19	0/11	3/15	3/15	4/18	1/27*	4/19
WATS line	11	5/22	3/13	3/20	6/17	5/22	6/27	7/21
Teletype	15	9/22	2/18	6/21	7/20	9/22	10/27	6/26
Payroll	17	9/24	2/20	6/23	6/23	9/24	11/28	7/27
Personnel	15	10/21	3/17	7/20	6/21	8/23	12/25	8/24
Budget	17	11/22	3/19	8/21	6/23	8/25	14/25	9/25
Number in Early Adopter Group		16	5	12	12	16	22	17

	Microfilm Photodup	Circ. Micro	Circulation Computer
Guards	11/23	11/22	5/21
Electronic Theft	8/26	9/24	7/19
Information Retrieval	8/19	9/17*	4/15
Local Computer Index	5/18	5/17	2/13
WATS line	7/21	3/24	3/17
Teletype	10/22	7/24	5/19
Payroll	11/23	8/25	3/23
Personnel	7/25	8/23	4/20
Budget	9/25	10/23	5/21
Number in Early Adopter Group	17	16	9

Note: The first number is the number of library systems that were among the first 50 percent of libraries to adopt both innovations. The second number indicated the number of libraries that were among the first half adopters for either innovation. The total number of systems examined is 31. Statistical significance of a chi-square test of a contingency table indicates whether the early adoptions are independent. * indicates lack of independence at the 10 percent level.

Table 6--continued

	Number in Early Adopter Group	Guards	Electr. check	Info. Retr.	WATS Local index		Teletype	Payroll	Personnel
Electronic Theft	17	10/24							
Information Retrieval	10	6/21	5/22						
Local Computer Index	6	4/19	3/20	4/12					
WATSline	11	5/23	5/23	2/19	2/15				
Teletype	15	10/22	7/25	6/19	2/19	6/20			
Payroll	17	12/22	9/25	6/21	3/20	6/22	10/22		
Personnel	15	8/24	7/25	3/22	3/18	5/21	8/22	6/26	
Budget	17	10/24	8/26	4/23	2/21	6/22	8/24	9/25	12/20*
Number in Early Adopter Group		17	17	10	6	11	15	17	15

are found in Table 6. Another possibility is that adoption of one innovation precludes the adoption of another. In this case, the first number should be small and the second large. This case is not found in the Table either. Therefore, the adoption of each innovation studied seems relatively independent of the adoption of the other innovations. A formal statistical test of this independence is performed by calculating a chi-square statistic for each contingency table. While the chi-square statistics are not reported, those cells of Table 6 with statistically significant chi-square statistics are indicated by asterisks. Of 190 contingency tables calculated, only seven have chi-square statistics suggesting interdependence at the 10 percent level. Of these only the interaction of automated budgeting and personnel records seems consistent with some strong technical link. It does not seem to be the case that libraries that have adopted some computer based innovations have tended to be early to adopt others. Nor have early adoption of computer based accounting systems--payroll and personnell--been associated with early adoption of library specific computer systems.

No small group of library systems seem likely to stand out as especially innovative, rather most libraries seem to participate in the early use of some innovations. This pattern may be desirable. The early use of innovations may involve investment in development that can be avoided by latecomers. Early users may also incur more risk of failure than latecomers. Therefore, it may be appropriate that most library systems participate in testing innovations. The innovations are also quite varied such that different circumstances may apply in the adoption of each. Therefore, it is not surprising that no single group of the 31 library systems surveyed stands out as trend setters in all areas of library innovation.

The specific characteristics of library systems who are early adopters is explored for each innovation by means of discriminant analysis. The explanatory variables are the same as those used in an analysis of library inputs and fall into three groups.[17] First, the cost of labor to the library, indicated by the compensation of a recruit librarian, may influence the decision to innovate. If some innovations are viewed as labor saving, libraries with higher labor costs would be expected to adopt them before libraries with lower labor costs.

Second, the fiscal circumstances of local government may influence the innovation decision. This effect may work in two directions, however. On the one hand, the development of an innovation may require slack resources. Some of the innovations require large setup costs in order to lower continuing costs. Library systems in local areas with higher expenditures per capita and larger levels of intergovernmental revenues per capita would be expected to adopt such innovations first. On the other hand, high levels of local government expenditures may reflect high competing demands from other agencies and so may indicate less available to finance change in the library. Therefore, the direction of association between local governments' own expenditures per capita and intergovernmental revenues per capita and the early adoption of innovations is ambiguous. A more detailed characterization of the local fiscal scene is very difficult. The flexibility of operations may differ for libraries that operate somewhat autonomously from local governments than for those that are departments. A department may have less flexibility to incur the fixed costs of computer systems in order to save operating costs, for example.

Third, the demographic characteristics of the area served may

influence the decision to innovate. Large systems may be better able to incur the costs of developing new practices. Some new techniques may involve economies of scale so that only larger systems can use them. On the other hand, very large systems may be more bureaucratic, and managers may find innovation more difficult. The population of the area measures the size of the system.

Areas with more educated adults use the public library more intensively and so certain innovations may be more useful in such libraries. Adults in central cities tend to have lower education levels than those in the suburbs, yet the central city systems tend to have larger central libraries and more specialized library services than the suburbs. Innovations such as microfilm readers that meet specialized needs would seem more likely to be adopted in central city systems before being adopted by suburbs.

Finally, the recent growth in population in the area serviced may influence the innovation decision. Rapid growth may pressure a library system such that new techniques are sought. A library system in a growing area may be less tied to traditional practices. Innovation may be easier with growth.

Standardized discriminant coefficients for each of twenty discriminant analyses are reported in Table 7. Each is reported such that a positive sign on the coefficient indicates that that variable is associated with a higher probability of being an early adopter. The rank order of the coefficients in each analysis indicates the relative importance of each variable in discriminating early from late adopters. The chi-square statistic for each analysis allows a probability statement about the ability to discriminate.

Table 7

Standardized Discriminant Coefficients for Early Adopters

	Greenaway Plan	Approval Plan	EDP Ordered	MARC Cataloging	Network Cataloging	Paper Books	Rental Books	Microfilm	Photo-Duplication	Circulation Microfilm
Number in early user group	16	5	12	12	16	22	17	17	17	16
Labor Cost	-0.193 (5)	-0.006 (7)	0.813 (2)	0.145 (5)	0.338 (4)	+0.393 (2)	-0.674 (2)	-0.237 (5)	0.349 (3)	0.539 (4)
Own Net Expenditures	-0.490 (3)	0.291 (4)	0.080 (5)	0.105 (6)	0.256 (6)	-0.254 (4)	-0.113 (6)	0.360 (3)	0.209 (4)	-0.459 (5)
Intergovernmental Expenditures	0.739 (1)	-0.231 (5)	0.495 (3)	-0.660 (3)	-0.520 (2)	0.338 (3)	-0.164 (5)	0.009 (7)	-0.396 (2)	0.066 (7)
Department (binary)	-0.558 (2)	-0.533 (2)	0.084 (4)	0.057 (7)	0.121 (7)	0.186 (5)	0.253 (4)	0.542 (2)	-0.001 (7)	-0.395 (6)
Population 1970	-0.116 (7)	0.130 (6)	-1.393 (1)	0.964 (2)	-0.309 (5)	-0.085 (7)	-0.031 (7)	0.295 (4)	0.096 (5)	-0.631 (3)
Percent of Adults High School Graduates	0.131 (6)	0.585 (1)	-0.007 (7)	0.992 (1)	-0.606 (1)	0.760 (1)	0.566 (3)	0.142 (6)	0.067 (6)	-1.158 (1)
Percent growth 1960-1970	-0.313 (4)	0.494 (3)	0.074 (6)	-0.154 (4)	-0.397 (3)	0.139 (6)	-0.985 (1)	-0.797 (1)	-0.825 (1)	0.722 (2)
Chi-square	4.740	7.799	7.333	6.064	17.632**	6.398	13.226*	4.096	10.290	4.669
Percent Correctly Classified	64.52	77.42	70.97	70.97	83.87	77.42	87.10	74.19	77.42	61.29

Note: First number is the standardized discriminant coefficient where a positive sign indicates a greater probability of being an early adopter if the variable is larger, other things equal. The second number, in parentheses, is the rank order of the standardized discriminant coefficients in absolute value. Statistical significance is indicated: ** .05 level; *** .01 level.

Table 7 -- Continued

	Computer Circulation	Guard	Electronic Check	EDP Information	EDP Index	WATS Line	Teletype	Payroll EDP	Personnel EDP	Budget EDP
Number in early user group	9	17	17	10	6	11	15	17	15	17
Labor Cost	0.343 (4)	0.101 (4)	0.599 (1)	-0.222 (6)	-0.118 (5)	-0.446 (4)	0.326 (3)	-0.083 (5)	1.137 (1)	0.778 (2)
Own Net Expenditures	0.623 (3)	-0.060 (5)	-0.482 (2)	-0.562 (1)	0.012 (7)	0.537 (1)	0.195 (6)	-0.054 (6)	-0.176 (6)	-0.451 (4)
Intergovernmental Expenditures	-0.932 (1)	0.010 (7)	0.120 (7)	-0.333 (4)	-0.549 (2)	-0.077 (7)	0.394 (1)	0.603 (1)	0.254 (5)	0.572 (3)
Department (binary)	-0.625 (2)	0.050 (6)	-0.300 (3)	-0.207 (7)	-0.099 (6)	0.510 (2)	-0.079 (7)	0.302 (3)	0.057 (7)	0.063 (6)
Population	-0.252 (5)	0.102 (3)	0.232 (5)	0.542 (2)	-0.385 (3)	-0.482 (3)	0.364 (2)	0.580 (2)	-1.128 (2)	-1.161 (1)
Percent of Adults High School Graduates	0.026 (7)	-0.819 (1)	-0.196 (6)	-0.254 (5)	-1.027 (1)	0.229 (6)	0.242 (5)	-0.103 (4)	-0.300 (4)	-0.026 (7)
Percent growth	-0.052 (6)	-0.163 (2)	-0.249 (4)	-0.466 (3)	0.230 (4)	-0.301 (5)	-0.296 (4)	0.013 (7)	0.334 (3)	0.075 (5)
Chi-square	7.575	16.644**	3.215	3.291	10.499	4.700	8.242	5.589	11.080	15.474**
Percent Correctly Classified	70.97	83.87	61.29	64.52	74.19	74.19	70.97	64.52	80.65	80.65

Overall, the discriminant exercise is not very successful as represented in Table 7. Only four of the twenty discriminant functions are statistically significant at the 5 percent level with the chi-square test: Network Cataloging, Guards, Rental Books, and Automated Budgeting. That is, given the values of the seven variables used in the exercise, one can make a statistically meaningful estimate of which libraries would adopt a particular innovation early for only four innovations. A second method for observing the ability to discriminate early from late adopters on the basis of library characteristics is to calculate what proportion of the libraries are correctly classified as early or late by the discriminant function. The value of each variable is multiplied by the discriminant coefficient and the products are summed for each library, establishing a discriminant score. If the score is greater than some critical value, the library is predicted to be an early adopter. The proportion correctly classified is reported at the bottom of each column in Table 7. Since the classification is based on the same libraries from which the discriminant functions were estimated, the classification exercise is not statistically meaningful, yet the values make clear the nature of the discriminant functions. Coin flipping would tend to classify 50 percent of the libraries correctly, so a powerful discriminant function should correctly classify a much higher proportion of the libraries. Over eighty percent of the libraries are correctly classified for only five innovations: the same four indicated by the chi-square statistic and automated personnel records.

The role of individual variables in discriminating early from late adopters--other things equal--is summarized in Table 8. The variables in the first and second largest coefficients when ranked in absolute value

Table 8
Summary of Discriminant Functions
First or Second Bank Coefficients

	Negative	Positive
Labor Costs	Rental Books*	Paperback Books Electronic Security Automated Personnel* Automated Budget* Automated Ordering
Own Net Expenditures per capita	Electronic Security Information Retrieval	WATS line
Intergovernmental Expenditures per capita	Network Cataloging* Photoduplication Computer Circulation Computer Index	Greenaway Plan Teletype Automated Payroll
Department (binary)	Greenaway Plan Approval Plan Computer Circulation	Microfilm WATS line
Population 1970	Automated Ordering Automated Personnel* Automated Budget*	LC-MARC based cataloging Information Retrieval Teletype Automated Payroll
Percent of Adults High School Graduates	Network Cataloging Microfilm Circulation Guards*	Approval Plan LC-MARC based cataloging Paperback Books Computer Index
Percent Growth in Population 1960-1970	Rental Books* Microfilm Photoduplication Guards*	Microfilm Circulation

Note: The classifications reported here summarize the discriminant functions reported in Table 7. *These innovations were over 80 percent correctly classified by the discriminant functions.

are reported for each innovation. No single observed factor is pushing early adoption of innovations. Each variable is positively and negatively associated with early adoption of different innovations. High labor costs seems associated with early use of the automation of several accounting and record keeping functions, but has played no strong role with automation of cataloging or circulation innovations. Fiscal stringency, represented by lower per capita expenditures from own sources and from intergovernmental sources on local government functions other than libraries, is associated with early adoption of some innovations, including network cataloging and computer based circulation. Yet the fiscal variables appear important for only a few of the innovations.

Libraries that are departments of city governments seem somewhat less likely to adopt approval plans and computer based circulation control systems early, suggesting that the flexibility of more autonomous library organization may be important for early adoption of these innovations. Yet this association is found to be important for only a few innovations.

The characteristics of the area served by the library also seem important for early adoption of some innovations. Larger libary systems seem more likely to have adopted LC-MARC computer generated catalogs and automated payrolls early. Yet smaller library systems seem to have been more likely to adopt automated ordering, personnel records, and budgets early. Areas with more adults who are high school graduates seem less likely to have adopted network cataloging and more likely to have adopted LC-MARC computer based cataloging and approval plans. Areas that grew more rapidly in the 1960's seem more likely to have adopted microfilm circulation control systems early, but less likely to have been

early users of rental books, microfilm readers, photoduplication, and guards. In part these differences may reflect differences among city, metropolitan and suburban systems.

Overall, it is difficult to generalize about the features of library systems that are early adopters of innovations. Each innovation has its own characteristics and consequently different factors seem important for the early adoption of different innovations. The hypothesis about the role of high labor costs, fiscal stringency, and the size and growth of the area served each find modest confirmation in the evidence but none are important for more than a few innovations. The process of early adoption of innovations is complex.

Interaction Between Inputs and Innovations

The effort to explain early use of innovations relative to the external characteristics of library systems subsumes the fact that other input choices the library makes may be important in the decision to adopt an innovation. For example, a library acquiring more materials and more titles may have greater need for new cataloging aids. Therefore, it is appropriate to compare the inputs of libraries that have adopted an innovation with those that have not. The difficulty with such a comparison is that the choice of inputs and innovations may be simultaneous. An innovation may allow a library to acquire more titles than it previously did, just as the acquisition of a large number of titles may influence the decision to innovate, say, in cataloging. A high cost library may innovate and the innovations may lower costs. Both effects will shape a comparison or costs between innovators and noninnovators. Thus the comparison of input levels between library systems using an innovation and

those not using an innovation is for descriptive purposes rather than an exercise to explore causes of innovation.

The mean value of the input is reported separately for the library systems that have innovated and for those that have not. An F-statistic indicates whether the difference between the two means is statistically significant. One input variable is binary, indicating whether the chief librarian had been promoted from within the library. A chi-square test indicates whether there is a statistically significant association between adoption and promotion from within. The statistics are reported in Table 9. Five innovations that might be expected to have important associations with other library inputs are examined.

Do the major technical service innovations lower library expenditures? Library expenditures per capita are higher in libraries that have LC-MARC cataloging than in those that do not; similarly for those with computer based circulation control. The higher expenditure levels, however, may indicate that the innovating library systems offer higher levels of service or face higher labor costs. Perhaps the higher costs have led to innovations as cost saving measures. One cannot infer that the innovations have raised costs.

In a very few instances there are associations between the main library activities and the innovations. Libraries with computer based ordering systems have fewer locations per square mile and have more volumes in stock per capita than those that have not adopted that innovation. Libraries with computer based circulation control buy more titles. There is no difference in branch hours per week or in public service staff per capita among libraries with these innovations than those without. Libraries using cataloging networks have a larger proportion of their public service staffs in the main library. Perhaps the

Table 9
Library Inputs and Innovation Interactions
Average of Sample with/without innovation; F-Statistic

	Computer Based Ordering	Approval Plan	LC-MARC Computer Generated Catalog	Cataloging Network	Computer Based Circulation Control
Number of Systems with/without Innovation	12/19	5/26	12/19	18/13	9/22
Library Expenditure per capita	7.02/6.07 0.468	6.64/6.40 0.017	8.05/5.41 4.031*	6.73/6.63 0.254	8.44/5.62 3.996*
Locations per square mile	0.08/0.23 3.208*	0.07/0.19 1.269	0.19/0.16 0.110	0.19/0.16 0.098	0.14/0.19 0.184
Acquisitions per capita thousand population annual	166.82/132.35 2.235	132.99/148.14 0.230	149.04/143.57 0.053	151.17/138.11 0.309	147.98/144.76 0.016
Titles Cataloged Annually in Thousands	13.84/21.73 1.932	11.99/19.97 1.094	22.33/16.38 1.067	22.48/13.42 2.675	26.30/15.56 3.239*
Volumes in Stock per capita	2.34/1.85 2.895*	2.28/2.00 0.490	2.02/05 0.013	2.18/1.85 1.249	2.30/1.93 1.329
Hours per week in Branches	48.24/48.08 0.001	47.54/48.26 0.018	47.41/48.61 0.086	47.87/48.52 0.026	46.11/48.98 0.437
Public Service Staff per thousand population	0.33/0.31 0.251	0.35/0.31 0.443	0.34/0.31 0.593	0.33/0.30 0.519	0.35/0.31 0.682
Percent of public service staff professional	40.72/36.69 0.953	38.99/38.16 0.023	33.87/40.87 2.970*	41.11/34.6 2.657	40.64/37.30 0.562
Percent of Public Service Staff in Main Library	31.46/35.09 0.282	22.41/35.88 2.426	27.09/37.43 2.384	40.46/24.71 6.684**	41.34/30.34 2.450

Table 9 -- Continued

Number of Systems with/without Innovation	Computer Based Ordering 12/19	Approval Plan 5/26	LC-MARC Computer Catalog 12/19	Cataloging Network 18/13	Computer Based Circulation Control 9/22
Year Chief Librarian has been chief	5.67/8.95 3.164*	6.60/7.88 0.252	7.42/7.84 0.048	7.50/7.92 0.049	6.89/8.00 0.287
Chief Promoted from within the Library (binary) (chi-square test)	42.1/50.0 0.004	42.3/60.0 0.056	42.1/50.0 0.004	38.9/53.8 0.212	33.3/50.0 0.201
Cataloging Lag in Days	49.54/53.06 0.020	33.8/55.68 0.499	58.5/47.59 0.189	62.07/38.58 0.957	68.13/44.68 0.800
Acquisition Lag in Weeks	15.1/9.18 1.668	12.5/11.27 0.037	16.44/8.82 2.763	10.93/12.18 0.072	9.63/12.28 0.286
Total Technical Service Staff	46.17/45.60 0.003	34.1/48.17 1.111	45.39/46.08 0.004	54.35/34.68 4.256**	58.5/40.39 2.959*
Percent of Technical Service Staff Professional	25.13/22.91 0.266	17.99/24.96 1.601	19.34/26.38 2.845	25.47/21.62 0.841	24.25/23.61 0.020
Technical Service Labor Cost in thousands of dollars	749.070/665.52 0.217	493.06/740.12 1.131	686.28/706.27 0.012	847.90/504.15 4.292**	928.04/600.76 3/217*
Technical Service Labor Cost per Title	55.28/34.68 6.292**	42.09/43.09 0.007	42.30/43.28 0.011	44.93/40.30 0.269	44.09/42.42 0.029

networks are more valuable for main library sources.

One might expect that the electronic innovations examined here, especially approval plans, ordering systems, the LC-MARC cataloging and the computer based circulation control would enable a library system to be more centrally managed. Thus technical librarianship skills might be applied in central decisions, while individual library units could be operated successfully with less professional skill. One might also expect smaller and less professional technical service staffs. Few such effects are apparent from comparing input levels between innovators and non-innovators. Those libraries with LC-MARC computer generated catalogs have a smaller fraction of public service workers professionally trained. One would expect, however, that the strongest effect on the public service division would be for ordering, selection, and circulation control rather that in the catalog preparation, a function mainly of technical services. Therefore, there is little evidence here that libraries that have adopted the innovations use less labor than other libraries. It is quite possible that the libraries that have innovated have been the largest, most labor intensive libraries and have reduced labor inputs in technical services from former levels or from levels that would otherwise be necessary to provide similar levels of service. A much more detailed study of specific library operations would be necessary to estimate what labor requirements might be in the absence of innovation in the libraries that have innovated.

The technical service staffs of the libraries are compared. The technical service staffs include selection and ordering if personnel are assigned specifically to these functions. They include cataloging and processing. Some technical service operations are organized in ways

that makes separating the subfunctions difficult; therefore, the total technical service labor force and labor costs are compared. Libraries using the cataloging networks and computer based circulation systems are found to have larger technical service labor forces. One might expect that some of the innovations would lead to less professional staff in technical services. In particular the use of LC-MARC computer generated cataloging might allow a library to substitute less skilled labor for more skilled labor. The technical service staffs of the LC-MARC computer using libraries average 19 percent professional while the technical service staffs of the other libraries average 26 percent professional. This difference is only very slightly statistically significant (at the 15% level),not a strong effect.

The labor cost of technical services can be estimated by multiplying the number of professional workers by the salary of professional workers with five years experience (a benchmark value) and adding in fringe benefits. A similar calculation is made for clerical workers and a sum taken. While there are apparently large differences in the labor costs of technical services, only those for the cataloging networks and for computer based circulation are statistically significant, with the innovators having larger expenditures. This evidence is consistent with certain innovationa being adopted by high cost libraries. A technical service labor cost per title is derived by dividing the total labor cost estimate by the number of titles cataloged. The labor cost per title is significantly higher among libraries with ordering systems. Again, the evidence suggests that high cost libraries have innovated, but the evidence is not so strong that this association holds for all innovations.

These cost and staffing comparisons would be more meaningful if information about staffing for particular functions were available from a larger group of libraries. The use of an approval plan and an automated ordering system may have larger impacts on selecting and ordering staffs and no impact on cataloging and processing operations. The use of computer assisted cataloging may influence cataloging and processing operations but not ordering and selection. The use of computer based circulation may influence public service operations, but not cataloging, processing or ordering. The processing of overdue notices may be performed in different divisions in different libraries; the costs of this function might be compared for the computer based circulation control innovators and non-innovators. Moreover, one would like to know expenditure on data processing and contractual services in order to compare total costs. These more detailed cost comparisons are beyond the scope of the present study.

One might expect that the approval plan, ordering systems, and cataloging systems would reduce both acquisiton lags and cataloging lags. The comparison of mean acquisiton and cataloging lags of innovators with non-innovators shows no significant differences. Again, however, the libraries with the longest lags may have innovated to reduce the lags; the present evidence does not reveal the changes in lags, if any, following innovation.

There may be an association between the characteristics of the chief executive of the library system and the adoption of innovations. A new chief executive, for example, may have more authority to adopt innovations. Such seems to be the case for ordering systems, but not for the other innovations. A chief promoted from within the library

system may feel acclimated to traditional practices in the system, while an outsider may be more interested in bringing in new techniques. Chief executives of public libraries are sometimes recruited from academic or special libraries. A national search may yield persons of varied experiences in libraries. No significant difference between inside and outside chiefs is found. Note however that most appointments of chief executives follow a search both within and without the system, thus promotion from within need not imply a ratification of the status quo in library operation. Moreover, librarians sometimes move among systems as assistant chief executives so that promotion from within need not imply that the new chief executive has no mangerial experience in other library systems.

Summary on Innovations in Public Libraries

A wide array of innovations are sweeping the public library industry. Most parts of the operation of a public library system may be changed by innovation, including material selection, ordering, cataloging, and circulation control. These innovations seem to be diffused rapidly across the large public library systems surveyed. While the study has not attempted to document the cost saving potential of these innovations, substantial benefits are presumed to exist.

The pattern of diffusion is influenced by the fact that many innovations may become obsolete before they are completely diffused. Only a few innovations may be climax technologies that will be completely diffused before becoming obsolete. Computer based circulation control, LC-MARC based computer generated catalogs, and electronic anti-theft devices may be such technologies.

No single group of libraries (among the large systems surveyed) stands out as pace setters. Each system has been among relatively early

adopters of some innovations and no system has been among early adopters of all innovations. Moreover, no particular characteristics of libraries seem especially significant in the decision to adopt innovations. Labor costs, fiscal circumstances, and system characteristics may each play some role, but the relative importance of each will change from innovation to innovation.

Two factors deserve mention as sources of technological change in public libraries. First, the development of the Machine Readable Cataloging by the Library of Congress has allowed private firms to distribute LC cataloging information at very low cost in microform. Other firms are able to use the LC-MARC tapes to prepare local catalogs. The cataloging information has public goods qualities: the cost of making the information available to additional users is very low relative to the cost of generating the information in the first place. Thus, the advance of cataloging services at the Library of Congress (with Ford Foundation support) has been of substantial benefit to public libraries.

Second, the chief executives of public libraries are professionals. They typically attend professional meetings annually or more frequently. They contribute to and read many periodicals on library methods. They participate in national markets and usually land their positions after national searches by library boards. The professional characteristics of library managers probably enhances the pace and diffuse character of innovation among libraries.

FOOTNOTES

[1]Joseph Newhouse and A. J. Alexander, An Economic Analysis of Public Library Services, Heath Lexington, Massachusetts, 1972.

[2]From June 7, 1970 to September, 1971 25 non-fiction titles appeared on the New York Times best seller lists, with a mean length of stay of 19.84 weeks. During the same period 25 fiction titles appeared with a mean stay of 24.04 weeks.

[3]Charles A. Goodrum, The Library of Congress, Praeger, New York, 1974, Chapter 3.

[4]Brett Butler, Brian Avery, and William Scholz, "The Conversion of Manual Catalogs to Collection Data Bases," American Library Association Library Technology Reports 14 #2, March/April 1978, p. 109.

[5]Municipal Library Department, City of Dallas, "Long-Range Plan for Public Library Service," Dallas Public Library, Dallas, Texas, 1977, p. 103.

[6]Brett Butler, Brian Avery, and William Scholz, "The Conversion of Manual Catalogs," op cit., p. 172.

[7]Brett Butler, Brian Avery, and William Scholz, "The Conversion of Manual Catalogs," op cit., p. 172.

[8]Brett Butler, Brian Avery, and William Scholz, "The Conversion of Manual Catalogs," op cit., p. 150.

[9]The speed of availability of Library of Congress cataloging has improved dramatically with the MARC tape system. For pre-MARC experience see: S. Elspeth Pope, The Time-lag in Cataloging (Metuchen, New Jersey: The Scarecrow Press, 1973), p. 128.

[10]Library of Congress Information Bulletin, June 17, 1977.

[11]F. W. Lancaster, The Measurement and Evaluation of Library Services, Information Resources Press, Washington, D.C., 1977, pp. 19-72, reviews the literature on the evaluation of catalogs.

[12]Brett Butler, Brian Avery, and William Scholz, "The Conversion of Manual Catalogs," op cit., p. 172.

[13]Josten's Library Service Division, "Book Lease Plans," Josten's Burnsville, Minnesota, 1978.

[14]See Edwin S. Mansfield, Industrial Research and Technological Change (New York: Norton, 1968), pp. 133-154 and Malcolm Getz, The Economics of the Urban Fire Department (Baltimore: The Johns Hopkins University Press, 1979), Chapter 6 for a more complete discussion of the theoretical underpinnings of the shape of the adoption path.

[15]Each library system was asked when it began using a particular technique. In this way, the year when any particular fraction had adopted could be identified. Unfortunately, not all libraries that had a practice in use could indicate when the practice had begun. The number of library systems using a technique but not reporting a year of adoption is reported in the last column of Table 5. In determining the year when 50 percent adoption is reached, these libraries are assumed to be among the first half adopters. Given the gaps in information, it is not possible to report a specific sigmoidal curve of the diffusion paths.

[16]Getz, Urban Fire Departments, op cit., Chapter 6.