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Computer-Derived Management Information in a Special Library

Introduction

Not the least of the benefits of automating libraries and information centers is the enhanced ability to monitor processes and services, to collect, structure, analyze, and report critical or useful data hitherto largely unavailable or excessively difficult and costly to obtain. Good management of information requires good management information—information that is as cogent, correct, current, clear, concise, and complete as cost effectiveness and enlightened decision-making demand. Computer-aided information systems offer not only opportunities to gain new insights into the services they support; they challenge the systems designer to build in the feedback necessary to control and improve the systems themselves.

The focus of this paper is computer-supplied management information in the special library environment. The particular context is that of an extensively computerized, corporate library network in a large research and development organization—Bell Laboratories.

Library Network Structure and Services

To help meet the information needs of its 24,000 people (of whom over 12,000 are scientists, engineers and managers),* Bell Laboratories has developed a multi-unit library system, structured and managed as a tightly integrated network. The present system is composed of twenty-five librar-

*All data, unless indicated otherwise, are as of April 1982.

ies, a half dozen special information services, and several supporting units serving nineteen Bell Laboratories and Western Electric sites in eight states.

The primary goal of the library system is to provide to all employees, however distant from company headquarters in Murray Hill, New Jersey, a full spectrum of information services of comparable high quality, at reasonable cost, quickly delivered. To this end, much emphasis is placed on networking, on functional interdependency, resource pooling, responsibility sharing, coordinated management, and commonality of systems, standards and goals. To help make networking work, a mix of centralized special services and decentralized standard services is employed, supported by substantial computer, communications, delivery, and management information systems.

Decentralization is preferred for the basic library functions, i.e., circulation and reference services, certain information alerting and online searching services, and the on-site supply of the book, journal and other information services required to handle promptly the majority of local information needs. Collection building, however, is not limited to local needs; each library has responsibilities to the system and, as will be noted later, coordinated resource management is one of the major targets and operational realities of the network.

Centralized services encompass functions and resources needed throughout the network that would be inefficient or uneconomical or impossible to provide on a local level. Centralization also offers opportunities for introducing and insuring common high standards and system-wide service monitoring, as well as supplying the critical mass and economies of scale necessary to justify certain specialized endeavors. Among the operations that are centralized, but not all at one location, are:

- acquisition, classification, cataloging, and the building and maintenance of network databases for books, journals, internal technical documents, and other resources;
- information alerting services, including the regular publication of thirteen major announcement bulletins, a computer-aided system for selectively disseminating internal technical documents, and an emerging electronic bulletin system;
- publication of a diversity of specialized information directories, catalogs, indexes, pathfinders, and so forth;
- information retrieval services using highly trained subject specialists, skilled in machine and manual searching, to undertake the more demanding information searches of both bibliographic and numeric databases, compile specific and continuing bibliographies, and supplement reference librarian services;

- computing information services, including specialized announcement and index services, the handling of external requests for Bell Labs software, and the operation of libraries specializing in computer information to support numerous computing activities;
- technical report services furnishing centrally a full range of acquisition, announcement, request processing, and search services on domestic and foreign technical reports of interest to Bell Labs;
- translation services providing oral and written translations by on-site staff or external assignment of all the major languages of science;
- management information services, as outlined in part below, supplying an extensive series of computer-compiled reports on library operations and performance;
- copyright royalty payment operations; and
- information system design and development services charged with the primary responsibility for designing, programming and establishing new and improved information handling systems for the whole network.

Computer Systems

Supporting these services and almost every facet of library operations is a complex of computer systems developed by the Bell Labs libraries since the mid-1960s. The principal computer-aided functions and systems are listed in figures 1 and 2 respectively. We shall note only sufficient details about these systems to help place in proper perspective the *information management information* they have been designed to provide. Additional details about some of the systems and services are contained in an earlier paper and its references.¹

Management Information

We shall address, in turn, examples of management information relating to book selection, acquisitions, financial accounting, and cataloging; serials control; information alerting, copying and royalty payments; circulation operations, supply services, and resource management; and finally, some retrieval services.

First, we shall discuss book selection. Two major imperatives apply to collection building in a library network that operates as an integrated system rather than as a loose consortium of essentially separate enterprises: meeting local needs *and* coordinating total resources in a service- and cost-effective way. Both these requirements have been significantly aided by a computer-supported selection system implemented in Bell Laboratories in 1975. In this system, used for both selection and weeding purposes, "selection profiles" have been established for each library. These define

COLLECTION BUILDING AND UPKEEP
CATALOGING AND INDEXING
INFORMATION ALERTING
DOCUMENT DISSEMINATION
CIRCULATION CONTROL AND REQUEST PROCESSING
INFORMATION RETRIEVAL
PREPARATION OF PUBLICATIONS
TEXT COMPOSITION AND EDITING
SERVICE MONITORING AND MANAGEMENT FEEDBACK
FISCAL CONTROL
NETWORKING
COPYRIGHT ROYALTY PAYMENT

Fig. 1. Computer-Aided Functions in Bell Labs Library Network

not only the precise subject interest of the location served but the degree of coverage or "collection level" appropriate for that library. Much pertinent management information, including extensive statistical data available from the network's online circulation system on subject usage by technical departments and locations, together with input obtained from users directly and other sources, contribute to the determination of interests. Interests are defined by descriptor and classification number. Collection levels are expressed numerically: 0 = not yet defined; 1 = a representative, basic collection; 2 = research-level coverage; and 3 implies all worthwhile information published worldwide to support long-term research and development interests. For every library, a profile statement and subject index are computer-produced. Figure 3 is a portion of one library's statement showing, for example, a level 3 interest in solid state physics. To help coordinate selection on a total network basis, the overall subject interests of all libraries are maintained in a master matrix, available to all, showing the profile level for each library in each subject class. In figure 4, the example, solid state physics (530.4), is shown to be an interest shared on various levels by nine libraries.

BELLTIP	Book Acquisition and Cataloging System
BELLSER	Serial Acquisition and Processing System
BELLREL	Loan and Query System
BELLCAT	Catalog Search System
BELLPAR	Publication Announcement System
BELLTAB	Technical Report Announcement System
MERCURY	Internal Document Dissemination System
BELLPULL	Internal Document Request Processing System
BELLPAY	Copyright Royalty Accounting System
BELLCALL	Online Shelflist
BELDEX	Indexing System

Fig. 2. Computer-Aided Information Systems in Bell Labs Library Network

Management information systems should, of course, provide periodic checks or analyses to reveal if they are being properly used. The selection profile system has several reports of this kind. One is a "Dollars by Dewey" performance report (see fig. 5) which shows for each subject, the number of items purchased and the dollars spent by each library/level. Total titles held by each library are also given. A companion analysis identifies all purchases made at the zero (undefined) level—a situation compelling attention at profile review time.

Items selected for network libraries under the coordinated profile system are submitted to the **BELLTIP** book acquisition, accounting and cataloging system operational since January 1972. In this system, input terminals coupled to a large central computer submit order information, receipt and invoice data, cataloging details, file changes, and various queries. Output includes order forms, cancellation and claim notices, financial summaries, "in-process" reports, and much additional data that enable management to monitor purchases, work processes and other areas. Up-to-date process and accounting status reports may be obtained online from any of the many terminals throughout the network. Figure 6 illustrates use of the online in-process file facility to determine if a particular book has been ordered and, if so, its status. In this example, a keyword

MURRAY HILL LIBRARY - SELECTION PROFILE

<u>SUBJECTS</u>	<u>DDC</u>	<u>LEVEL</u>
Signal Theory (Telecommunication)	621.3804301	2
Simulation Methods	658.54	1
Size (Particles)	620.106	1
Social Sciences, Mathematical Models	300.18	1
Societies (Scientific)	506	1
Solar Batteries	621.475	2
Solid State Chemistry	541.042	2
Solid State Physics	530.41	3
Solid State Reactions	541.39	2
Solubility	541.34	1
Solutions (Electrolyte)	541.372	2
Solving (Problem)	153	2
Sound	534	2
Sound (Noise)	613.6	1
Speaking (Public)	808.5	1
Spectra, Infrared	535.842	2
Spectra (Organic Compounds)	547.346	1
Spectroscopy	535.846	2
Speech, Analysis	621.3819	2

Fig. 3. Selection Profile List

BTL LIBRARY NETWORK SELECTION - PROFILE LEVELS

DDC NO	LOCATIONS																		
	AK	AL	CB	CH	CR	DR	HC	HO	HP	IH	IN	MH	MV	PR	PY	RD	WB	WH	
530.1					1			1		1			2						
530.101						1													
530.12			1		1			2		1		2	1		1				
530.13												2							
530.143									1	1									
530.144												2							
530.2	1	1			1				1				1	1					1
530.3	1								1										
530.41	2				1			2	1	1	3	1	1	1		1			
530.5					1			1	1		2	1							1
530.7					1			1			2								
530.8												1							
530.85								1											
530.9									1				1						2
531									1										1
531.017													1						
531.3															1				1
531.32										1				1	1				2

Fig. 4. Selection Profile Matrix

SELECTION PROFILE PERFORMANCE (DOLLARS BY DEWEY)

<u>DDC No.</u>	<u>Library - Level</u>	<u>Items</u>	<u>\$</u>	<u>Titles</u>
530.41	AL - 2	7	167.97	131
	HO - 2	9	200.72	127
	IH - 1	0	0.00	78
	IN - 1	1	26.26	10
	MH - 3	23	694.27	209
	MV - 1	1	40.05	49
	PR - 1	1	33.58	77
	RD - 1	2	44.22	82

530.41 Solid State Physics

Level 1 Representative Collection

Level 2 Research Collection

Level 3 Comprehensive Collection

Fig. 5. Selection Profile Performance Report

search was made for the book, *Soul of a New Machine*; two libraries are shown to have ordered and just received the item. Another online report is particularly useful in monitoring the overall status of items flowing through the acquisitions/invoicing/cataloging system of BELLTIP. This report, the In Process File Scoreboard, permits a manager not only to determine how many items are in any given status (e.g., on order, in cataloging, etc.) but to compare the current status with a selected earlier date, say one month ago, as shown in figure 7. Scoreboard reports not only book copies, or book titles as appropriate, but machine words—i.e., disk space in use—for the system manager.

Other insight into problem situations in the BELLTIP world—e.g., books remaining too long in a particular state such as cataloging or invoicing—is provided automatically in a series of specific offline reports. On the financial side, online accounting reports, not shown, give to-the-moment information on payments, commitments, budgets, and percent committed for any or all libraries specified. Supplier account information is similarly available online. Still another report, available in both online and offline versions, provides valuable information on vendor performance. This report summarizes average order costs, discount percentages, delivery times, and number of claims and cancellations for each vendor over a period of time; the document's usefulness to management in renewing purchase orders and maintaining effective supply sources is obvious and substantial.

Several of the information tools helpful to catalogers in managing their activities may be of interest. One is a simple online facility, BELLCALL, for determining if a newly-selected call number is already in use; the video display response identifies the two closest neighbors on either side (see fig. 8). Another tool, useful in managing the large, specialized subject headings authority database, is a periodic printout of all the headings used with a given class number (see fig. 9) and another printout of all the class numbers associated with a given heading. These instruments are helpful in developing standardized headings for the selection profile system, for reclassifying parts of the collection, and for adapting or refining subject headings to the specificity required in a high-technology environment. Still another management report useful to catalogers, but especially to library supervisors for collection management, is the Related Editions Report which identifies all the editions held of titles held in more than one edition in any library in the network; multiple editions may or may not be justified, but they should be scrutinized. This report, and another listing books by publication date, are of substantial help in keeping collection growth, and shelf space, under control. The principal management aids generated by the BELLTIP acquisitions, cataloging and accounting system are summarized in figure 10.

*online/ipf
09:01:51 Tue Mar 30, 1982

Welcome to the Online In Process File.
For help, type, 'HELP'. To stop, type, 'STOP'.
You may proceed.

=k/soul machine

1. 1 SOUL
2. 55 MACHIN
3. 1 k/soul machine

B-NO: 199390D CALL NO: 001.64019/K46s ISBN: 0-316-49170-5

TITLE: Soul of a new machine.

AUTH: Kidder, T.

PUBL: Little.

YEAR: 1981. 293p. ED: VOL: LCCN: 81-6044

LIB.	REQU.	TYPE	O.D.	STAT	S.D.	A.D.	PO/VEN	INV	PRICE	B-NUMBER	SUB
DR01	2043		S	2063			07	P	12.55	199390D	01
CB01	TID	R	2063	S	2077		32	P	10.46	199390D	03

Fig. 6. Online In Process File Query

Please give cutoff date (today is 3728)

= 3698

The following copies are inadequate for order

326025A 1

326600A 1

The following titles are inadequate for cataloging

199297C

The In Process File includes:

	Total Now		Prior to Day 3698	
	# entries	# words	# entries	# words
Copies				
Requisitioned	136	3768	69	1608
On Order	3944	82550	2181	46012
Claimed	665	17864	476	13356
Standing Orders	51	1041	50	1021
In Cataloging	1193	34095	367	10255
In Preparations	1179	35634	35	1082
Sent	1842	55278	4	124
Sent Direct	104	3011	1	31
Cancelled	121	2823	0	0
Aborted	0	0	0	0
Titles				
Supporting Order	6208	345104	4547	260004
Orig. Cataloging	2524	166045	2083	140259
Catalog Changes	1271	27444	0	0
Invoice Traces				
	234	3723	0	0

Fig. 7. Online In Process File Scoreboard

Comparable to the BELLTIP system for books is the BELLSER system for serials acquisition, cataloging and financial control. One of its management facilities is called MONEY. This provides online displays of library accounts, vendor accounts and other serials data, including anticipated inflation factors for budgeting purposes (see fig. 11). The cost of serials in libraries supporting advanced technology explorations tend to be significant and demand close management attention to keep them reasonable. The cost problem is compounded in a large multi-library environment. One practice followed in the Bell Labs Library Network is to have a formal, face-to-face annual meeting of librarians to review serial orders and negotiate "adds and drops" in a coordinated manner. To aid this process, the decision-makers have much management information,

=001.6424P27/F79p

Nothing on file for call number #001.6424P27/F79p

Books with close call numbers follow

001.6424P27/E36p + 0 153174
EISENBACH, S./ PASCAL PROGRAM

001.6424P27/F49p + 0 122510
FINDLAY, W./ PASCAL

001.6424P27/G74i + 0 176818
GRAHAM, N. INTROD PASCAL

001.6424P27/G87p + 0 149623
GROGONO, P. PROGRAMMING IN PASCAL

Fig. 8. BELLCALL Online Call Number Facility

including circulation and alerting bulletin statistics, user reactions, etc. Especially helpful are two BELLSER reports: one an alpha listing of all current serial subscriptions and their prices; the other, a price-ordered list, high to low, of all serials (see fig. 12). Clearly, the high-cost journals at the top of the list get particular scrutiny.

Strong emphasis is placed in the Bell Labs Library Network on information alerting and dissemination services. As already noted, thirteen different computer-compiled announcement bulletins addressed to particular subjects and audiences are regularly produced. Supplementing these network media are a number of local library bulletins that focus on the special interests of a given laboratory location. Another major component of the current information alerting service is MERCURY, a computer-driven system for selectively disseminating internal reports. Electronic versions of the bulletins are also being developed.

How are these alerting services kept on target? Substantial management information is available to the editors, primarily from the computer

621.38413	3 Piezoelectric crystals	621.384151	- 304 -	10 Ultra high frequency transmission	621.384153
	2 Piezoelectricity			7 Radio, Short wave	
	1 Electronic equipment			6 Ultra high frequency technique	621.38415b
	1 --Reliability			3 High frequency transmission	
	1 Filters, Electric-			3 Ultra high frequency systems	
	1 Piezoelectric crystals-			2 Data transmission	
	-Bibliography			2 Digital communication systems	
	1 Probability			2 Radio reception	
	1 Radio--Apparatus and supplies-			2 Radio telegraph	
	-Directories			2 Radio wave propagation	
	1 Radio transmission			2 Telecommunication	
	1 Radio transmitters			1 Amateur radio stations	
	1 Resonators, Quartz-			1 Antennas	
	-Bibliography			1 Frequency modulation	
	1 Statistics			1 High frequency houses	
621.384131	1 Vibrators			1 Ionospheric radio wave propagation	
	1 Radio transmission			1 Quantum electronics	
	1 Television			1 Radio communication	
	transmission			1 Radio engineering	
621.384132	3 Vacuum tubes			1 Radio waves	
	1 Modulators			1 Solid state devices	
	1 Thermionics			1 Television	
	1 Vacuum tubes (High)			1 Broadcasting	
	1 Coils			1 Waveguides	
	1 Resistors, Fixed composition			19 Frequency modulation	
	1 Transformers			2 Distortion	
621.384135	3 Antennas, Dielectric	621.384152		2 Frequency modulation	
	1 Antennas				
	1 Antennas--Data processing				
	1 Dielectric loss				

Fig. 9. Subject Headings Used with Class Numbers

- Selection Profile Management - Indexes, Matrices, Dollars
- Online In Process File - Order Status, etc.
- Online Accounting - Library, Budgets, Expenditures
- Online Process Overview (Scoreboard)
- Monitoring/Action Reports - Ordering, Cataloging, Invoicing, etc.
- Vendor Performance Analysis
- Call Number Usage (BELLCALL)
- Subject Heading/Classification Number Analyses
- Related Editions, Dated Publications

Fig. 10. Some Management Aids from the BELLTIP Acquisitions, Cataloging, Accounting System

- Displays library accounts for serials
 - Expenditures, encumbrances, budgets, % committed
 - For all libraries, some, or single library
- Displays vendor accounts
 - For all or specified vendors
 - For all or specified libraries
- Displays vendor inflation factor
 - For all or specified vendors
- Handles online changes in cost and budget data

Fig. 11. MONEY, an Online Management Information Facility in the BELLSER Serials System

244784v	Journal of Plasma Physics				
	MH	1	MC	\$	354.00
278640v	Theoretical Computer Science				
	CIB	1	MC	\$	350.00
	HL	1	MC	\$	350.00
	IH	1	F	\$	350.00
	IW	1	F	\$	350.00
	PY	1	MC	\$	350.00
210112h	Biochemical and Biophysical Research Communications				
	MH	1	MC	\$	345.00
237352n	Soviet Materials Science				
	MH	1	MC	\$	345.00
220770s	Dissertation Abstracts International. C. (European Abstracts).				
	HO	1	MC	\$	345.00
	MH	1	MC	\$	345.00
278656m	Theoretical and Experimental Chemistry				
	MH	1	MC	\$	345.00
219584d	Cybernetics				
	LS	1	MC	\$	345.00
	MH	1	MC	\$	345.00
215600y	Chemical Engineering Science				
	MH	1	E	\$	340.00
	PR	1	E	\$	340.00
218896f	CRC Critical Reviews in Analytical Chemistry				
	MH	1	F	\$	332.00
200015h	CRC Critical Reviews in Biochemistry				
	MH	1	F	\$	332.00
279680a	Transactions of the American Mathematical Society				
	HO	1	MC	\$	330.00
	MH	1	MC	\$	330.00
	WH	1	MC	\$	330.00

Fig. 12. Price-Ordered Subscription List

systems used to process the article request traffic and to record copyright royalty payment obligations. The bulletin request program, for example, employs information about the journal and the requester (e.g., department, location) to compile a rich statistical record of usage; among the analyses routinely made are various rank orderings of the journals covered in the bulletins—by articles announced, total requests, announced/request ratios, etc. These data greatly assist in determining which of the many competing journals should be regularly indexed; although heavy use is made of external data sources, many journals must still be indexed in-house and careful attention to profitability is necessary. A similar approach is taken for the technical reports bulletin; analyses of the “hit” rates of each of the bulletin’s many subject categories help in refining coverage and maintaining an overall hit rate of 80 percent or better.

BELLPAY, the copyright royalty payment system begun in 1978, provides further valuable insights into journal usage. One report from the system (see fig. 13) summarizes the demand for journal articles by time—i.e., by the date of publication. This provides a perspective of substantial consequence in managing costly serial resources.

We now consider the management information which the online circulation system (BELLREL) has been designed to supply. The principal reports are listed in figure 14. The most important is the Titles in Demand list, produced weekly to identify all book titles for which there is a total of five or more people waiting anywhere in the network (see fig. 15). The two-line entry for each title shows the number of people waiting at each location, the number of copies available, copies on order (as learned from the BELLTIP acquisition system) or missing, and the ratio of copies to requesters in the waiting queue. (In figure 15, the book by Ball, *Algorithms for RPN Calculators*, has forty-six people waiting, six copies available or on order, and hence a ratio of eight.) Using this list, library supervisors hold a weekly teleconference to decide what additional purchases should be made to help meet demands and keep response time short. Counterbalancing this “hot” list is a “cold” list, the Zero Activity Report, run at least annually to identify titles that have had little or no recorded use in a specified time span. This list, along with such other management data as the principal users of a given subject class, are distinctly helpful in purging the collection, conserving space and saving money.

Several of the other BELLREL management reports listed in figure 14 might be noted. The weekly Reserve Queue Aging Report identifies requests not satisfied within a specified time period because of some hangup such as the loss of the book. The Get Off the Shelf Report points to all cases where the system says (1) a request exists, (2) a copy is, in fact, available to meet the need, but (3) for some reason the item has not yet been

230320 IEEE TRANS COMPUT

	CURR	1 Yr.	3 Yr.	5 Yr.	10 Yr.	20 Yr.	>20 Yr.	TOTAL
AK	0	0	1	0	1	0	0	2
AL	45	10	3	1	4	4	0	67
CB	18	11	0	0	1	0	0	30
DR	38	9	1	1	1	0	0	50
EL	1	0	0	0	0	0	0	1
FJ	54	29	0	0	0	0	0	83
HL	3	3	0	0	0	0	0	6
HO	153	95	15	5	12	3	0	283
HP	20	17	7	8	8	1	0	61
IH	54	50	2	0	2	0	0	108
IN	15	34	0	0	0	0	0	49
IW	55	43	0	0	0	0	0	98
MH	168	98	14	10	28	4	0	318
MV	10	0	0	0	0	0	0	10
NP	8	4	0	0	0	0	0	12
PR	3	27	1	1	1	0	0	33
PY	27	26	0	4	3	0	0	60
RD	12	1	0	0	0	0	0	13
ST	2	0	0	0	0	0	0	2
WB	7	7	0	0	2	0	0	16
WH	48	19	1	6	9	2	0	85
XX	14	22	0	0	0	0	0	36
	753	505	45	36	70	14	0	1423

Fig. 13. Journal Usage Data from the BELLPAY Copyright Royalty Payment System

supplied. Missing Item Reports, produced every two weeks in class number order, are used routinely to search shelves. In addition to these BELLREL reports, much other circulation information is available in a variety of correlations of subject, library, time, and borrower. One of these is the Loan History Report, a subject-classed listing of the materials borrowed by a specified technical department. This report is particularly helpful in establishing an appropriate onsite collection when a technical department moves to another laboratory location.

Information retrieval services at Bell Laboratories both supply and apply management information to good effect. Management information

- Titles in Demand
- Zero Activity Report
- Reserve Queue Aging
- Get Off the Shelf
- Missing Items
- Circulation Data - Library, Subject, User Dept. Correlations

Fig. 14. Some Management Aids from the BELLREL Circulation System

is, of course, often the subject of online searches. In addition to bibliographic retrieval, however, *bibliometric* studies are frequently a most appropriate exercise of interactive searching powers. Quantitative analyses of a body of literature to assemble, say, data on the leading crystallographic journals or the principal contributors to the field of magnetic bubbles, can be of much interest to information, and other managers. Online searching also generates statistics helpful in monitoring and measuring the systems and databases used, cost trends, searcher activity by library and time and type of search, and so on. Extensive compilations of these kinds of data are regularly given to management by the Bell Labs Information Retrieval Service.

Conclusion

We have touched briefly on some of the numerous variants of management information reports that can be made available in a computer-supported special library. Much of the satisfaction of working with automated systems derives from power and responsiveness of the systems in providing decision-aiding data. As most information managers recognize, however, the very ease with which elegant compilations of all kinds can be

produced may encourage excesses in reporting. The results may be unhappy (see. fig. 16).

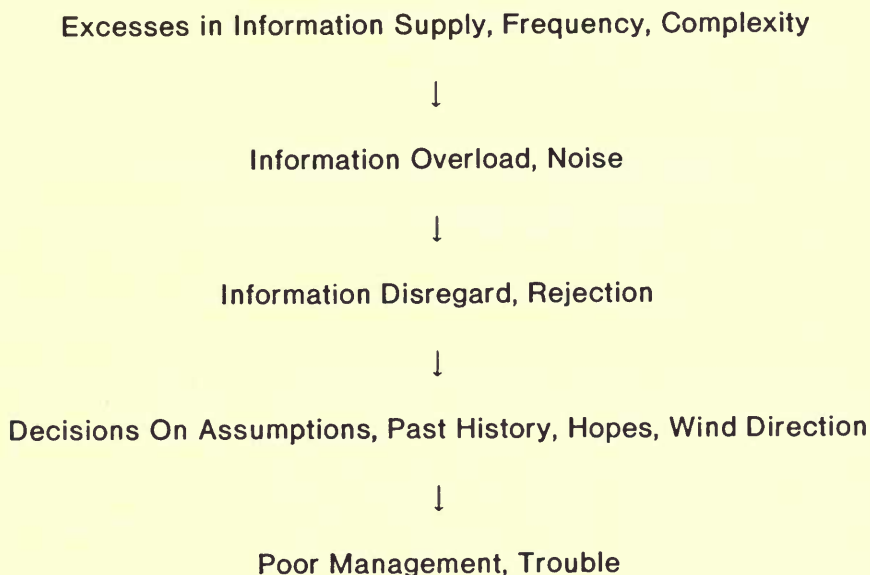


Fig. 16. Management Information Systems Perils

Professionals engaged in the uncertainties of the information transfer process, striving to couple information need to information source precisely, swiftly and economically, need all the help they can get. The value to information managers of a carefully defined, coherent management information program can hardly be overstated.

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1. Kennedy, Robert A. "Bell Laboratories Library Network." In *The Special Library Role in Networks*, edited by Robert W. Gibson, Jr., pp. 17-36. New York: Special Libraries Association, 1980.