Coordination and Integration of Technical Information Services*

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Centralized and decentralized routes for supplying information needs of scientific personnel are reviewed, and management guidelines for maintaining effective operating functions for the evolving and rapidly changing field of technical information services administration are suggested.

There is a parallel between the invention of the telephone and the automobile and the invention of modern information systems. It has been stated recently by John R. Pierce of Bell Telephone Laboratories (*1*) that for neither the telephone nor the automobile was there any pressing need at the time of their creation. If they had been destroyed the year after their introduction, mankind would have given little notice. Their disappearance today, however, would bring chaos. Pierce concludes with the proposition that "needs come into being and grow as new means come into being."

For many of our modern information programs and services, a parallel analogy can be drawn. If most of them had been discarded the year after their founding, the event would seldom have been front page news. A single year is too short a time for people to become highly dependent on an information system, nor can most systems contribute much in so short a time. The interplay of needs and means in such cases has had too little time for full development.

I believe we are actually still in this formative period for technical information services. We have not reached the time when chaos will ensue if these services are discontinued, although, for some services we may be approaching this condition. For example, the demise of our major secondary sources, such as *Chemical Abstracts* and others, would certainly create a tremendous new burden if they disappeared overnight from the scene. Nevertheless, we are approaching the time when our increasing dependence on information systems and services will result in substantial inefficiency if the services are not properly coordinated and integrated.

This leads me to the central topic of this presentation: the nature of the coordination and integration of technical information services that is necessary for their effective utilization and the fulfilling of users needs. We must always keep in mind, however, in our examination of this problem, the characteristic of information systems that relates them to the telephone and the automobile: That needs develop mainly as users become dependent on the system involved.

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NEEDS AND FUNCTIONS

This topic will be examined in the environment that confronts the majority of chemists, scientists, and engineers employed today. This environment is the industrial research or development laboratory for a profit-making industrial or business firm. From a blending of means and needs, we are able to recognize a number of the typical needs of scientific personnel, as listed in Table I.

Table I. Information Needs of Scientists

Help in browsing
Specific answers
Knowledge of prior work on problem
Knowledge of what has not been done
Knowledge of both fruitful and unfruitful findings
Who is working in field
Applications
Costs
Manufacturing facilities available
Status of competitive situation
Existing and potential patent constraints

First the scientist wants to know what is happening currently in his field; this calls for browsing. He certainly can make use of help here, if for no other reason than simply to save time, and because there is insufficient time to browse as far and wide as one would like to do.

The scientist also wants specific answers to many things: to prior work on the problem, to what has been done as well as what has not been done; he is also interested in negative or unfruitful results as well as the positive or fruitful ones. Furthermore, he is interested in knowing about who else is working in the field and where their work is being done, and probably for what purpose. The researcher also wants to know about existing and possible new applications, what are ingredient and processing costs, what kind of facilities are available for eventual manufacturing operations, who else is in the business or might be getting into the field. Lastly, but by no means of any less significance to him, he wants to know the extent of prior patent art and what limitations this may place on the direction of his research efforts. This list is not intended to be an all-inclusive one. There are certainly other kinds of things that the research man wants to know, but this indicates the range of his needs—needs that we already know exist, as these are the topical areas one has to become familiar with to do the job assigned.

We should now turn to the other side of the issue. We have recognized the information needs of the user and we can leave him alone to get his information any way he can, or we can assist him in a variety of ways. Specifically, we can provide him with information services of a wide and growing variety to enable him to get his job done more effectively, more creatively, and hopefully, less expensively. Fundamentally, whatever is provided in the way of information services will be directed to performing certain specific functions, such as:

Locating	Selective dissemination
Alerting	Retrieval
Abstracting	Reference
Extracting	Referral
Acquisition	State-of-art compiling
Storage	Bibliography compiling
Evaluation	

Some of these functions would appear to be newer than others. However, all have existed for a considerable time. The difference today is that we are now doing more about the entire list than we did in the past.

We are now living in an environment in which access to and utilization of information is a popular topic not only to scientists, for whom it has always been a necessity, but to the public at large, our educators, local and state governments, our national government, the man in the street, everyone who reads or listens to any of the mass media of communication. Any one of these can tell you that the mechanized library is just a year or two away, or at least no more than 10 years in the future. It even comes closer to home than that, because regulatory and control functions of all kinds, including bills, accounts, taxes, inventories, shipments, and the census, involve information processing of a type that leads modern man to expect comparable accommodations for the full range of information he may need, if not at home, at least in his place of work or business. It seems to all only good business to harness modern electronic and mechanical methods to the systems that could supply information to our scientists and engineers whatever be their needs. Thus we appear to have the means, and the needs are clamoring to receive attention.

This leads us to one of the central responsibilities of the information systems management function. How should the director of such operations plan and organize an information system that has as broad a base as the list of functions given here? It is apparent that there is, or can be, a great deal of interplay between the various items listed above. The challenge then is to determine how these should be aligned, or more importantly, how can they be aligned in a practical way for efficient and economic functioning.

SOURCES AND TYPES OF INFORMATION

We have examined thus far only the functions involved in information systems operations. We need now to relate these to the information sources involved.

Broadly speaking, in spite of the fact that there are many many sources of information, the information system manager will find it useful to consider all these as embracing only two major categories: (a) internal or proprietary information, and (b) external or published information. For the former, one must depend completely on his own resources; for published information, he can rely fully or partially on outside services and systems.

Internally generated information comes from a number of different sources in the organization. Each source: may require a different type of access, will probably have a different internal user group, may reflect a different rate of obsolescence, can present different and variable degrees of acquisition, and in the final analysis will very likely require basically different systems for handling. Some such information is only potentially available and may require further processing to make it available for general use in the organization. Table II lists several of the general categories involved.

Table II. Types of Internal Information

General and miscellaneous
Scientific-research
Process development
Engineering
Manufacturing
Commercial
Product
Other inhouse business information

The capturing of information from these sources can become a major undertaking and will in any event require a detailed understanding of the particular methods of work and communication paths followed by each suboperating unit in the total organization. This can embrace a full range of internal documents from notebooks, drawings, studies, projects, surveys, reports, appraisals, forecasts, memoranda, correspondence, records, and correlations all the way back to the recording and capture of data as it is created.

The externally generated literature is, as all of us are only too well aware, voluminous, produced in great quantities, and in many instances is available as both primary and further processed information (secondary and tertiary publications). Table III indicates generally the scope of these sources. The impact of U. S. government information

Table III. Typical Sources of Nonproprietary Information

U. S. government
State, county, and city governments
Commercial information sources
Publishers
Universities
Research institutes
Industrial corporations
Professional societies
Trade associations

has had a profound effect in all information systems operations not only because of its volume and potential pertinency, but also because of the way it is packaged and disseminated. For the first time, we are confronted with the pervading effect on much of our entire economy of decisions reached within the government area for organizing and handling government-sponsored research and development information. This has had the result of much reexamination of so-called national goals in information handling and the realization of the interdependence of many areas of information on each other.

These trends, coupled with desires to improve information handling in the several scientific disciplines (chemistry, physics, life sciences, engineering), are leading to some type of evolving information network that will most likely have a profound effect on how nonproprietary information is handled within many private business firms. The reason for this is probably obvious—basically one of following a trend established for a volume-type operation where moving counter to the trend will not be practical or economic.

Much thought by U.S. government agencies (*2*), as summarized by COSATI (Committee on Scientific and Technical Information of the Federal Council for Science and Technology), is significantly being given to improving the handling of government-generated scientific information. The work of the Engineers Joint Council toward a coordinated engineering information system (*3*), and of the American Chemical Society in generating a steady sequence of information-oriented new products from Chemical Abstracts Service, are examples of changes in the types of services available from scientific and technical societies. For all other sources in Table III, similar dynamic changes are in progress. All these will affect the way a proprietary information center will have to operate. In particular, institutions of higher learning are currently taking significant steps for improving and expanding the scope of technical information interchange (*4–6*).

INFORMATION CENTER ORGANIZATION

With this review of the needs, an awareness of the means, and an understanding of the sources of information, we can turn our attention to some of the decision areas involved in organizing information system services for an operating unit.

One can consider the merit and advantages of a single monolithic organization providing all information services required by his particular set of clients. This is a workable plan and most likely an excellent one for a particular set of circumstances, especially for a compact client group restricted to a small geographical area. This and other types of information center support are listed in Table IV.

The decentralized operation will certainly be required to at least some extent where research clients are widely dispersed geographically. There are certain functions that need to be provided locally. There is always the question of whether adequate or economic services can be supplied from a distance. Much will depend on the number of people being served, frequency of need, availability of information from other locations, staff available, and willingness of management to see merit in funding duplicate facilities on a fully decentralized basis.

Table IV. Types of Information Support

Centralized
Decentralized
Combinations of centralized and decentralized
Networks
Information analysis centers
Local information officers
Information liaison
Special contractors

There are many widely accepted operating arrangements wherein some services are provided locally and others from some central point. A careful examination of all issues will probably lead to the conclusion that the completely decentralized operation is never justified where one is dealing with other than a highly specialized area. One guiding principle is that, where information of a particular type is needed by only a single isolated unit, it is probably better to handle this activity as a decentralized operation under local administration. The corollary is that if information is frequently needed by many people at many locations, there is much merit in handling the function on a centralized basis. This is particularly true for internally generated information where internal systems processing of the information is required. Information from outside or public sources can often be effectively reprocessed centrally for proprietary uses. But, in these instances the over-all economics and requirements expected of the services will be the controlling factors.

For example, it would appear impractical in most cases not to have adequate library book collections for each large user group if the groups are scattered widely geographically. On the other hand, an information analysis center for proprietary reports may be well justified as a central operation, giving access to all proprietary report documents on a single search, as the alternative to a multiple independent search approach *via* a number of dispersed subsets of the total collection.

There are several other types of combinations. The total information problem may require or justify a combination of centralized and decentralized operations. The practicality of employing a network between various types of specialized information centers is becoming apparent in many situations. Specialized information analysis centers provide an increasingly growing approach; some of these are being integrated into the network concept, also. One might see a parallel between the local information officer, historically the literature chemist (in new clothes and environment), and the specialized information analysis center. In some situations these can be the same individuals, but only as a matter of staffing convenience, since the functions involved are not strictly parallel. Although I have made a distinction between the "local information officer" and "information liaison" in Table IV, the line of demarcation is not always or necessarily a distinct one.

The last item on this list is the "special contractor." In general, this is a new function in the information field. It should always be considered as one route for expanding or supplementing coverage required by an organization.

One should not overlook the fact that the "contractor" can be either an internal or outside organization.

A number of the functions that are currently carried out by information analysis centers are noted in Table V. The information analysis center should be thought of as a technology-oriented service unit and one that supplies a wide range of services for a specialized area. There has been a great proliferation in the past few years of such centers, particularly for information generated or sponsored by the U. S. government. Parallels in private business operations exist to varying degrees depending on specialized information needs. Perhaps many proprietary information retrieval organizations might be more realistically designated as information analysis centers.

Table V. Functions of Information Liaison

Assist user to find information
Obtain specific answers
Provide referral service
Interface with other centers
Conduct bibliographic surveys
Provide current awareness
Provide selective dissemination

The functions of "information liaison" (Table V) represent activities that to a degree are repetitious of functions listed above. I believe this emphasizes the interrelationship of many of the functions carried out by all practitioners who assist clients in acquiring needed technical information.

The provision of technical information services is producing a growing number of specialists who serve as systems designers and operators. Currently, many of these individuals are being produced or created largely by the "on-the-job" route. They are being drawn from at least three different backgrounds (Table VI). These individuals may be scientists, such as chemists, physicists, or engineers; they may be librarians; or they may be systems personnel.

Table VI. Sources of Information Services Personnel

Source and Special Background	Specialized Functions
Trained Within Information Center	
Chemists, engineers, other scientists	Analysis: Input Searching: Output
Librarians	Document control Reference services
Systems personnel	Analysis of problems Design systems System applications
Formal University Programs	
Information science training or degree	One or more of above functions

To be completely accurate, technical information services need and utilize the specialities that each group provides. We appear to be moving in the direction of being better able to define what background training is required for the person assigned to providing technical information services. A number of colleges and universities have recognized the need for people trained broadly in the field of a scientific discipline, librarianship, and systems design and operation. They are charting out new educational programs to provide graduates with appropriate formal training in these areas. It is encouraging to note this trend. But, the applications field is not a static one, and I would predict a continuing involvement of new people *via* the "on-the-job" route into information service functions.

MANAGEMENT AND PLANNING

The management of technical information services requires a degree of futuristic thinking about what is ahead and what the operation should be doing in the next two to five years. Undoubtedly we are currently living in a dynamically changing era for information service functions. This is a period of evolution as well as one of rapid change. There is a relatively high probability that some operations initiated in one year will be outdated before their full value can be felt. Some information services will need to be continually changed to keep pace with changing environmental conditions. These conditions will affect both users and organizers of information. The manager should plan, as best he can, to employ systems for which there will be a high conversion efficiency to the next generation of the system. He should also be willing to leave the *first model* as is and design the *next model* if the inertia inherent in the predecessor system does not truly justify upgrading and conversion.

In a very practical sense, management and planning will require taking into account the extent to which both integrated and independent services should be provided, their relationship to other information services, and the degree to which central processing may be beneficial. He must be tuned to the true needs of the user and also to the degree that the means for information handling are generating new needs.

In conclusion, it must be emphasized that one guiding principle must always be that of continuous reappraisal in a truly changing environment. One should feel obligated to evaluate new approaches and to assist in the obsolescence process, to acquaint users with what can be done, and to attempt to find solutions to their problems. There is no one general formula, as of now, as how best to coordinate and integrate the spectrum of services that may be required. One can, however, examine the issues confronting him in an objective and openminded manner. As in most situations, there can be no substitute for common sense.

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Continuing Education in Technical Information Services*

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Several educational choices available to literature chemists are discussed.

In recent years we have all read and heard a lot about what has come to be known as continuing education. This concept has been developed to combat technical obsolescence of the individual scientist. For the chemist, continuation of his education offers a challenging opportunity to acquire significant and substantive information, especially that with broad implications. In this paper, I will examine several of the major continuing education choices open to the chemist working in a technical information services department in industry.

At least one good review of continuing education in chemistry has been published (*1*). This source estimates that: "The 'half-life' of a scientist or engineer is very close to 10 years—half of what the scientist and engineer has learned will be obsolete in a decade, and half of what he will need to know 10 years hence is not now available to him. Now more than ever before, greater pressure is brought to bear on the technical man to keep up-to-date—to make his work more effective by continuing his education."

According to another source (*2*), "The senior manager with 10–15 years to serve can no longer count on exploiting his present knowledge and skills comfortably until he retires. The younger man just beginning his career... must prepare for peak responsibilities two or three decades hence in a world whose characteristics he... can only dimly foresee." This same paper suggests that for many the need is to survive today, not to prepare for tomorrow; this kind of situation is one which needs to be surmounted.

THE PROFESSIONAL SOCIETY and CONTINUING EDUCATION

The role of the professional society is important (*1*). The American Chemical Society now offers, on a regular basis, short courses, both at national meetings and elsewhere. Interestingly, one of the courses scheduled for the September 1966 National Meeting relates to Information Retrieval.

The first ACS short courses were presented in April 1965, at the national meeting in Detroit, where 263 registrants participated in three courses. Dr Moses Passer, ACS Educational Secretary, scheduled five courses for the Fall 1965 meeting in Atlantic City; some 600 registrants attended the five courses offered. This series has been continued at subsequent meetings. The second phase of the ACS program in continuing education—traveling short courses—began in the fall of 1965. These courses are aimed at serving a greater number of ACS members, many of whom are seldom able to attend a national ACS meeting.

It has been reported (*1*) that the ACS is also considering approaches such as courses on tape complete with supplementary materials. Tapes and accessories would then be made available to any local section or topical group. In addition, exploratory studies are reportedly in progress for producing some pilot TV films appropriate to the ACS continuing education program.

Local ACS sections are also active in continuing education. In 1964, 11 sections gave a total of 18 courses to their members. These courses were generally not available at local colleges and universities.

Another well-known program is that of the American Institute of Chemists. This program, which began in 1964, has been characterized by two main features. The first of these is the "AIChemLecs" program (*3*). These lectures have been designed to develop new techniques for continuing education. The program was inaugurated by a lecture on the subject, "Statistical Theory of Polymer Structure," by Dr. Richard Stein of the University of Massachusetts. Dr. Stein spoke to groups of chemists in two different geographic locations simultaneously. He used telephone microphones and amplifiers in conjunction with an Electrowriter instrument as a "blackboard."

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