directed control form vital functions within an undertaking. Survival under intensified competitive conditions is no longer exclusively decided by quality and a marketable product. A much greater significance in respect of growth and "survival" accrues to the manner in which the enterprise exercises overall control over the information service within its structure in imparting concentrated knowledge to its staff and purposefully communicates with the business world outside. The information requirements and expectations must be established and the exchange of information organized. This comprises obtaining data from internal and external sources of information and also evaluating, integrating, classifying, and storing the data, information, literature, and documentation in a central data bank. The latter's content is made accessible to all validly interested parties with the flow of information being controlled centrally.

This survey is based on replies supplied by the following industrial information centers: Atlantic-Richfield, Esso, Standard Oil of Indiana, General Tire, Goodrich, Goodyear, Armour-Dial, Continental Can, Abbott, Baxter, Bristol, Lederle, Lilly, McNeill, Merck, Pfizer, Roche, Searle, Squibb, Warner-Lambert, Wyeth, and Upjohn.

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The Development, Cost, and Impact of a Current Awareness Service in an Industrial Organization*

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The development of a current awareness system in The Dow Chemical Company has resulted in four established services, one based on internal information and the other three on *Chemical Abstracts*. In addition several other services are now being tried or considered. The operation of such a service is expensive, but the willingness of the user to pay for it and responses to a survey indicate that it is a useful and worthwhile tool to the scientist and engineer. The use of such services also has a significant effect on other established information services.

The Dow Current Awareness Service has evolved from an experimental system based on the tape version of *Chemical Titles* to a system which searches four data bases for over 300 Dow users. In this paper we will try to describe the impact that these services have had on the Dow community, some costs related to such an information service, and some benefits derived from the service.

HISTORICAL DEVELOPMENT

First let us consider the historical development of the service. *Chemical Titles* was offered first to a small group of research people who were willing to cooperate in the development of the system.[1] Very soon after it became apparent that the system was viable, we added the titles of our current internal company reports to the data base. This added about 100 additional titles each week. Thus a user would receive alerting notices based on approximately 4000 open literature references and 200 proprietary reports every 2 weeks. The service was very well accepted and we were encouraged to add more data bases.

An obvious limitation to the service was the inadequate representation of the contents of the article by the words in the title. At this time (1965) the Chemical Abstracts Service was launching *Chemical-Biological Activities* (CBAC).[1,2] The CBAC tapes contained not only the bibliographical data but had in addition a specially constructed summary of the biological activity in what became known as a digest. This additional information was what was needed to increase the effectiveness of the title, so we started a CBAC service on an experimental basis. It was well accepted by a limited number of users and we continued it until the end of 1969.[3]

The so-called "Selective Dissemination of Information Experiment" was launched by CAS in 1967.[4] Since it appeared to be a prototype of things to come, we participated in the experiment, hoping to be prepared for a completely automated Chemical Abstracts. This service was discontinued at the end of the experiment period, because the number of journals it covered was not adequate. More will be said later about this. At about this time we added two new Chemical Abstracts publications, *Polymer Science and Technology Journals* and *Patents* (*POST-J* and *P*). They were similar to CBAC in that they included a digest as well as the bibliographic reference. These services were moderately well received and each had about 100 users at the time we discontinued them in 1969.

All of the data bases we have referred to are subsets

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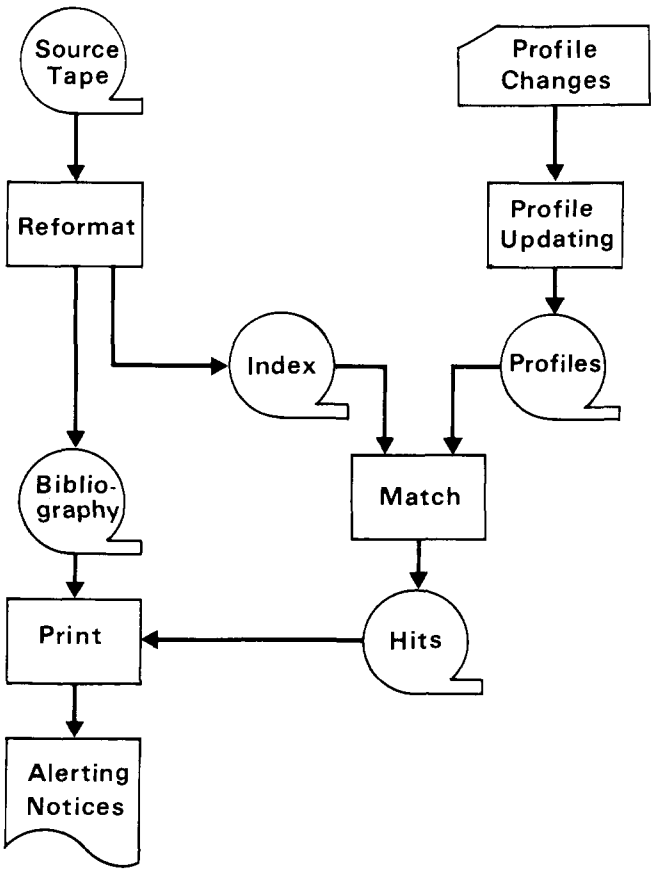

Figure 1. Software systems

of *Chemical Abstracts*. In 1967 we agreed to participate in an experiment using tapes containing all the bibliographic references in *Chemical Abstracts* as well as the indexing entries which are found at the end of each issue. These tapes were originally called the "Issue Tapes," and later became *CA Condensates*.[5] The main differences between these tapes and those previously mentioned are the more extensive coverage and the greater lag from time of primary publication. In an effort to increase the efficiency of the service and to reduce cost, the relative merits of the various data bases were evaluated. Since *CA Condensates* tapes contain all the material in the other tapes the decision had to be made around timeliness and the difference in the retrieval performance as opposed to cost.

The time lag between *Chemical Titles* and *Condensates* is significant enough that many of our users expressed a desire to retain *Chemical Titles* as a quick alerting tool. The time lag between *Condensates* and the digest services, *CBAC*, *POST-P* and *J*, was negligible. In addition, the retrieval was better for the digests as would be expected, but the operating cost was much higher. Since the number of users of each of the digest services is also a subset of the total number of users, the fixed cost per user for these services was higher. Thus, primarily because of economic considerations, the digest services were discontinued.

In addition to the CAS data bases, we have added *Biological Abstracts* on a trial status. We are in the process of adding *COMPENDEX*, the tapes provided by *Engineering Index*, and a service based on the *Index Chemicus Registry System*, which will provide alerting notices based on chemical compounds. At a later date a patent data base will be added as well as government R&D reports.

As the number of computer-readable data bases increases, the user as well as those operating current awareness services must evaluate the potential benefit of using each new data base. In order to do this we must be familiar with the needs and literature habits of the users. Detailed studies of user behavior in this context are currently being made and reported.[6] In general we can say that a researcher usually scans and reads regularly a small number of journals (4–10). He then turns to some alerting service to keep up with what is reported in the several thousand other journals which might have items of interest to him. Usually that small number of core journals will produce 80 to 90% of the material he will want to read. A current awareness system then must be such that it covers the other journals for him. We found, during the "Selective Dissemination of Information Experiment" in which we participated with CAS and several other companies, that our users were already reading most of those journals on which those tapes were based. Thus the additional benefit to the users was minimal as they were already seeing the material in the service, sometimes before the alerting notices were received. Since the benefit to the user was not appreciable we did not continue the service after the completion of the experiment.

SOFTWARE

The software package which we use and which we developed for a Burroughs B-5500 computer consists of a reformatting and index generation program, a matching or searching program, a printing program, and a profile updating program (Figure 1). Since we anticipated a large number of users we decided to create an inverted file index based on all the significant words in the data base, thus making matching a rather quick and inexpensive task. The preparation of this index is expensive, however, and requires more than 100 users to be economically feasible. Our search strategy is based on weighted terms and permits right-hand truncation. Our users can search on words in the title or index entries, authors' names, and journals. They can use negative weights thus permitting the elimination of some information. They receive their notices on 4 × 6 inch cards which contain the bibliographic reference as well as other pertinent information such as profile number, sum of the weights of the terms matched, terms matched, etc. Currently we offer our users four alerting services (Table I). Each user is expected to pay his share of the cost of the service. This is paid from his departmental budget, with his supervisor's approval. The cost is not insignificant, but the possible benefits are such that our 314 users are paying for 640 profiles.

Table I. Services Offered

Services	Annual subscription
Dow Internal Reports	$ 52
Chemical Titles	$130
CA Condensates (Odd issues)	$260
CA Condensates (Even issues)	$260

Table II. Response to Discontinuing Service

	%
Mild disappointment	37
Negative reaction	18
No reaction	13
Seek outside service	5
Use old methods	7
Get it going again	2
No answer	18

Table III. How Should the Service Be Supported

	%
Department	45
Library	15
Overhead	3
No opinion	28
Other	9

USER EDUCATION

The introduction of a computerized awareness service has a very definite impact on the users and the organization. In many cases this is the first time that a user has made direct use of a computer. He has to learn some of the basic factors underlying the operation and programming of a computer. Foremost among these is exactness. He must learn that while in English the addition of the letter "s" to the end of a word does not significantly affect the meaning, in a computer comparison the extra letter makes the new word something entirely different. He must also learn that in programming a search strategy there is no way of including inference, everything must be explicitly stated. The user soon realizes that this is not a simple push button operation, but that he must think through his question very carefully and in most instances rephrase it and retry it several times before his output is satisfactory. The user suddenly becomes aware of a greater amount of information which may be pertinent to his work. These services do not reduce the amount of information an individual must read, they simply find it faster and more efficiently. Much of the new material he receives will refer to work reported in a foreign language, thus increasing the need for language competence in the user and the organization. These services do change the information habits of the user; however, they are not substitutes for the regular scanning of those few core journals which yield the vast majority of the pertinent information.

COST

The greatest impact these services have on an organization is one of cost. It costs us about $100,000 a year to provide the four services we mentioned earlier. When we talk about computerized information services we have graduated to big money. Decisions on whether to undertake these types of services are usually no longer in the province of the information center or the laboratory leader, but in most cases the commitment must be made by top management. This means that such services must be much more carefully evaluated and the benefits must be quantified in some manner. This can be done quite often in terms of time saved, but occasionally we can find an instance in which the service has brought to our attention information which has had a real impact on the work we are doing. We believe that by requiring each individual to justify the use of the service to his management, the benefits of the service can be better evaluated. We have been encouraged in that although we are all now going through a rather tight economic period, when we significantly raised the price of the services, we lost only a small fraction of our users.

Unfortunately, the cost of operating the service is not the only one that must be considered in the evaluation of such a system. The introduction of current awareness services adds a very significant burden to the library staff. This can be noted in a sharp increase in requests for photocopying, interlibrary loans, and translations. In our case we had to add personnel to our library. The awareness of the existence of an article of interest in some obscure foreign journal creates a great deal of work and frustration, particularly if the information on the tape is not explicit enough to completely identify the source. A common frustration occurs when an individual orders a copy of a paper whose English title is most intriguing only to find out when he gets it that the article is not in English and that a translation is required.

The user as well as his management must weigh all these factors before undertaking the use of such services. Of prime consideration should be the decision of whether to use an available center or whether to do all the work inside and merely purchase the data base. In general, the services offered for sale are as good as what can be produced internally, except for proprietary information, so the decision is almost entirely an economic one. In any event the financial commitment is a significant one.

VALUE TO USER

In order to assess the value and impact of the services, we queried our users using a questionnaire. This questionnaire was circulated at the same time that significant price increases were announced for the service, so we expected an emphasis on dissatisfaction factors. The questionnaire was sent to 341 people and 142 returned them for a 42% return.

We asked the question "What would be your reaction if these services were discontinued?" In response 18% expressed a very negative reaction, 37% a mild disappointment, 7% said they would go back to old methods of keeping current, and 5% said they would seek an outside service; 2% of the respondents indicated they would try to get it started again. We can only conclude from Table II that the majority would miss the service, but that discontinuing would not be disastrous.

One of the ways of measuring the value of a service is to determine the willingness of the user to pay for it. We asked the question "How should this service be supported? Who should pay for it?" A large portion, 45%, indicated that their own departments should pay for it directly (Table III). This means that they were willing to justify its use to their supervision. Some, 15%, felt the library should provide it as a service and 3% said that the company overhead cost should include it. Several miscellaneous answers were received including "use

Table IV. Effect on Literature Searching Time

	%
No change	42
Reduction to 25%	20
Reduction to 50%	13
Complete dependence	5
Increase	1
Other	4
Do not know	7
No answer	8

Table V. Has the Service Saved Research Time By:

	No.
New research leads	73
Awareness of others in field	80
Awareness that work had been done	12
Making more time available	60
Others	10
No time saved	6
No answer	15

confederate dollars," but 28% had no opinion. From these answers we concluded that the user feels the service is valuable and that he is willing to pay for it. We considered this a favorable response in light of the existing stringent economic climate.

We also wanted to know what effect the use of the service had on the time users spent on literature work (Table IV). We found that 42% had not experienced any significant change. This means to us that they continued to scan their basic journals and references and merely used the service as an alerting tool. It also means an increased effectiveness since they were now aware of more literature and still only spent the same amount of time. Two people (1%) indicated an increase in their literature time. However, 20% indicated that their literature searching time was reduced by 75% and 13% of the respondents felt that their time had been reduced by 50%. About 5% said they were now completely dependent on the current awareness service for their literature needs, which is not good as we feel that the researcher should rely heavily on the core journals in his field to keep up to date.

In an effort to find out what effect the service has had on the productive time available to the researcher we asked several questions on how the service had saved research time (Table V). We must point out that a saving in time is not necessarily an increase in productivity unless the time saved is used for something productive. In response to these questions we allowed more than one answer so we report numbers rather than percentages.

Time was saved by 73 people when they found new research leads; 80 became aware of other people working in the field and were able to make more direct contact; 12 found out that their current project had already been done and 60 reported that they had more time available. It appears from this that our service does save time.

The value of the service to the company is difficult to assess in concrete terms. Most subscribers find that it either cuts down the time required to search and collect pertinent articles they wish to read or it allows them to make better use of the time they do spend searching the literature. The reduction in time required for searching the literature, if it is all applied to active research may, by itself, justify the cost of our system. The value of happier, better informed supervisors and researchers is very hard to assess.

Aside from the searching time saved by the service, there is no doubt that research time is also saved. The service has made our users aware of others working in their fields and has given them new research leads. It has made more time available for research and actually uncovered instances where similar work had already been done. Unfortunately no precise estimates for the time saved could be made.

Although the costs of operating our current awareness service are high and the tangible savings to the company elusive, we feel, as does our research management, that the service is invaluable to Dow.

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