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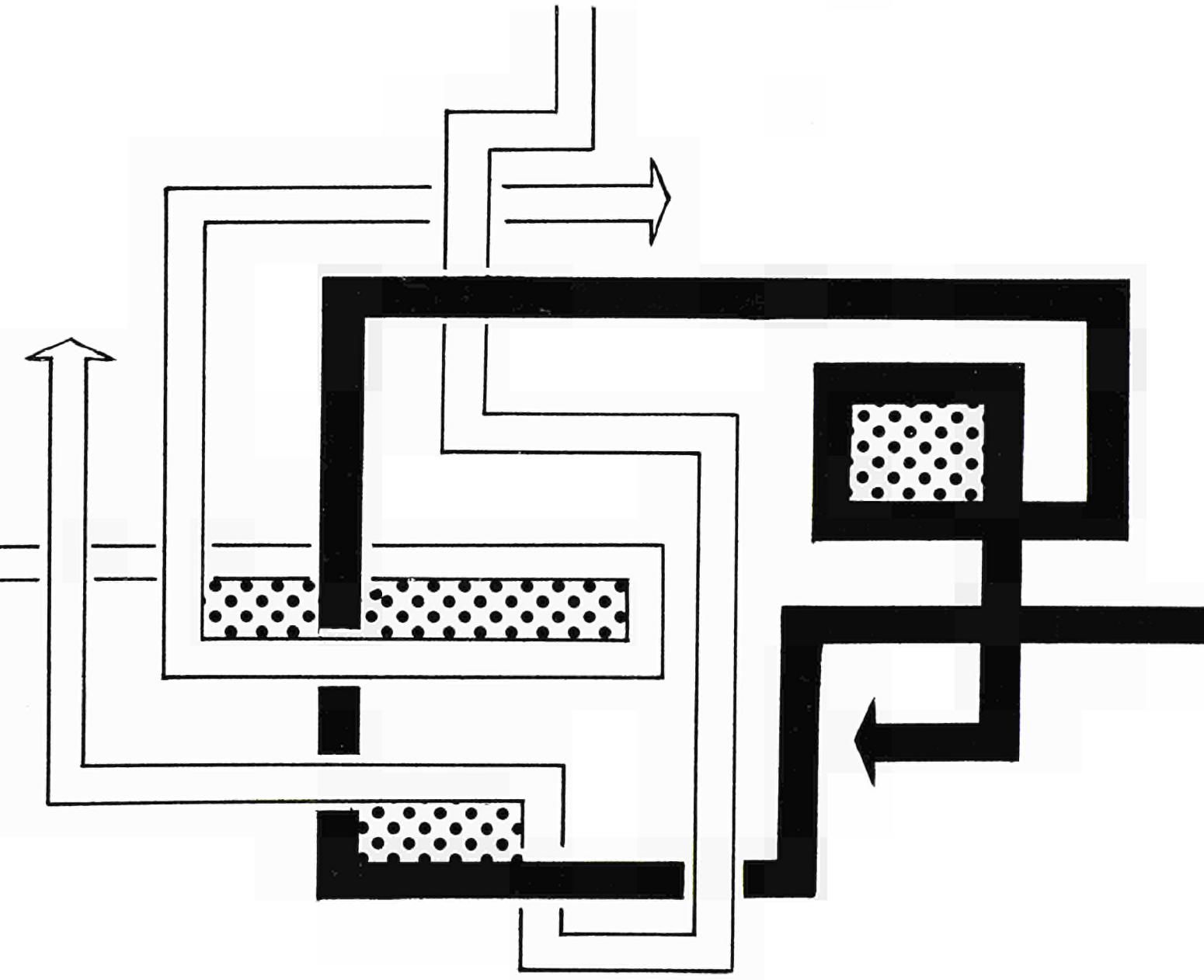

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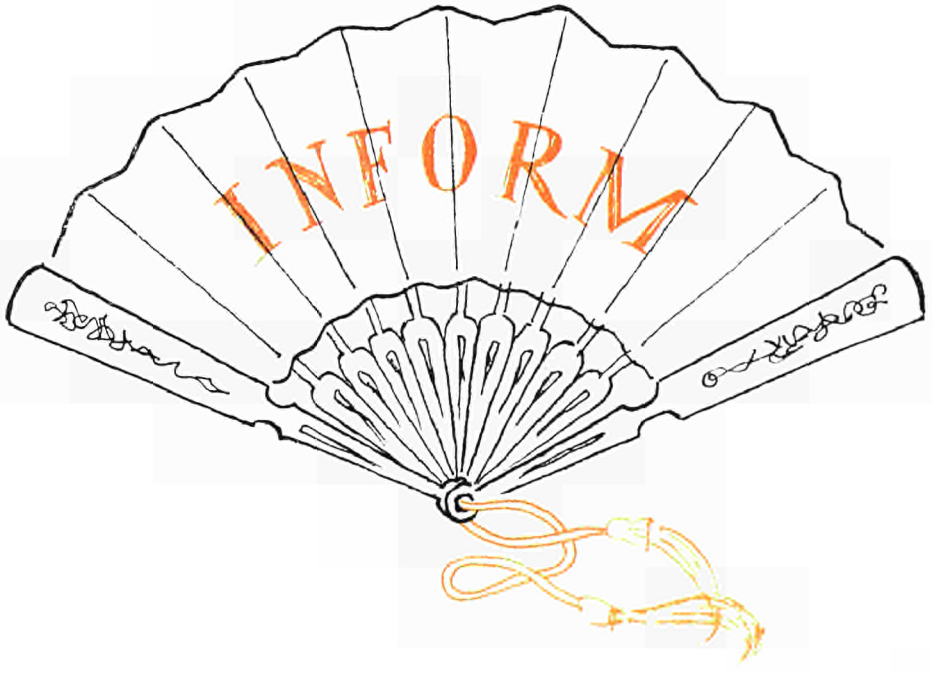
The European Contribution to the World network of Scientific and Technical Information

JACQUES H. d'OLIER

AT ITS 157th SESSION, the EEC Council of Ministers decided (a) to take steps to coordinate Member States' activities in the field of scientific and technical information and documentation, and (b) to approve the participation of the Commission's departments in setting up a European data network on the subject of metallurgy, in collaboration with the specialised documentation centres of the member countries.

These two decisions reflect the Council's desire to encourage the growth of a European regional network in order to coordinate efforts in this field, as part of the world-wide network for the exchange of information. But why is this necessary, when national data networks are being set up in each country and when a vast international move towards the creation of a world-wide data-pooling system has just been translated into concrete action in the form of the *UNISIST* scheme proposed by *UNESCO* and the Scientific Unions? In other words, what can be the role and purpose of a regional network?

In his article entitled "The Latest Child of a Great Family", Mr Mauperon indicates the importance of a united Europe to data producers and users. Admittedly, it is not up to Europeans to draw up standards and define the methods best suited to the needs of the whole world, but effective joint planning could help to solve the large number of problems which are bound to arise at each stage in the improvement of this world-wide network now being set up. Europe will hold all the trump cards provided it manages to create efficient methods of communication and systems, embodying as it does the majority of the principal difficulties —linguistic problems, differences in approach, a diversity of equipment and resources, and difficulties concerning the linking-up of information sources which are a priori incompatible and



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virtually beyond control. Such will be the purpose of this joint planning body, the creation of which has just been decided upon by the Council of Ministers.

Just as they will not draw up standards, the European organisations do not seem to contemplate providing services directly to data users. A great number of national bodies are better qualified to do this, are closer to the customer and are frequently cheaper. Apart from this, the word "service" inevitably implies invoicing and payment and it is difficult to imagine how this could be arranged in practice.

On the other hand, the European centre *IDST* [1] must of necessity be the "reference library" of, as well as for Europe. This term is used here in its modern sence and in the context described above, it being a question not so much of storing entire documents as of employing automated equipment to set up a vast compiling system by means of which customers can be referred immediately to the most appropriate specialised departments. Those who benefit from this indispensable work will be the information centres of the member countries, who, although they have themselves made only a modest contribution, will consequently have access to an unlimited flow of information from the entire European network. To this end, a pilot scheme has already been decided on and is extremely well described in Mr Rolling's article entitled *"SDIM"* (The CEC Metallurgical Documentation and Information System). At present, scrutiny of the various possible sources of information is divided between the member countries, but should the need arise there is nothing to prevent collaboration with other bodies in order to obtain some of this information from them and hence to lighten the burden on the member countries. By virtue of the cooperation thus achieved, the *SDIM* will play the part of a metallurgy reference library for Europe.

However, the pursuit of information is always closely linked with research and these two activities become inextricably intertwined the minute one gets onto the sector of observational science, where progress is based on the exploitation and compilation of a long series of classified information and data. In medicine, for example, Mrs Dusoulier and Mr Van Wesemael demonstrate how documentation methods (such as indexing) can become an important factor in the development of research, and how continuous com-

[1] Information et documentation scientifique et technique.

munication is established between those producing and using published documents, medical files and biomedical data, since they are all working on the same basis.

In this field, therefore, the European centre would indeed be the "reference library" for Europe, at the disposal of laboratories, hospitals and the multidisciplinary and specialised information centres of the member countries. The scheme thus outlined could well constitute one of the most efficient and original tools of biomedical research in Europe.

Compared with these two pilot schemes, of which one has already been decided upon and the other has just been proposed, the subject of agricultural information is a more complex one, for, as Mr Buntrock explains, there are already 500 agricultural information services in the world, not one of which can claim to keep the tabs on the relevant literature in a satisfactory manner, and it is in this area more than any other that there are a great number of highly specific problems. If, therefore, it has been chosen as a subject for collective study, it is certainly not with the ultimate aim of creating a 501st information service, but in order to coordinate and strengthen the facilities already existing in the member countries, to add to them if necessary, and thus to set up a "reference library" of and for Europe on this subject also. Of course, the possibility of collaboration with outside bodies or centres cannot be ruled out here. In this field, as in others, the best course might well be to aim at pooling Europe's resources and then to study the way in which they might be keyed into the world network.

Whatever measures are adopted, there is no escaping the cost of information. A good network will provide rapid and easy access to the document or data required. It will be possible to select it from amongst thousands of others, but such a service is not without its cost. To deny this would be tantamount to jeopardizing all subsequent development, for no government or financing body will accept the idea of a deficit which increases as the service becomes more efficient and the clients grow in number. Mr Bree's appeal for cash therefore reflects a real need for financial backing. Even on the European scale, where it will not be customary to establish direct contact with users, a financial balance must be created between the participation of each member country and interested centre and the benefits they will draw from the network. In general, except when the promotion of new projects is involved, it is better to subsidise users rather than the producers, since this leaves the former a greater range of choice and encourages technical progress and the most rational and economic management possible on the part of the producers.

In the same way as national networks, the European network of scientific and technical information will have to be able to carry out a constant evaluation of users' requirements.

The main elements of this evaluation are presented very clearly in Mr Winter's article, which throws light on a number of consumer attitudes towards a service network. In the majority of cases there is in fact a need for relay stations, in the form of specialised centres, if engineers are to derive the maximum benefit from the information systems, however adequate they may otherwise be.

In conclusion, the Community's prime objective should be the coordination of policies and the harmonisation of working methods so as to derive the maximum benefit from Europe's resources and make the most of them on a world-wide scale. The second aim should be a sector-by-sector approach to the creation of a homogenous network to provide a genuine scientific and technical data bank for Europe, at the disposal of national bodies and forming one of the basic elements of the world network as defined in the *UNISIST* scheme. All this will only be achieved with the aid of qualified staff having received a training which is, if not common, at least coordinated, and this should be the third objective. The opening of the Common Market to admit countries such as Britain does not appear likely to lead to any fundamental changes in these aims, but should, on the contrary, strengthen them and provide them with a firmer base and a wider hearing on the world scale.

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The latest child of a great family

ANDRÉ MAUPERON

NO ONE WOULD DENY that science and industry can only flourish in countries where considerable efforts, backed by the nation's intellectual and material resources, are devoted to them; hence the nations are quite naturally prompted to define and then set up scientific, industrial, economic and social policies that will enable them to allocate their resources in an efficient, harmonious and balanced manner; in particular, the assigning of funds and equipment and the training of research scientists, engineers and technicians are a matter of perpetual concern to government authorities.

On the other hand the organising of the documentary resources which have accumulated, too often purely through force of circumstances, has only recently awakened interest at high levels. People are only now realising that scientific information is an essential working tool for the world of today, and that it knows no frontiers. The astounding speed of progress in the sciences has had an appreciable effect on the problems of spreading scientific information, making them both keener and more complex; at a more general level, it has become clear that the concept of independence has for many nations lost part of its meaning and its formerly essential character; they have had to recognise that they can only survive through cooperation. And what is more, although the recent developments in technology, particularly in data processing and data transmission, have helped to solve a great many problems, they have generated others in regard to organisation, standardisation, harmonisation and economics.

Where does responsibility lie?

The prime task today is to speed up the application and improving of the new methods and techniques throughout the field of scientific and technical documentation and information so as to attain the highest performance for the lowest cost; but in spite of the difficulty of achieving the desirable degree of rationalisation, it is particularly crucial to decide upon objectives and practical projects because outside the Community the development and organising of scientific and technical data-processing and documentation is going ahead rapidly. These developments, however, call in their turn for proper organisation of responsibility. In the past, information and documentation were to a large extent left to individual initiative, but now the scale of organising effort and the cost of the infrastructures to be set up are such that the public authorities must take a hand; their tasks will generally consist in the setting up and efficient running of systems, the fostering of research and development, the training of qualified staff, the development of international collaboration and, increasingly, assistance in the publication of research findings.

Thus the Third Ministerial Conference on Science, held in March 1968, recommended the member countries of *OECD* [1] to "take the appropriate steps to establish, within their Government, a single, high-level 'focus', to be responsible for all the country's activities concerning scientific and technical information".

Steps towards the application of this recommendation were taken in most of the Community countries. Generally speaking, it is now possible to identify the competent ministerial authorities. For historical reasons there are still noticeable differences as regards the powers, means of action and effective role of the various national bodies. It is essential, however, that the national bodies within the Community be de-

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[1] Organisation for Economic Cooperation and Development.

veloped efficiently and along the same lines as quickly as possible, not merely to carry out the home duties assigned to a national authority, but to enable them to take a full share in Community and international activities.

Birth of a Community project

It was not by chance, therefore, that on 31 October 1967 the Council asked the Committee for Medium-Term Economic Policy: "to examine the ways and means of setting up a Community system to process and disseminate technical information or of coordinating the national data systems..."

The Scientific and Technical Research Policy (PREST) Group set up by the Committee for Medium-Term Economic Policy appointed a Working Party on *Scientific and Technical Information and Documentation (IDST)* and requested it:

a) to propose the content and forms of cooperation to be set up at the Community level on *IDST* policy matters;

b) to recommend, after analysing the requirements and the completed or envisaged projects, such operations as could usefully be undertaken in the four fields of metallurgy, agriculture, medicine and patents.

In the light of the circumstances already described above, the *IDST* Working Party recognised the urgent need for action within the Community; the necessity stems from the specific needs of economic, social, scientific, technological and industrial development in the Community as it now is and, a fortiori, as it will be after enlargement; it is rendered even more acute by the need to safeguard Europe's interests in her developing cooperation with the other major countries.

The *IDST* Working Party proposed action along two lines, one relating to the Community's *IDST* policy whilst the other dealt with the various technical sectors which the Working Party had been asked to study.

The Community STID policy

The objective was twofold—the gradual establishing of a European *IDST* network, capable of providing all users with selective information on uniform bases; and, to ensure the development and efficient running of this network, the dovetailing of the national *IDST* policies within a Community policy. The European "network" concept seems more appropriate than "system", because it recalls the telecommunications networks to which the users resort, whilst the structural or organisational differences between these networks do not affect their use.

The network

The European *IDST* network has not been defined down to its least details as it was thought more important to indicate what structure and functions it should have; the practical details can then be arranged in the light of these.

Step by step the network should link up:

a) the national and all other *IDST* centres set up in the Member States which serve users;

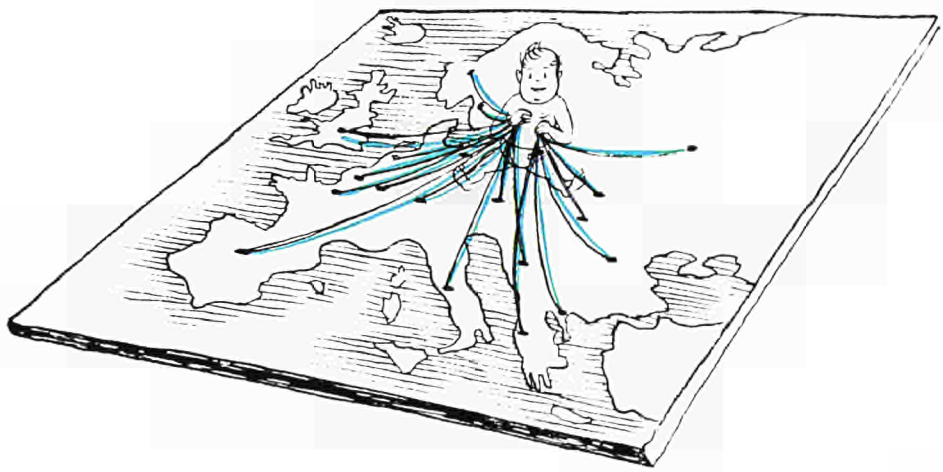
b) the sectorial documentary systems, including the European or national associates of broader international documentary systems;

c) the data banks and probably certain management information systems;

d) the telecommunications network linking the centres and systems;

e) the referral centres which direct the user to specialised centres.

The mode of operation of the network will be freely chosen by the



national units composing it, in the light of such criteria as maximum economy and facility; even if some of the units in the network operate on a commercial basis, the network will have the character of a European service to the public, and this, as will be seen further on, will be reflected in the services rendered by the network to its customers. As to the practical details of organisation, the conditions to be fulfilled so as to achieve the link-up of the systems and an adequate degree of compatibility will be of fundamental importance.

The European network, whose internal structure will be decentralised to a large extent, must function as a uniform public service that guarantees all users the same types of service under the same conditions; it will have to cover all sectors and branches of science, including their economic and legal aspects, and above all it must be suited to the needs of the users. In particular it must:

a) be exact and complete, without giving too much irrelevant information;

b) supply the information in a language understood by the user;

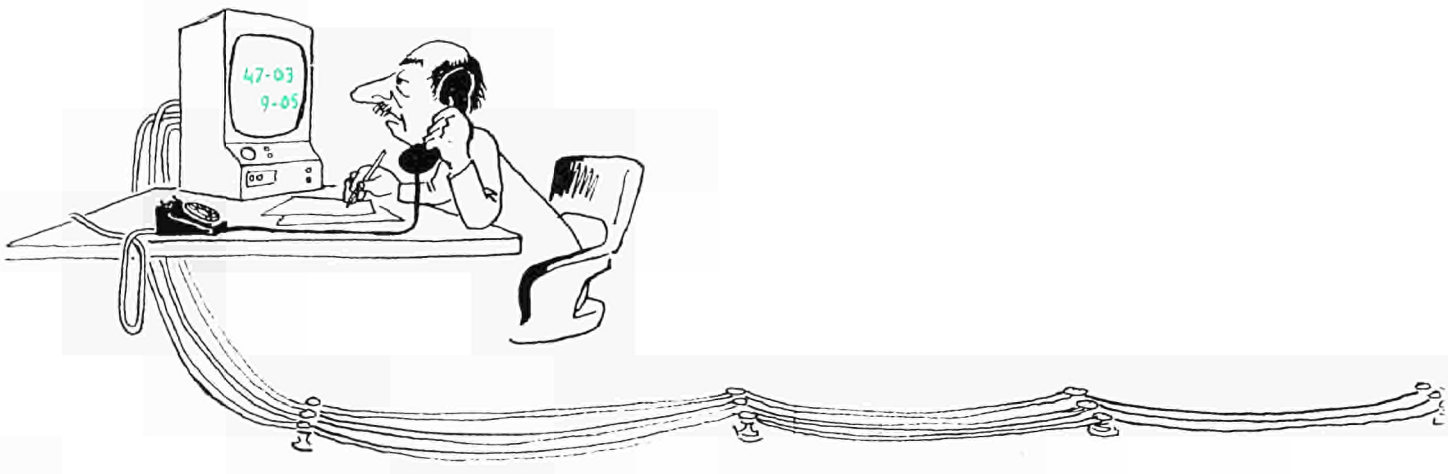
c) be quick;

d) be as cheap as possible.

Out of these somewhat conflicting requirements the first, which consists in not overwhelming the user with a mass of document that do not answer his needs, seems relatively easy to meet; the automation of the documentary retrieval services and the progress achieved in search processes have considerably enhanced their efficiency and precision without having raised the cost in proportion to the improvement.

The language question, on the other hand, is an expensive matter and consequently puts Europe at a disadvantage, particularly in regard to the United States; the compromise solution of computerised multilingual thesauri is relatively satisfactory in some fields but it is to be hoped that the research on automatic translation, which ought to be stepped up, will find the right answer soon.

Obviously the fact that the science of documentation is still growing up gives it a very dynamic aspect; nothing is rigid as yet, there are no final answers and every day brings new progress. But these constant improvements cost money and add more to the already substantial budgets allocated to the service of the users; it is not really possible today to invoice these services at cost price, mainly for psychological reasons: the user, or rather the financial controller behind him, does not readily see why he should suddenly be faced with further expenditure over and above the considerable but "traditional" sums that have always been spent on books, newspapers, journals and reports. It must be admitted, moreover, that no documentary system is at present capable of supplying the ideal information, i.e. immediate, complete and pertinent; the experimental nature



of most systems is hardly in keeping with a substantial payment, in the view of the users, especially considering that they are often asked to make a contribution "in kind" in the form of an assessment of the service rendered. Logically, therefore, the government will for some years to come have to continue providing at least in part, for the development and running of the systems, whatever projects industry may undertake in this field. Incidentally, it is essential to establish uniform conditions in the context of the European documentation network so as to bring the dues into line as nearly as possible, thus avoiding discrimination between countries or between systems. This likewise applies, though in a lesser degree, to international cooperation in general.

As to the organising of the documentary systems associated within the network, it can already be stated that a very flexible arrangement will be advocated; a sufficient degree of compatibility must be achieved, of course, but certainly not uniformity; in principle, to fulfil the aim of giving the users better service, the units directly in touch with them will be maintained in the national structure; the national centres will have means of access to the "Bank" where the data and most of the documents are stored. Collecting, indexing and abstracting will be done within the national context, particularly as regards information originating in the country itself.

The following will have to be elaborated in the context of international collaboration, within the European network and perhaps on a wider basis:

a) the allocation of the processing work on information from countries not included in the system;
b) the exchange or pooling of information processed by the participating countries;
c) the breakdown of the financial charges of the system among the participating countries.

It should be noted that the above guidelines do not cover all the functions to be fulfilled; thus one can still decide case by case whether the central processing and storage are to be done at the national, European or international level. This choice will be determined by cost and efficiency considerations.

The concerted policy

To ensure that the European network develops quickly and operates economically and harmoniously, it is necessary to concert the national *IDST* policies and this warrants the setting up of appropriate institutional machinery under the Community; the practical outcome of this alignment will be a Community policy, the main features of which are given below:

Rational development of network and creation of new systems

It is necessary to compare the national objectives periodically in order to define common objectives and a medium-term programme establishing the priorities concerning the progressive development of the network, the setting up of new systems and participation in broader undertakings resulting from external international action.

Several preliminary surveys could be carried out in various fields of applied research, including electrical technology, the environment, and electronic data and information processing, without prejudice to the setting up of a multiannual development programme for the European network.

Operating and management of the network

Certain points must be kept under continuous study and, if necessary, be dealt with by concerted arrangements or proposals to the political authorities:

a) interconnections and compatibility;
b) the economic aspects and the pricing policy;
c) the preparation of proposals for technical standards, where this is not adequately done at the international level;
d) linguistic problems and the preparation of multilingual tools (thesauri);
e) legal problems (agreements, relations between suppliers and customers, copyright, etc.);

f) certain administrative problems (maintenance of up-to-date documentation on the network structure, building of connections of restricted-circulation documents, joint preparation of abstracts by authors and publishers, etc.);

g) supervision of management of systems set up on the initiative of the Community (financing, personnel).

Collaboration with non-member countries and international organisations

The object here is the exchange of documentary contributions from the largest possible number of countries, in principle involving only a minimum transfer of funds.

As a group, the Community states produce about 20-30 % (depending on the disciplines) of the world's scientific and tecnhical literature, i.e. a very much bigger percentage than that of any of the countries taken separately. Hence a continuous exchange of information must be provided for between these countries, with concertation whenever the interests of the European network might be affected.

Fostering of the training of skilled personnel and education of users

There is still a terrible shortage of skilled personnel capable of dealing with specific information and documentation problems in spite of the considerable efforts made by the Member States; their efforts must be backed and reinforced by a plan of action to harmonise *IDST* training at the European level so as to obtain personnel capable of efficiently managing the cooperative systems that will be operating on the international level.

As to the users, they must be informed of the full range of possibilities offered by the systems so as to make the best use of them.

Fostering of technological progress

A key factor in the improvement of the *IDST* service is the progress of documentary science and of electronic data-processing and communications technology. The importance of research and development in this field has been widely recognised in the United States, which spends over 60 million dollars a year on it, whereas in Europe the most optimistic estimates appear to lie in the region of one-tenth of that sum.

The *IDST* group has made an initial investigation of the problems involved, aided in some cases by the Working Party on Data-Processing.

An inventory is to be prepared, probably on the basis of the following list:

—researches for the functioning of the European network on the basis of present-day techniques:

a) compatibility as to design and technology,

b) automatic verification of relevance,

c) optimisation of thesauri,

d) optimisation of card-index management,

e) *IDST* program library;

—equipment for use with computers in *IDST*—peripherals, optical recording, reproduction, etc.;

—automatic translation;

—automatic indexing;

—special computers for non-numerical information.

The concerting machinery

It follows naturally from the foregoing that the purpose of the concerting machinery will be to formulate the guiding lines and submit to the ministerial level suitable proposals regarding the policies and plans of action required for the coordination, development and efficient running of the Community's *IDST* systems and networks. Its tasks will be to see to the implementation of the decisions taken at the Ministry level and, in the context of its terms of reference, it will also have to oversee the following:

—the carrying out of the surveys and studies;

—the continuous concerting of the national policies and action at the level of system and network management;

—supervision of the management of the system set up on the initiative of the Community;

—the exchange of information and the concerting of the national attitudes for negotiations with non-member countries when the interests of the European network are involved;

—the harmonisation of attitudes on ordinary problems (standardisation);

—the training of qualified personnel and the development of documentary technology;

—the pursuit of any action necessary to achieve the optimum degree of system compatibility and interconnection.

Structure

The foregoing tasks clearly imply two levels of responsibility:

a) a ministerial level at which decisions should be taken;

b) a management level which would have to prepare proposals, implement the Ministry decisions and deal with everyday matters.

This two-level machinery could be set up within the Community framework; the Council would be the ministerial organ whilst the other responsibilities would be entrusted to a Committee composed of representatives of the Member States and the Commission's departments; the Commission would also provide the secretariat for the Committee.

Council decisions

The Council and the Representatives of the Member States meeting in the Council examined the report prepared by the *IDST* Working Party during their meeting of 24 June 1971; as a result of their discussions, they took the important decision to coordinate their action to set up a consistent European network and to promote the training of qualified personnel, the education of users and the advance of technology in information science; the systems forming the network will be open to other European States; as to relations and negotiations with outside countries, regular reciprocal information is planned; confrontation with a view to harmonisation is desired.

The Member States likewise agreed that in regard to the implementing of coordinated projects, the overall guidelines and, where necessary, the common attitude would be defined by the Council; the Council will also decide on all expenditure proposals.

The preparation of the projects or other action stemming from the said decisions is to be done by the Commission and the *PREST (Scientific and Technical Research Policy)* Group of the *Medium-Term Economic Policy Committee* assisted by a *Committee on Scientific and Technical Information and Documentation (CIDST)* which will be set up by the Medium-Term Economic Policy Committee within the framework of the *PREST* Group. The *CIDST* Committee will also carry out the everyday work of concertation and management and will be composed of the officials responsible for preparing the scientific and technical information and documentation policy in each Member State and officials of the Commission.

In addition the Council recognised the usefulness of setting up a Metallurgy Information and Documentation System *(SDIM)* in which the Commission will participate. A detailed article on the *SDIM* will be found in this review.

Conclusions and future prospects

The work of the *IDST* Working Party is almost done; the sum of these labours is very considerable: the Council has officially recognised the need for a continuous concerting machinery, and for the creation of a European information and documentation network, both of them concepts which are milestones in the history both of Europe and of the young science of scientific information. The sectoral projects, practically confined for the moment to metallurgical information, will be an excellent touchstone from the technical angle and in the more sensitive, less well-planned, matter of cooperation between the different countries. Probably it will not all go smoothly, the road is bound to be bumpy, but this pilot experiment must succeed; for it is the embodiment of the awakening of that Europe which, at the highest level, has decided to acquire an instrument which, though relatively cheap, is nonetheless one of the most efficacious by reason of the contribution it will make to the science, industry and the economy of our countries.

S. D. I. M.

The System of Documentation and Information for Metallurgy of the European Communities

LOLL ROLLING

Past History

When, in 1967, it was decided to merge the executive bodies of the *ECSC* with those of the Common Market and Euratom, the work of the Euratom Centre for Information and Documentation *(CID)* was expanded to deal with documentation in the sectors covered by the Common Market and the *ECSC*. The *ECSC* had already had its own Working Party since 1964, composed of the members of the *ASELT* [1], which had laid the foundations of the future European Metallurgical Documentation system by inventorising the terminology of this discipline in French, German and English.

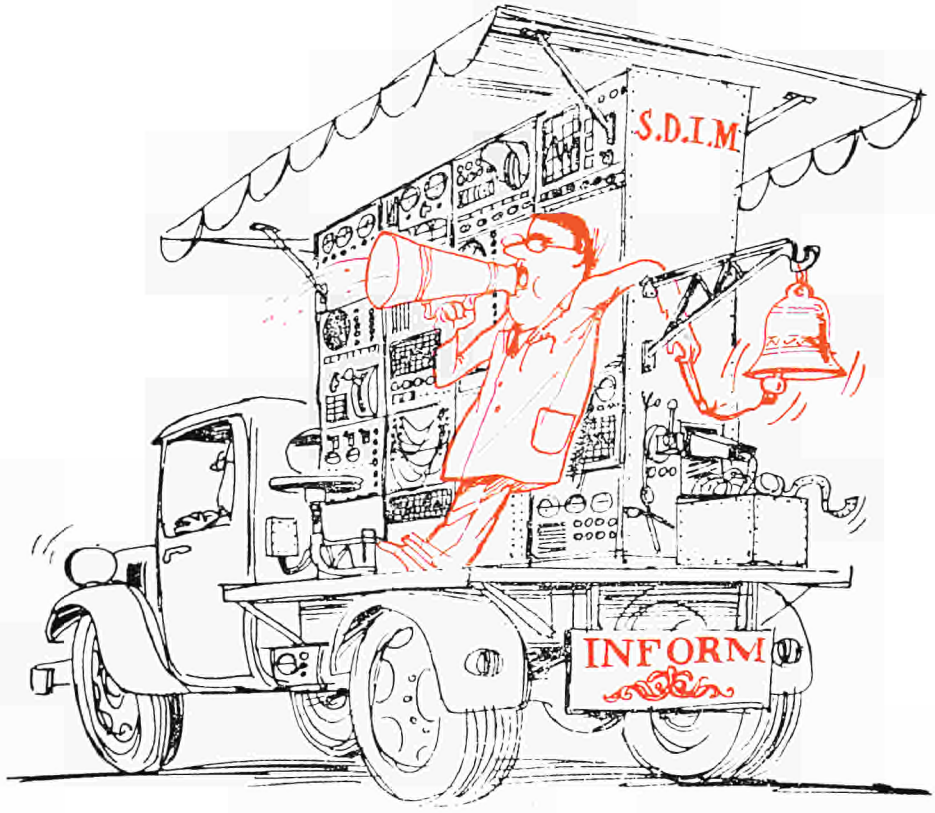
From 1968 onwards, the *CID* carried on this work, incorporating into it the *ASM*, *CSM* and *ISCOR* [2] thesauri and establishing the complete terminology diagrams for the whole field of metallurgy.

In 1969 the *CID* submitted to the *STID* [3] Working Party a project which, after undergoing a few amendments, was approved by the Council of Ministers on 24 June 1971. The *SDIM* was set up in consequence of the signing of a technical agreement defining the procedures and allocating the tasks among the participating centres, which are as follows:

[1] Association for the Exchange of Technical Literature on Coal and Steel, composed of the Six countries' Metallurgy Information Centres.

[2] American Society for Metals, Centro Sperimentale Metallurgico, Iron and Steel Corporation (of South Africa).

[3] Scientific and Technical Information and Documentation (Study Group under the Working Party on Scientific and Technical Research Policy).



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—Consiglio nazionale delle ricerche, Rome;
—Institut für Dokumentationswesen, Frankfurt;
—Ministère de l'éducation nationale, Luxembourg;
—Nederlands Orgaan voor de Bevordering van de Informatieverzorging, The Hague.

Coverage

The *SDIM* covers the entire world literature on Metallurgy, i.e. all scientific, technical and economic information on ferrous and non-ferrous metals. Its scope extends from the manufacture to the utilisation of metals, taking in all intermediate and ancillary sectors such as metallography, physical and mechanical properties, heat treatments, refining, machining, corrosion, etc. A detailed list of subjects covered is given in Fig. 1.

Feeding the system

The Member States are responsible for the input of the *SDIM*; it is their task to acquire, scan and index documents of interest to metallurgists in their countries. They also process part of the literature obtained from non-member countries on the basis of a work-sharing plan devised by common agreement.

For each document processed, a formsheet is drawn up. This contains a reference number, bibliographical data, an abstract in one of the working languages of the System (the Community languages plus English) and a list of descriptors characterizing the contents of the document.

Indexing is done on the basis of the primary literature; the national centres concerned therefore keep the original version of the document processed.

Information processing

The national centres regularly send in the formsheets containing the result of their work to the Centre for Information and Documentation of the European Communities *(CID)*, which undertakes computerised storage, the amalgamation of contributions, error control and correction.

The reference number, bibliographical data and descriptors assigned to each document are punched and then recorded on magnetic tape. The computer subsequently carries out the automatic correction of the descriptors. Each descriptor is compared with the standardised list, which constitutes the

Fig. 1: *Subjects to be covered.*

1. Physics of metals
2. Crystal structure
3. Lattice defects
4. Microstructure
5. Equilibrium diagrams
6. Phase transformations
7. Physical properties
8. Mechanical properties
9. Testing, measurement and control
10. Furnace technology and fuel utilization
11. Ore processing
12. Ironmaking
13. Steelmaking
14. Production an refining of non ferrous metals
15. Foundry
16. Powder metallurgy
17. Chemical analysis
18. Heat treatments
19. Metal forming
20. Machining
21. Surface treatments and coatings
22. Joining
23. Corrosion of metals and equipment
24. Corrosion protection
25. Uses of metals
26. Economic and social aspects of the metal industry
27. Transport and maintenance
28. Metallurgical plant equipment

thesaurus. Spelling and punching errors are thus detected and corrected. The same program enriches the conceptual analysis by the addition of terms less specific than those assigned at the outset. Consequently it is possible to carry out document searches at a lower level of specificity than that of the original indexing.

In addition, the formsheets are reproduced on microfiches. A fast reproduction device makes it possible to send out photocopies of these formsheets (containing, in particular, the abstracts) in response to requests for literature searches.

SDIM Thesaurus

All documentation systems make use of a documentary language. In the case of *SDIM*, a standardised descriptor vocabulary is used.

The *CID* has drawn up a descriptor thesaurus for metallurgy based, in particular, on existing collections of terms and on its own experience in the operation of the automatic nuclear documentation service.

The *SDIM* thesaurus comprises some 9 000 words, 6 500 of which are descriptors. The remaining 2 500 words are forbidden as descriptor synonyms or homographic terms. The thesaurus is continuously updated by the addition of new terms.

In order to facilitate the search for the most suitable terms, the thesaurus is built up in the form of terminological diagrams, which contain all the descriptors available in one and the same semantic field. The diagrams indicate, in particular, the hierarchical relations existing between the various descriptors (fig. 2).

The thesaurus exists in Dutch, English and French (German and Italian versions are being prepared) which enables each centre to work in its own language.

Documentary searches

Copies of magnetic tapes containing the bulk of the common documentary material are made available to those of the participating centres with the equipment needed to use them. The *CID* can also carry out document searches.

In the search process, the request is translated by specialist documentalists into descriptors which are associated and grouped according to the laws of Boolean algebra. The formulation obtained is fed into the computer, which compares the descriptors representing the request with those characterising the documents already stored. A high-speed printer produces the list of reference numbers of the documents corresponding to the request. After their relevance has been checked by a documentalist, the formsheets for these documents are reproduced and sent to the requestor.

It is thus possible to carry out retrospective and periodic searches *(SDI)*.

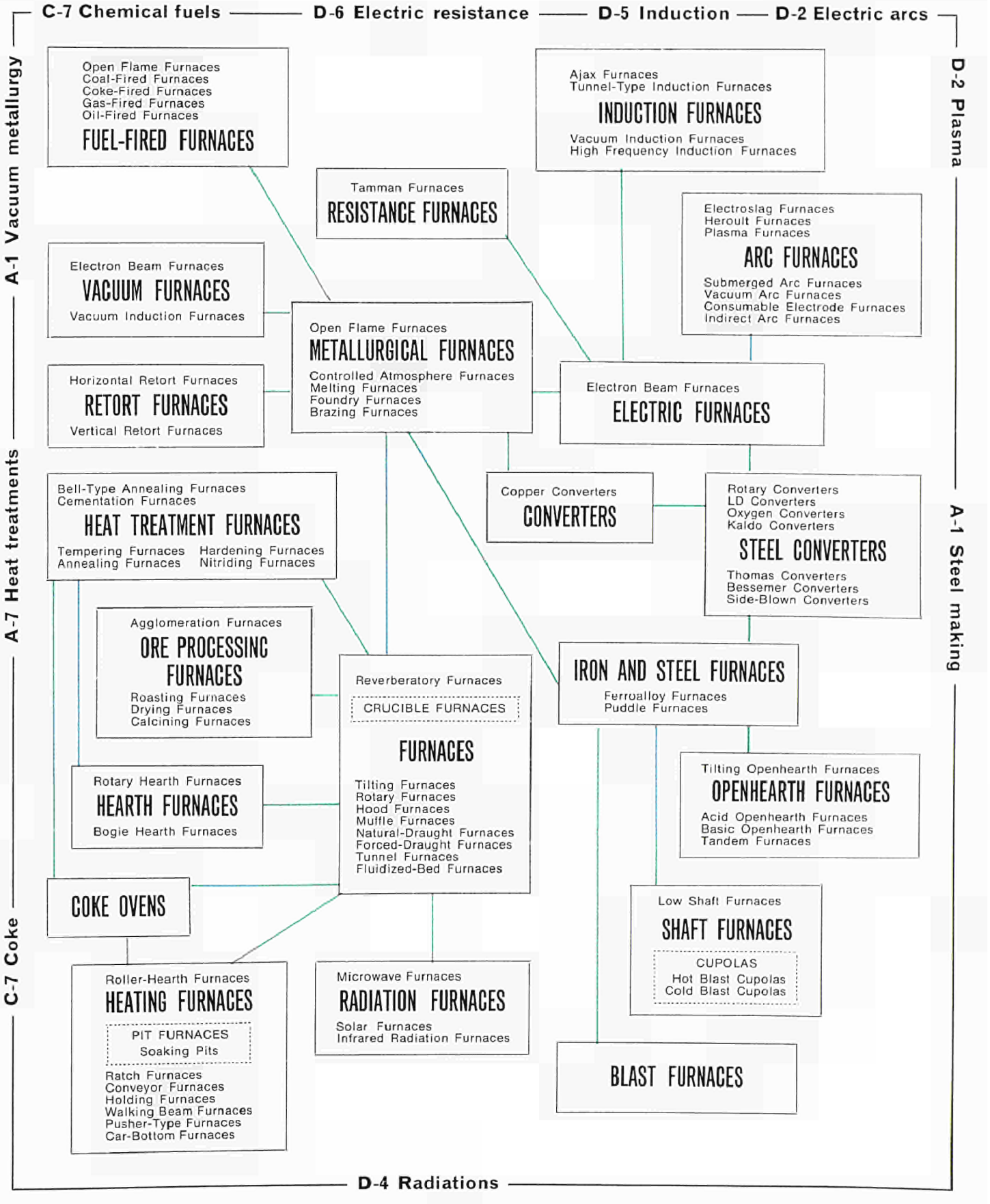
In this latter type of search, the documentalist can compile a permanent "interest profile" for the requestor concerned. The question, formulated once and for all, is fed periodically into the computer, which indicates any appropriate new document fed into its memory. The user receives regularly, once a month for example, photocopies of the formsheets of documents corresponding to his interest profile.

Extension of the Agreement

The technical agreement setting up the *SDIM* made provision for new members to join, if only in anticipation of the entry of new countries into the European Community.

Already a number of countries have expressed their intention to contribute to the joint effort; this expansion will lighten the present burden on the founder centres, as the work will be redistributed to include the new centres, and it will allow a fuller grasp of the world literature on metallurgy.

As the *CID* is responsible for the computer processing work and for supervision of terminology, it will be easy to adapt the *SDIM* to new technical and methodological improvements as and when they prove themselves in the context of the nuclear documentation system.


C-7 Chemical fuels
D-6 Electric resistance
D-5 Induction
D-2 Electric arcs
A-1 Vacuum metallurgy
A-7 Heat treatments
C-7 Coke
D-2 Plasma
A-1 Steel making
D-4 Radiations
Open Flame Furnaces
Coal-Fired Furnaces
Coke-Fired Furnaces
Gas-Fired Furnaces
Oil-Fired Furnaces
FUEL-FIRED FURNACES
Ajax Furnaces
Tunnel-Type Induction Furnaces
INDUCTION FURNACES
Vacuum Induction Furnaces
High Frequency Induction Furnaces
Tamman Furnaces
RESISTANCE FURNACES
Electroslag Furnaces
Heroult Furnaces
Plasma Furnaces
ARC FURNACES
Submerged Arc Furnaces
Vacuum Arc Furnaces
Consumable Electrode Furnaces
Indirect Arc Furnaces
Electron Beam Furnaces
VACUUM FURNACES
Vacuum Induction Furnaces
Open Flame Furnaces
METALLURGICAL FURNACES
Controlled Atmosphere Furnaces
Melting Furnaces
Foundry Furnaces
Brazing Furnaces
Horizontal Retort Furnaces
RETORT FURNACES
Vertical Retort Furnaces
Electron Beam Furnaces
ELECTRIC FURNACES
Bell-Type Annealing Furnaces
Cementation Furnaces
HEAT TREATMENT FURNACES
Tempering Furnaces
Hardening Furnaces
Annealing Furnaces
Nitriding Furnaces
Copper Converters
CONVERTERS
Rotary Converters
LD Converters
Oxygen Converters
Kaldo Converters
STEEL CONVERTERS
Thomas Converters
Bessemer Converters
Side-Blown Converters
Agglomeration Furnaces
ORE PROCESSING FURNACES
Roasting Furnaces
Drying Furnaces
Calcining Furnaces
Reverberatory Furnaces
CRUCIBLE FURNACES
FURNACES
Tilting Furnaces
Rotary Furnaces
Hood Furnaces
Muffle Furnaces
Natural-Draught Furnaces
Forced-Draught Furnaces
Tunnel Furnaces
Fluidized-Bed Furnaces
IRON AND STEEL FURNACES
Ferroalloy Furnaces
Puddle Furnaces
Rotary Hearth Furnaces
HEARTH FURNACES
Bogie Hearth Furnaces
Tilting Openhearth Furnaces
OPENHEARTH FURNACES
Acid Openhearth Furnaces
Basic Openhearth Furnaces
Tandem Furnaces
COKE OVENS
Low Shaft Furnaces
SHAFT FURNACES
CUPOLAS
Hot Blast Cupolas
Cold Blast Cupolas
Roller-Hearth Furnaces
HEATING FURNACES
PIT FURNACES
Soaking Pits
Ratch Furnaces
Conveyor Furnaces
Holding Furnaces
Walking Beam Furnaces
Pusher-Type Furnaces
Car-Bottom Furnaces
Microwave Furnaces
RADIATION FURNACES
Solar Furnaces
Infrared Radiation Furnaces
BLAST FURNACES

The Working Party on Biomedical Information and Documentation : work and prospects

N. DUSOULIER and A.L. van WESEMAEL

Introduction

The wide range covered by what is termed the "biomedical sector", the "publications explosion" which is now commonplace but is a typical feature of that sector, and the ill-coordinated attempts of a number of centres to master this mass of papers and circulate them to various, generally dissatisfied users, prompted the *IDST* Group to choose medicine as the sector to study as a possible field for European co-operation.

Europe, moreover, has an ancient tradition of medical literature, although other countries have tended to take the lead in recent decades. With a European network, the European publications could be prompted more successfully.

The experts of the Six countries have therefore been entrusted with a task comprising the following stages:

a) a precise definition of the field covered, with specific reference to the various angles from which it should be viewed (scientific, industrial, economic, social, legal);

b) a study of the points where it overlaps other fields;

c) a documentation survey covering information sources, publications, specialised centres and libraries;

d) a survey of the user structure with a definition of users' needs;

e) an analysis of the structure of the existing documentation services.

In the light of this information, recommendations were to be made regarding the best structure for a European biomedical documentation network, the division of work between the national and Community levels, and the relations that should be established with non-Community and non-European countries.

Activities of the Biomedical Working Party

Situation analysis and definition of the field covered

After an attempt to classify the mass of biomedical documentation, the experts thought it best to group all branches of science concerning man as a medical subject under the term "biomedicine", owing to the difficulty of considering medicine proper apart from other disciplines of which a list (not exhaustive) was drawn up for guidance purposes.

The situation analysis showed that most of the findings of biomedical research are published in specialised journals, of which there are a vast number, and that the sheer volume of this primary literature has led to the appearance of a number of secondary abstracting and indexing publications and the development of documentation systems, automatic or now being automated, in various countries.

Review of possibility of setting up a Community system

Because there are already a number of internationally-geared systems in the course of development, plus national centres for general or special purposes in all the Community countries, the Working Party does not think a Community move to set up yet another international system would be advisable; it considers that at the present stage the facilities provided by the systems already in operation would suffice to meet the chief needs of users in the field of medical literature.

Some countries, moreover, have already entered into agreements with those systems, whilst others are still negotiating, but all these, to one extent or another, consider that the quality, speed or cost of the services provided need to be improved.

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The Working Party takes the view that in future, to prevent the piecemeal expenditure of effort and funds, the member countries ought to set up a procedure for collective decisions on schemes for medical data systems, and that they should adopt a common position towards the international systems, in order to give weight to the principal users' views and requirements.

Regarding collaboration between national systems, it would be advisable to encourage exchanges of information between the multidiscipline or specialist centres by improving the accounting of classifications and vocabulary. It is proposed that a closer look be taken at the existing international systems and their trend of development, to see how far they meet the needs of Community users.

Review and detailed study of existing systems

In most of the Community countries one finds approximately the following pattern: a general biomedical centre (*DIMDI* in Germany, *CNRS* in France): centres specialising in one or other branch of biomedicine (cancerology, microbiology, etc.): and hospital libraries or medical research centre libraries.

Some of the general centres, Community and otherwise, have, through their coverage scale, acquired international proportions which should be taken into account.

Multidisciplinary systems

The services provided or being planned by three centres have been studied in detail: these are the *Medlars* system developed by the *National Library of Medicine*, USA, *Excerpta*

Medica, Netherlands, and the *Pascal* system of the *CNRS Documentation Centre*, France.

Each of these systems was examined from the standpoints of:

a) *the field covered:* by *Excerpta Medica*, 3 000 biomedical journals; by *Medlars*, about 2 500; and by *Pascal*, *CNRS*, 9 000 journals including 3 500 concerning the biomedical field;

b) *the thesaurus:* for *Excerpta Medica*, 70 000 keywords and 80 000 cross-references; too large for manual consultation, it is stored in the computer's random access store, and the indexing is done in plain language. For *Medlars*, the *Medlars I* thesaurus has a somewhat limited number of terms, arranged in alphabetical order and hierarchically by category. The indexers have the use of 18 000 terms which cross-refer to the keywords of the *Mesh* thesaurus. For the *CNRS* system, there are special thesauri for each branch of medicine (pathology proper, pharmacology, microbiology, etc.), the indexing being done with a dual aim—retrieval and a computerised index of subjects.

In the case of the three services studied, retrieval may be a search for back information or it may be periodical, with variants in the services rendered or envisaged.

Specialised systems

The cooperative schemes initiated at a few specialised centres (cancer, pediatrics) have been studied in order to see how they can best meet the needs of certain categories of users and serve as pilot schemes for European cooperation on a wider scale.

The Working Party experts proposed that the efficacy of the documentary systems should be evaluated. An efficacy assessment is a sort of compromise between optimum functioning of the system and the cost of the various operations, and depends on a number of parameters including the level of the documentation indexed, the degrees of retrieval and precision, the average response time, the qualifications of the staff and the wealth of documentation available.

The results of this evaluation could serve as a sort of guide for users according to their needs and criteria, provided that these are defined, and this the Working Party has been tackling.

Users' viewpoint

Review of users

The experts accepted a proposal to group users under five heads according to their behaviour and their known or supposed requirements.

There are:

1) the medical practitioners in private practice, in hospitals, in dispensaries, in medical analysis laboratories, and the dispensing pharmacists;

2) the practitioners in "advanced" medicine and surgery, who require highly specialised up-to-date scientific and technical information;

3) research workers looking for back material and thus having specific *IDST* requirements;

4) teachers (professors and their assistants) who need to know everything of importance and also the general trend of medical science;

5) students, whose needs (and resources) can also be expressed in specific terms.

As this list shows, the range of requirements is enormous. At one end are the private practitioners and certain groups assimilated to them, who need to consult short, factual review articles in their own language; at the other end is the broad miscellany of publications and services needed by practitioners at university hospitals or by research workers.

To find out what they need, users consult specialised or other primary publications, of course, but they also read journals of abstracts and titles. In addition to these sources of infor-

mation, increasing use is being made of information retrieval and selective circulation services.

Unsatisfied needs

There seem to be at least three fields where action to meet poorly satisfied needs ought to be encouraged:

a) better distribution of epidemiological information among the Community countries;

b) publication of annual reviews, progress reviews, etc., on European work;

c) publicity and information on journals useful to university or post-graduate teaching.

Specific matters examined with a view to cooperation between centres in the Six countries

Although the delegation think there are no grounds for encouraging the creation of a Community coordinating body, they said they were in favour of any action that would give easier access to the existing services or improve the services provided. In some cases such access could be facilitated by recourse to national centres of a public service type which would act as intermediaries between the existing services and the users.

In any case, it seems expedient to study at Community level the ways and means of improving or promoting exchanges of information between the multidisciplinary or specialised centres in the various countries, whilst encouraging accounting at all levels.

1. *Bibliographical format*

Magnetic tape is the quickest and cheapest means of exchanging information, but it raises cataloguing and format problems.

The Working Party, though fully aware of the importance of this problem, nevertheless thought it went beyond the scope of the biomedical sector and that it would be wiser to keep a very close watch on the various studies now being conducted by different international authorities.

2. *Language problem*

Among researchers in the leading sectors the knowledge of languages is sufficiently advanced to raise no major problems, but as soon as technique—and hence certain categories of users—are involved, information in the inquirer's language is absolutely essential. Furthermore, entry into a system is generally more pertinent when it is done in the user's language. All this means that work must be started on the compiling of multilingual thesauri. This need has been felt in other international bodies such as *UNESCO*, which is preparing a system of principles for compiling such thesauri.

3. *Problems raised by the different approaches to medicine in the various Community countries*

The problem here is not simply one of language but rather of the philosophy of each school, the same word being used to cover widely different, scarcely overlapping concepts. There can be no ready solution to this difficulty, which will simply have to be borne in mind.

4. *Problems due to the various levels at which medical information is processed*

Because some centres deal with several branches of biomedicine whilst others specialise, medical literature is processed twice over, though sometimes by slightly different methods.

The first guidelines for a rational system should be able to make due allowance for a cooperative arrangement between the general-purpose and the specialised centres; the latter could probably profit from preliminary selection and macroindexing done by the encyclopedic centres.

This would result, first, in optimum use of the services provided by these centres, which have to invest substantial sums in order to cover the full range of biomedical literature.

This problem of levels crops up again when exchanges are to be arranged between the various countries' centres. Such exchanges, which appear to be feasible mainly between specialised centres, again raise the question of format.

A contribution to the study of the relations that can be established between general systems, special systems and national organisations has been prepared by the experts. They concentrated on the formal relations between the various systems and organisations. Such relations will only be practicable when the accounting and convertibility studies have been done (language, hardware, software, etc.).

Here again we encounter the problems of vocabulary and the need for a macrothesaurus and microthesaurus in depth for each of the specialised centres. This is a very knotty problem because of the size of the vocabulary to be dealt with, but considering that the same difficulty arises in the processing of medical records it is certainly worth tackling. Experiments being tried in certain specialised centres are tending to confirm the worth of the vocabulary used there for literature processing, as a language for medical records.

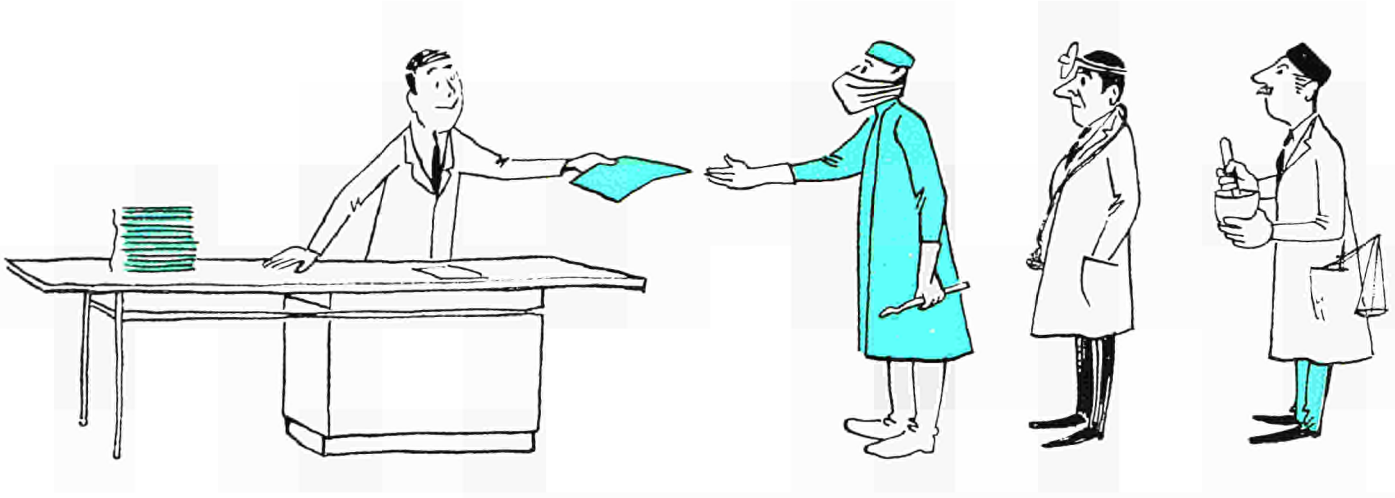
Future activities of the Working Party

Work still to be done under the present brief

1. *Solve the vocabulary problems.* A common multilingual terminology will have to be established; the first stage could be the macrothesaurus needed for diffusing information from the encyclopedic centres to the specialised centres.

The next task will be the specialised thesauri; a methodology could be prepared and tried out in one or two leading sectors.

To transfer information from one language to another, it will be necessary to convert the first or all of the thesauri into the other Community languages. This is easier to do with the



macrothesaurus than at the specialist level, although conclusive experiments have been carried out in some sectors.

2. Investigation of the users' unfulfilled needs has proved that summary reviews of European work are necessary. A certain number of matters have to be examined, such as the question of publishing, to be discussed with potential publishers, the problem of staff capable of carrying out such work and the market surveys without which work of this kind can only be a hit-or-miss undertaking.

Guidelines proposed by the Study Group in keeping with the development of medical data handling

1. *Increasingly close relations* must be established between the primary publications and the secondary services.

Work has already been done in this field by such bodies as *ELSE (European Life Science Editors), UNESCO, ICSU-AB, Iso TC46,* and at various national levels. Meetings are held to find points where cooperation would be to the advantage of everybody.

One of the most important of these is that articles published in journals should be accompanied by an abstract and indexing terms, the abstract complying with international standards (a corresponding standard is being prepared at the *ISO*) and the indexing being consistent with the principles of the macrothesaurus, which still have to be decided upon.

The primary literature could also be more widely disseminated (periodicals in Japanese and East European languages are more readily acquired and consulted if summaries are given with the articles).

The documents would be more rapidly accessible; this is a very important point, since articles today have an increasingly short lifetime.

The saving on analyses in the secondary services could lead to better services and a share in the actual preparation of the abstracts in the primary journals.

2. *Relations between the processing of medical information* obtained:

a) from publications and

b) from case histories.

In view of the spread of medical data processing and utilisation at the present time, it is advisable to consider the problems raised by the medical data processing sectors, which are closely linked to the documentary problems.

Since the Study Group was first set up there have been such rapid changes in these fields that it has had to revise its original attitude, which was that these problems should be left on one side for the time being.

In particular:

a) the medical records and

b) the data banks ought to be dealt with, leaving aside the questions of monitoring, hospital logistics and

even, for the moment, programmed teaching.

The two first-named sectors are faced with a major problem, that of terminology. At present there is a considerable lack of order among the experiments in hand, leading to great difficulties in the communication, comparison and large-scale statistical evaluation of results. The language used differs through, first, the choice of classifications and, secondly, the incompatibility of the thesauri and the indexing depth resulting therefrom.

Coordination in this field should enable medical information to be made available to Europe's research workers and medical men.

a) *Medical records*

Systematic exploitation of medical records should make it possible to:

—keep track of patients over a long period;

—build up the basic material for epidemiological statistics;

—amass a store of documents for studies, surveys or research work.

To make such information exchangeable, it will be necessary to define:

—the minimum contents of a record, so that it can be used as widely as possible by computer;

—a terminology sufficiently specific to allow description of the symptoms.

It should be possible to envisage in-depth indexing from macroterms, however, in an adjacent zone, in plain language or coded.

The possible use of existing thesauri should be considered. Pilot sectors could be chosen for a preliminary study.

b) *Data banks*

The card-indexes of precise data are established from patients' records or by in-depth literature searches using very detailed grids. They are organised in such a way as to be utilised by a large number of specialists.

Many of the data are in figure form, but the figures relate to events, substances or objects, the designation of which must be generally agreed upon without any ambiguity. Other data consist of vocabulary terms (adjectives or nouns) selected from a very strict range and often presented in coded form.

Here again, then, the problem of the controlled vocabulary is paramount. An even sterner choice of words is necessary here than in the indexing of documents or medical records. The aim should be to establish a kind of micro-language in the sectors where joint action is decided upon.

On the other hand, once the terminology has been agreed on, data banks cross the linguistic frontiers far more easily than any other form of information, the interpreting work having, so to speak, been done beforehand. Moreover, since it takes a considerable amount of work to set up a data bank, it will really only give full value in a sufficiently broad scientific population.

It appears, too, that as the medical data banks are still at the starting-up stage, this is a field where "it would be possible to act in time" to achieve in a single sweep a consistent Europe-wide system which would be of unquestionable value.

In France, the chief data bank now being formed concerns drugs (physical and chemical characteristics, action, treatments, etc.). It covers 2 500 active principles and 8 500 branded products. It is thought that there are not many other basic substances in the other Common Market countries, but the total number of branded products may be around 40 000 or 50 000. Hence the idea of trying to set up a basic substances bank associated with three brand banks, which would usually be interrogated singly (a French physician being primarily interested in French brands) but could, if necessary, be grouped together, subject to a longer access time and higher computer costs.

In the Netherlands a data bank on pathological anatomy *(PALGA)* is now being set up and could be the subject of more detailed cooperation studies.

The vocabulary question is particularly important because the information sources are extremely various.

Documentation from the literature and from case histories must be processed with the same language. Here again, the following should be established:

—a census of the present biomedical or medical data banks;

—a definition of the specificity of the language to be used for the data banks, in relation to the documentary languages;

—the relations to be established between information and data from different sources (case histories, literature, etc.);

—the fields where a European-scale pilot test could be contemplated.

Conclusion

Although the results produced by the Biomedical Working Party were not as spectacular as those of the Metallurgy Working Party, for example, their experts do seem to have analysed the subject and pinpointed the problems to some extent.

Some of the proposals could render certain aspects of international cooperation more tangible, but substantial funds and the assistance of competent specialists would be needed to achieve success in this task, which is no less than the preparing of the future of the medical world's information.

Agricultural Documentation

HERBERT BUNTROCK

Two terms and their meanings

The meaning of the word "agriculture" seems obvious to everybody—until he starts to think about it. Not only agriculture as such, but also the words that describe it have a history. At one time they denoted something like the disposal of land, then the ownership of land, and later the tending of soil, plants, animals and people. It is only in recent times that the word "agriculture" has become connected with the systematic activity by farmers for the purpose of producing foodstuffs and other commodities, with which agricultural science is becoming ever more closely associated (1). What began purely as a way of life and gradually developed into a craft acquired an increasingly refined structure through scientific theory and experimentation. The appended schematic diagram (Fig. 1), which does not claim to be complete, gives an idea of the activities that can be classified under the general heading of agriculture, it being left to everyone to decide for himself whether he wishes to draw the boundary at the point where the products leave the farm or whether he would include also the upgrading and processing industries, which in turn are drawing ever nearer to the farm.

Agriculture is "documented". What does documented mean? Tourists send for documentation before going on a journey; governments issue documentation on political questions; the meaning is informative documents. In colloquial language the word "documentation" is used in a very wide and often differing sense. Paul Otlet, the founder of modern documentation, and the *Fédération Internationale de la Documentation (FID)*, among others, understand scientific documentation—which is what we are concerned with here—as being the collection, arrangement, evaluation and distribution of documents of all kinds (2). Depending on whether we are working with documents or with data, we find ourselves in the realm of literature documentation or that of data documentation, and these processes differ so widely in their methods and objectives that they have no more than the name in common. By agricultural data documentation, for example, would be understood the recording and processing—wherever possible, automatically—of measurement and test results. In the following paragraphs, however, we shall be concerned solely with agricultural literature documentation, which, as to content, covers such differing spheres of application as the natural and social sciences and, as to methods, embraces such diverse processes as cataloguing, abstracting, indexing, retrieval, *SDI (selective dissemination of information)*, etc.

History of agricultural research and documentation

Agriculture is one of the oldest forms of culture. Men first started to till the land when they ceased to be nomadic fruit gatherers and hunters and established permanent settlements. The beginnings of agriculture in these latitudes probably go back eight to ten thousand years, but it was only in the last century that farming came within the purview of science. This is astonishing when one considers that for thousands of years working on the land was man's principal occupation and when one compares this tardy evolution with the very early development of such sciences as astronomy, mathematics, architecture and philosophy.

Admittedly, men have written about agriculture since very early times and not merely since Gutenberg—witness, for example, the "husbandman's calendar" from Gezer in Israel (3), which dates from between the tenth and the eighth century B.C. In the main, however, agricultural knowledge and experience were handed down from father to son, and were not considered worthy of intellectural penetration. Scientific concern with agriculture followed only in the wake of chemistry, the chemists having discovered nitrogen in 1772, oxygen in 1774 and the composition of water in 1781. The first school of agriculture in Germany was founded in 1806 by Albrecht Thaer, whom many historians have called "the father of the agricultural sciences" and who had been a physician before taking up agriculture. In 1846 Justus von Liebig published his famous book *"Die Chemie in ihrer Anwendung auf Agrarkultur und Physiologie"* and followed it in 1855 with *"Die Grundsätze der Agrikulturchemie"*, in which he recommends that "one should give back to the field what has been taken away from it, neither more nor less but exactly as much", and goes on to say "... just as we now cure the ague with a few grains of quinine, whereas formerly the patient was made to swallow an ounce of wood as well...". Even in those days, however, there was no lack of controversy; Liebig's propositions were disputed by the Utrecht professor G.J. Mulder; Liebig himself had little more than contempt for Thaer's humus theory, De Bary's discovery of micro-organisms as causes of plant diseases and Way's research into base-exchange in the soil. Nevertheless, the development continued. In 1834 Bocessignault founded the first agricultural experimental station in Alsace and in 1843 Sir J.B. Lawes set up the *Rothamsted Institute* (1).

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With the increase of agricultural literature there was also a greater need for collection and classification of the publications. In 1596 the Nuremburg physician and naturalist J. Camerarius listed, in a bibliography entitled "*Elekta georgika sive opuscula quadem de re rustica*", 100 printed texts, 170 manuscripts and 190 Greek and Roman works on agriculture. In 1803 more than 6 000 titles were quoted in F.B. Weber's "*Handbuch der ökonomischen Literature oder Systematische Anleitung zur Kenntnis der Deutschen ökonomischen Schriften, die sowohl die gesamte Lande- und Hauswirtschaft als die mit derselben verbunden Hilfs- und Nebenwissenschaften angehen*". From 1860 on, A. Kroker published the "*Repertorium der preussischen landwirtschaftlichen Literatur*" and from 1863 to 1864 his "*Archiv der landwirtschaftlichen Literatur des In- und Auslandes*". The "*Experiment Station Record*", published by the *U.S. Department of Agriculture* in Washington, appeared for the first time in 1890. The "*Bibliography of Agriculture*" has been published since 1942 by the *National Agricultural Library* in Washington (4). The origins of the *Commonwealth Agricultural Bureaux (CAB)*, which today operate over a dozen abstracting services covering a very wide range of agricultural subjects, date back to 1909, when the *Entomological Research Committee for Tropical Africa* began its work (5).

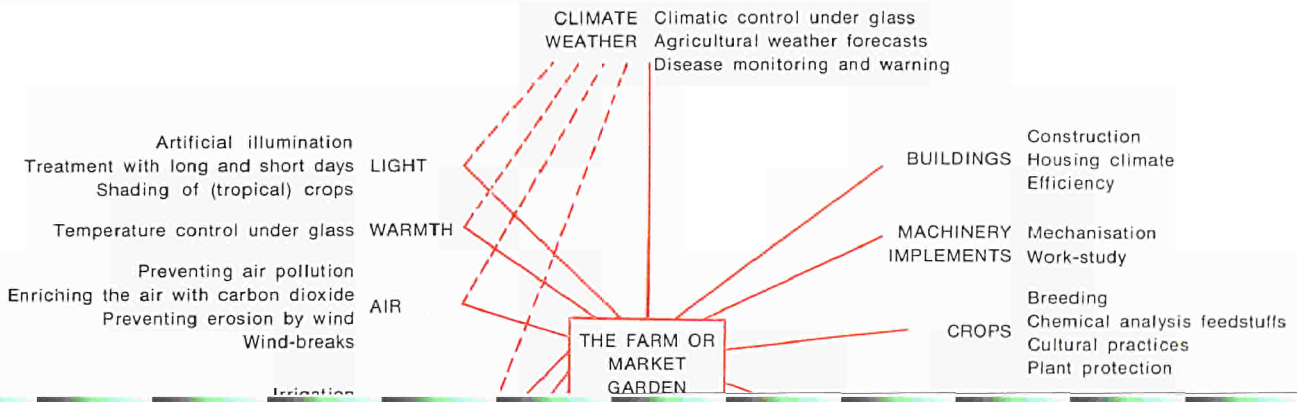
The progress of documentation is probably attributable to two main factors:

1) the emergence of journal literature, together with the impossibility of handling this kind of literature by means of the traditional library methods and the need to analyse individual journals;
2) the delegation, by scientists, of literature searches to libraries or other appropriate institutions (2).

Special features of agricultural documentation

The agricultural sciences are applied sciences. In contrast to younger disciplines such as the nuclear sciences, in which application was preceded by research, agriculture is an example of the reverse sequence. It had been practised for thousands of years—first as a way of life and then as a craft—before it was discovered and further developed by the scientists. This is not the least of the reasons for the linking of mythical concepts with production when agriculture is under discussion, and for the social role as a defender

Fig. 1: *Schematic diagram of agricultural activities. (After Maltha, Wageningen; Ref. 1.)*



of the conservative way of life which is attributed to agriculture or which it claims for itself.

At any rate, the origins of scientific agricultural documentation go back a good hundred years. Its present structure is consequently more the result of its historical development than of methodical organisation. From the outset, the literature has been collected in accordance with areas of emphasis, i.e. topical, regional or linguistic interests, rather than on systematic lines.

Agricultural science embraces numerous widely differing subjects ranging, for instance, from physiology to the cooperative system. Agricultural documentation not only has to cover such central areas as plant-breeding and animal husbandry, but must also obtain access to fundamental disciplines such as chemistry, biology and the social sciences. This gives rise to demarcation problems and the constant danger of overcrowding and overlapping, or, if these are to be avoided, the need for interchangeability of the various subject documentation systems.

Regional disparities play a particularly important part in agriculture. They are due on the one hand to natural variations of climate and soil and on the other hand to historical differences, e.g., as regards state of development (North-South gradient), economic organisation (West-East) and consumer habits. Owing to regional interests, tradition and the pragmatism of agriculture, agricultural science and documentation are closely linked with the national languages. Furthermore, the increasing emancipation of the developing countries entails an increasing geographical and linguistic scatter in the production of knowledge and complicates the task of documentation.

Fig. 2 : *Limestone tablet from Gezer, Israel, bearing the "husbandman's calendar" and dating from between the tenth and the eighth century B.C.*

"During two months olives are harvested, / during two months corn is sown, / during two months the late sowing is done. / During one month the flax is pulled. / During one month barley is harvested. / During one month everything else is harvested. / During two months the vines are pruned, / during one month summer fruit (is gathered)." (after Bardtke, Ref. 3.)

Users and their information requirements

Who makes use of agricultural documentation? Without being able to give a full analysis, it is possible to mention the following categories of users:

Fundamental research scientists are above all wedded to their particular discipline and carry out research more for its own sake than with a view to the direct application of the results. Their findings are reflected in the production of literature, with which at the same time they announce the priority of their investigations. Hence their interest in rapid information, for which purpose lists of titles generally suffice: recall is more important than relevance. Comprehensive coverage of the specialised field concerned, which frequently goes far beyond classical agriculture, and a knowledge of the original literature are indispensable.

Applied research scientists are usually more concerned with projects than with disciplines. Their research is aimed at the realisation of projects rather than with the production of knowledge. These scientists are interested in delegating at least some of the literature searches to documentation centres and will only occasionally wish to consult original literature themselves. The procurement of relevant material is more important than comprehensiveness, so that a high degree of selectivity as regards access is desirable (informative abstracts and detailed index).

Engineers and technicians generally deal with specific aspects of individual projects. Laboratory and field work take precedence over literature searches, which are delegated wherever possible. These specialists are interested in literature only insofar as it is of immediate relevance, and even then their requirement is for data rather than reference.

Industrial firms usually have such highly specialised interests (products, processes, patents, etc.) that although they use the results of general documentation as a basis, they otherwise distrust them and frequently run their own internal documentation services.

Farmers and horticulturists are supplied with information by advisory services which, in view of the necessary orientation towards specific crops, are mostly conducted in the language concerned by national or regional bodies such as *PUDOC* in the Netherlands, *AID* in West Germany and similar organisations elsewhere.

How many users must agricultural documentation be presumed to serve, and what is the justification for the expenditure thereon? According to information supplied by the Member States and the results of a survey conducted by the Commission of the European Communities, there are about 2 000 agricultural research institutes in the six Communities countries. Between them they employ 5 500 to 6 000 graduate scientists and more than twice as many scientific assistants. The average annual expenditure per scientist was $ 20 000 in 1966 and will now be close to $ 30 000. This means an annual expenditure of $ 180 million on scientific research staff alone. A survey conducted in the United States in the 1950's revealed that the agricultural scientists there spent about 13 % of their working hours on literature studies (6). On this basis the corresponding cost in respect of the agricultural scientists in the European Community would be $ 20-25 million. The task of documentation is to make literature searches easier and more effective. How desirable this is can be judged from the foregoing cost figures.

Present status of agricultural documentation

In 1970 a world-wide survey of agricultural documentation services (7) was carried out jointly by the European Communities' *Centre for Information and Documentation (CID)* and a working party set up by the United Nations *Food and Agriculture Organisation (FAO)*. This survey embraced about 500 services which between them publish 1.5 million titles annually. In 1969 Frauendorfer listed nearly 700 services (8). Various estimates agree that the annual number of scientific publications relating to agriculture is between 200 000 and 250 000. This means that on average each original contribution must be mentioned about seven times in the bibliographies and abstracts. The actual situation is probably more complicated since some articles are referred to even more frequently in the secondary literature and others not at all. A certain amount of duplication is undoubtedly necessary for linguistic reasons and also in order to take account of different objective viewpoints. Despite the sometimes marked degree of overlap there is as yet not a single bibliography which adequately identifies the whole of agricultural literature.

Barely one-third of the documentation services analysed are bibliographies, though these publish 43 % of all the titles; over two-thirds are abstract journals, which publish 57 % of the references. The services appear in 52 countries and in 22 languages. The largest producers are the United States and Britain, each of which accounts for 16 %, the Soviet Union with 12 %, and France and West Germany with 10 % each. In reality, the American and Soviet shares are probably even greater. Over 36 % of all titles and abstracts appear in English; German, Russian and French each account for 11-12 %. Automation is not yet very widespread in agricultural documentation; nevertheless, some 200 000 titles a year are believed to be available on

Fig. 3: *The patriarch's library: frontis piece to O. von Münchhausen's "Der Hausvater" (third edition, 1771). (After Franz, Ref. 9.)*

Fig. 4: *Justus von Liebig. (Part of a painting by Thiersch, 1868. After Franz, Ref. 9.)*

magnetic tape from about 20 services, and these figures should increase rapidly in the next few years (7).

International collaboration

International collaboration in agricultural documentation has existed on a scale worth mentioning for half a century. In 1970 the *Comité International de Pédologie* began its work on the terminology and classification of soils. Between the two world wars the *International Institute for Agriculture*, which later gave birth to the *FAO*, was active in Rome. The origins of the *Commonwealth Agricultural Bureaux (CAB)* go back to 1909. Also, professional bodies such as the *International Association of Agricultural Librarians and Documentalists (IAALD)* and the *Inter-American Association of Agricultural Librarians and Documentalists* at Turrialba, Costa Rica, have made the promotion of agricultural documentation their aim (5). The survey conducted in 1970 revealed that there are today between 40 and 50 international agricultural documentation services in operation, most of them for specialised fields (7). It is only in very recent times, however, that there has been a break-through to organised international collaboration on a major scale. The reason for this is the ever-greater scatter in the output of literature and the consequent increasing difficulty, even in the foremost literature-producing countries, of achieving complete coverage. Possibilities for collaboration on a grander scale are being opened up by computer techniques, which on the one hand enable large volumes of titles to be processed and on the other hand allow coordinated working by an integrated network of documentation centres.

In this connection mention must be made of two recent projects for international cooperation: the first of these is *AGRIS (International Information System for the Agricultural Sciences and Technology)*, a world-wide scheme that is being sponsored by the principal organisations and will be implemented under the aegis of the *FAO*, its immediate objective being the complete identification of agricultural literature; the second is a project launched by the European Communities with the aim of furthering cooperation in the member countries.

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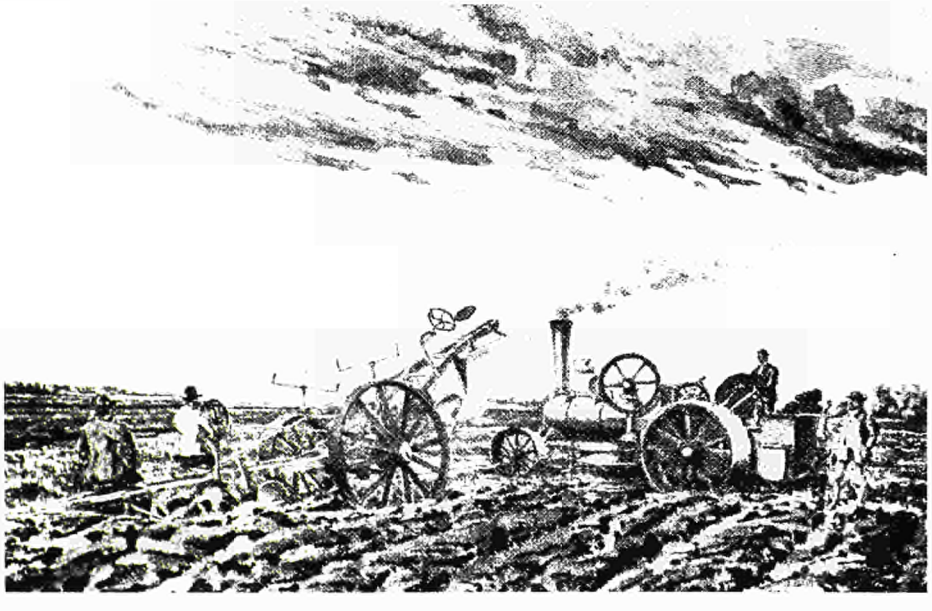
Fig. 5: *Max Eyth: Steam plough in operation. (Original in the city archives, Ulm. After Franz, Ref. 9.)*



References: (1) *Centre for Agricultural Publishing and Documentation*, Wageningen: Living for life. The interplay between agriculture and science. A Dutch view in word and picture of agricultural research. (2) T.P. LOOSJES: Dokumentation wissenschaftlicher Literatur, *BLV Verlagsgesellschaft Munich, Basel, Vienna* (1962). (3) H. BARDTKE: Bibel, Spaten und Geschichte. *Verlag Koehler und Amelang, Leipzig*. (4) G. FRANZ: Die Entwicklung des landwirtschaftlichen Bibliotheks- und Dokumentationswesens. *Mitteilungen der Gesellschaft für Bibliothekswesen und Dokumentation des Landbaues*, No. 13 (1970) pp. 6-27. (5) H.D. BOALCH: Internationale und interregionale Zusammenarbeit auf dem Gebiet der Landwirtschaftlichen Dokumentation. *OEEC/EPA Seminar on Agricultural Documentation, Stuttgart-Hohenheim*, 20-23.6.1960. (6) H. LOHMEYER: Internationale Zusammenarbeit im landwirtschaftlichen Informations- Dokumentations- und Bibliothekswesen. *Nachrichten für Dokumentation* 11 (1960) 2, pp. 85-92. (7) H. BUNTROCK: A survey of world agricultural documentation services, December 1970. *Prepared on behalf of the FAO Panel of Experts in "AGRIS" (International information system for the agricultural sciences and technology) FAO/DC/AGRIS 1.* (8) S. von FRAUENDORFER: Survey of abstracting services and current bibliographical tools in agriculture, forestry, fisheries, nutrition, veterinary medicine and related subjects. (BLV-Verlagsgesellschaft Munich, Basel, Vienna) (1969). (9) G. FRANZ, H. HAUSHOFER: Große Landwirte. *DLG-Verlag, Frankfurt/Main.*

Our acknowledgements are due to the following publishing houses for kindly providing the illustrations: *PUDOC*, Wageningen, for fig. 1; *Koehler & Amelang*, Leipzig, for fig. 2; *DLG-Verlag*, Frankfurt/Main, for figs. 3, 4 and 5.

Cash, Please!

RUDOLF BREE

Modern information storage systems are expensive, both to set up and to operate. If governments—particularly in industrialised countries—nevertheless are actively engaged in establishing such facilities for their national users or providing access to them, they are hardly doing it on grounds of altruism. Instead they are demonstrating their understanding of the fact that it is in the interest of their states to possess a good infrastructure for obtaining access to the world's store of knowledge. The competitiveness of their economies is ultimately governed largely by the quality of their industrial products. Knowledge of existing studies, and their results, is indispensable for their continued development, and for solving a large number of social problems.

This can be accomplished by setting up national facilities or by resorting to an appropriate form of collaboration with outside bodies. The decision on this is primarily a financial problem, which is rendered all the more unpleasant when governments face it for the first time.

What governments would undoubtedly like most would be the continuance of the traditional method of supply used by their citizens (and their economic and scientific institutions), i.e. if it were possible to rely on individuals buying publications of primary or secondary nature, to obtain semi-public literature through exchange agreements, to maintain an adequate number of public libraries and, additionally, to promote manually operated documentation centres for especially important fields.

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The trends of the last twenty years make any such wish utopian, and in the choice between having the social and economic development of their societies inadequately underpinned by the use of information, and creating the required information supply facilities, governments have no alternative but to direct their attention to information systems backed up by data-processing systems, without which the problem of access to information can no longer be solved.

In so doing they will find that there are not— yet —particularly in Europe any industrially and commercially operating firms to which they can quite simply refer their national users. A further unpleasant finding is that European countries lack suitably trained specialists. Even worse, however, is the fact that a well-founded cost estimate rapidly reveals that the desire to create facilities for independent, accurate and fast access to the relevant world literature demands far more than the resources that could, in the best case, be allocated to meet it in any national budget. There are still very grave financing problems, even in cases where the aim is to participate in more or less adequate forms of cooperative work.

Governments which, feeling obliged to make such an effort in the interest of maintaining the competitiveness of their economies and of their scientific potential will acquire such facilities of information and are bound to use public funds to this end, will also seek to recover at least some of their money. After all, these facilities are to a certain extent used as part of the country's economic, profit-oriented activities. Why should the country's economy not pay something for their operation?

Its is hardly to be disputed, however, that state-financed educational and research establishments, too, have almost as much to gain from good access to world literature on technical and scientific subjects. There are thus two differing groups of users to be considered, which cannot be simply dealt with on the same footing when it comes to the question of payment.

After further thorough deliberation on the problems arising in this connection a better insight into the matter could, or rather should rapidly result.

A government that feels obliged, for reasons of clearly understood national interest, to underpin the standard of knowledge and the economic and scientific activities of its citizens by creating the appropriate informational infrastructure can only do this if the facilities set up as a result are utilised accordingly. It will have to promote such utilisation, or at least carefully weigh up all its measures that might tend to affect adversely the utilisation of such facilities, e.g., excessive user charges.

The situation is clearly full of conflicting factors. What can be advocated as a practicable alternative?

In view of the high level of the new burdens on the national budgets, an attempt should first be made to establish which sectors justify such endeavours, having regard to the national development trend in the field of science and business. Two points will emerge clearly in the process, namely:

1) the financial burden will be affected very heavily by the degree of national autonomy aimed at in the particular case. In other words: the greater the national independence considered indispensable, the more money has to be spent. Conversely: the more reliance is placed on trans-frontier cooperation, the more will it be possible to reduce the expenditure;
2) if the additional expenditure needed for the improvement of the informational infrastructure is compared with state budgets for education and training and for the promotion of research, the increases emerge as relatively modest. Their significance as part of the national balance-sheet becomes even smaller considering the number of qualified personnel who will not be sidetracked from their main duties into unproductive literature searches.

Even these two points, however, do not provide sufficient grounds for abandoning the desire for at least partial cost recovery.

But, even so, it must be borne in mind that the lower costs are, the easier it is to recover them. In other words, the governments will have to consider it their duty to provide maximum access to the world's technical and scientific literature for the lowest possible expenditure. Failure to do so would have undesirable consequences: either the additional burden on the budget is made excessive, or an attempt to reduce it by imposing high user charges has a deterrent effect on the users. And this would not only further reduce the prospect of covering costs, but also make the main aim impossible, namely, the use of existing knowledge on a planned basis.

A number of basic principles can be derived from the foregoing considerations:

1) *Organisational and operational measures designed to reduce costs:*

—The acquisition and processing of literature data covering any given field is relatively expensive, both on account of its volume and because it has its origins in a variety of languages and places. The same applies to storage on magnetic tape, which is both practical in itself and an aid to location. *All* national institutions, at least those in industrialised countries, have the same interest in the collection and storage of these data. Collection and initial storage on magnetic media need be done only once, however, for the whole world, as the data can easily be copied, provided that all national institutions can obtain copies of the stored data, either through purchase or under an agreement. The conclusion to be drawn is that international, indeed world-wide, collaboration to this end can result in very beneficial cost-sharing, i.e. a saving for all those taking part in the scheme. This approach entails some loss of national independence in the supplying of information.

—Providing access to magnetic storage for individual national users still

entails substantial spending in terms of funds and manpower on the part of the nation. These are fixed costs, apportioned over the sum of national users, increased by the additional costs incurred in each particular case.

—Where the potential in a nation is so small as to make it disproportionately expensive to service the individual user, as is probably not infrequently the case in Europe, well organised cooperation also provides a way out. A number of neighbouring countries operate the relatively expensive hardware on a joint basis and link their national centres to such regional centres. The common fixed costs then relate to the utilisation figures for the whole region. From the technical angle this kind of network can take many forms. The question of user charges should not be tackled until it is certain that these possibilities of reducing the national budget have been exhausted; this enables the rates to be kept low enough to have no deterrent effect, thus obviating the risk of the desired benefit to the nation being unattainable and making all the expenditure pointless.

2) *In shaping the national pricing policy:*

—Is a single rate of charge to be introduced for all users—those in education and science, as well as business users? In that case it would be logical to subsidise those *users* who are in education and science, otherwise they would be in practice precluded from using the system. This approach would enable a standardised charge to be levied, a very welcome feature as regards the operation of information services.

—If scientific and educational users are either given a free ride or charged less than business users, the information services have the task of checking which rate is appropriate to the users, thus complicating operations.

—In fixing charges, the corresponding rates in neighbouring countries must be taken into consideration, with regard both to their level and division into classes, in order to preclude large differences.

—The rates charged by any commercially operated information services in a country must also be taken into account, owing to their level and their impact on the required subsidisation of the national users in the educational and scientific fields.

Still more problems are sure to be pinpointed in the course of an even more thorough treatment of problems regarding the financing and pricing of information facilities and their use. Regarding user charges, a good case can even be made out for allowing all users free use of the service, particularly if it may be safely assumed that this is a predominant factor in fostering the habit of consistent exploitation of recent findings, for the benefits expected to accrue therefrom, i.e. the enhanced competitiveness of the nation's economy and science, are the basis of the national interest, and this is the ultimate end.

At the same time it cannot be sufficiently stressed that the easing of the burden on public expenditure provided by the revenue from charges levied for information supply services will probably in almost every case be less than the potential saving permitted by international and regional cooperation. It is quite plain that the European Community offers many possibilities for getting the most out of such benefits.

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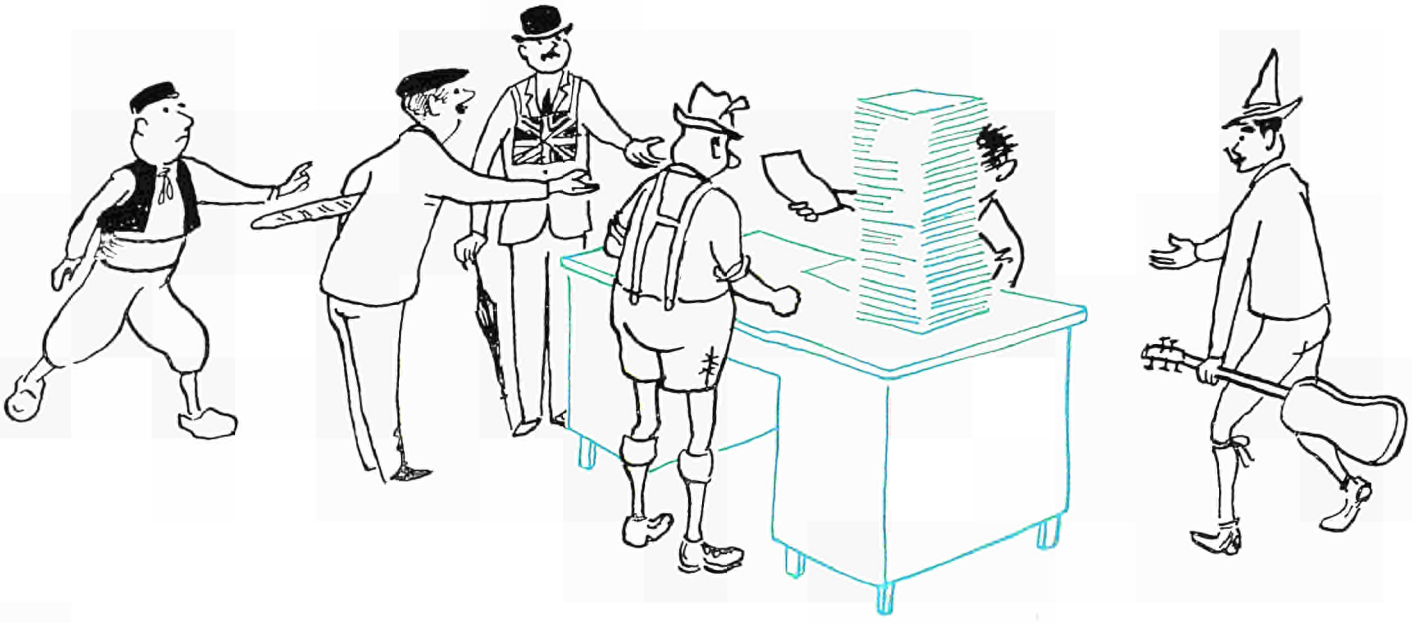

User needs in an information system [1]

A.A. WINTERS

Needs

Often it is of very little help to a worker, be he manager, scientist or engineer, merely to supply him with a long list of publications relevant to the problem with which he is grappling. What he needs is something that will organise and evaluate what is known about a subject and present it in language that he can understand and at the level of detail that he wants, in other words his own hand-tailored information system.

The special features of such individualised systems would be most apparent in those media in which a user seeks first for facts, ideas and suggestions:

1) consolidations of accumulated knowledge (articles reviewing research progress in specific fields, critical compilations of numerical data, state-of-the-art articles in the literature of practice, and the like);
2) handbooks;
3) abstracting and indexing services;
4) library catalogues.

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Need groups

The time when we can afford to supply hand-tailored access for an individual or a very small group is not yet in sight : what is done about this will depend on the efforts of the individual or small group concerned. What can be done for groups of reasonable size—a thousand or so—is a very different matter. It is both feasible and necessary to hand-tailor access to information to what is called "need groups".

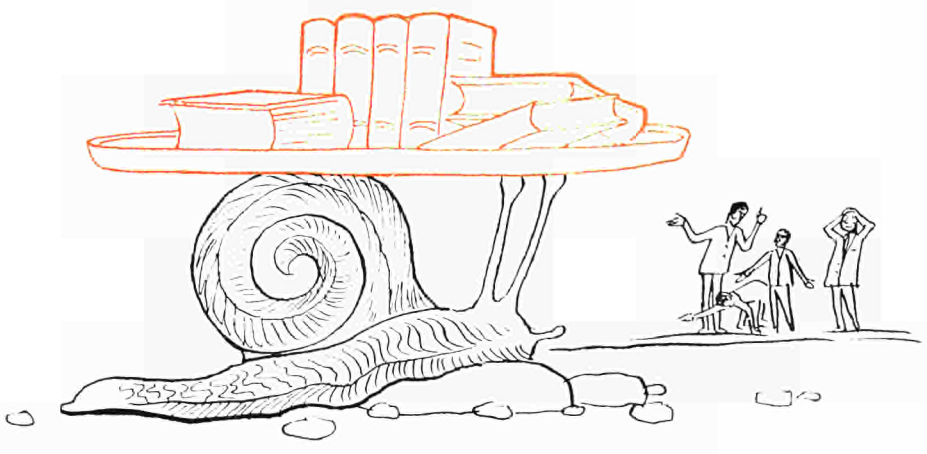
Today, three factors increase the likelihood that significant services will be provided for a need group:

1) substantial size of the group;
2) existence at the national level of a government agency which in the fulfilment of its mission assumes an especially active role in providing information services in its field;
3) existence of an active national and/or international scientific or technical society or industrial association.

Need-group services

The information service that supports such need groups occurs at a level beyond primary (initial publication) and secondary (basic abstracting and indexing) communications; therefore these specialised need-group services are called "third-level services". The emergence of the third-level need-group service is an inevitable consequence of the growth of knowledge, and, in its emphasis on "how to find" rather than on "what is known", it closely parallels the shift that has necessarily occurred in scientific education.

From the four major component services mentioned in the first paragraph to which a user is likely to turn, abstracting and indexing services play by far the most irreplaceable part in the use of scientific and technical information. These services developed in relation to broad disciplines, such as chemistry or biology, and tended to cover only the scholarly journals. Some degree of coverage is now provided in some disciplines (e.g., chemistry) for the wide variety of practice-oriented literature, especially patents and trade publications. The resulting general growth has brought apparent disorder and difficulty, which we are beginning to recognise as the early stage of a major step in hand-tailoring information access for specialised need groups. Rather than less of such growth, we must expect more, both in numbers and diversity, for the time has come when we badly need and are able to separate in our thinking and planning:



[1] This paper is based on certain parts of a report by the Committee on Scientific and Technical Communications (SATCOM) (1).

a) the basic abstracting and indexing function, in which abstracts are obtained, assembled and indexed (often in great depth); and

b) the reprocessing, repackaging function, in which these collected abstracts are made available to need groups in a number of different ways. The latter function may be as simple as sorting out the abstracts associated with part of the field covered by a basic service, though even here pressures for modified emphasis in the abstract and different schemes of organisation and indexing are great. At an intermediate level, it might be necessary to combine abstracts from a number of basic services: water, a natural example, would require information from, e.g., physics, chemistry, biomedicine, agriculture, meteorology, geology, social sciences and engineering. At a deeper level—one not yet attained— reprocessing might include a steady accumulation of comments, observed relationships, and modified descriptions through which the active members of a need group could keep their information in a much more nearly consolidated state. For the near future, therefore, stimulating and expanding reprocessing is the single most important thrust in making scientific and technical information effective for those who use it.

Access to basic services

Need group information services will not spring into being at once. For a long time many workers will have to rely on the basic services, while all workers probably will do so when seeking information outside their areas of specialisation.

Indexing and abstracting services have developed in a wide variety of patterns. The "Guide to the world's Indexing and Abstracting Services in Science and Technology" lists over 1 800 such services, but it is of limited value to the seeker who wishes to find either a service available in his library system that covers his area of search reasonably well or a collection of services that will give him almost exhaustive coverage.

Frequently, all that keeps the user from complete bewilderment is his ignorance of what is available.

A well-structured index to the indexing and abstracting services in the need group field, possibly incorporating an internationally agreed-on classification scheme, could be valuable. Similarly, subject entries in library catalogues might play an important role in guiding users to the most appropriate secondary services.

These measures should also contribute to one of the basic requirements for orderly systems growth, i.e. a common input format. Clearly, there must be a distinction between straightforward merging of data bases, which might affect the sales of the producers, and the merging of information using problem-oriented profiles, which, subject to negotiation of royalty payments, might prove acceptable to producers. Such arrangements would strongly favour the establishment of user- or problem-oriented information *networks* on one hand, and the application of computer and communications technology in the direct interest of the ultimate user of information on the other.

The Information Analysis Centre

A potentially useful tool for the transfer of scientific and technical information exists in the information analysis centres. *COSATI* (2) uses the following comprehensive definition:

"An information analysis centre is a formally structured organisational unit, specifically (but not necessarily) established for the purpose of acquiring, selecting, storing, retrieving, evaluating, analysing and synthetising a body information and/or data in a clearly defined specialised field or pertaining to a specified mission with intent of compiling, digesting, repackaging, or otherwise organising and presenting pertinent information and/or data in a form most authoritative, timely, and useful to a society of peers and management".

Such centres, in fact creating new information, consist of one or more active specialists who:

a) systematically collect, index, and store information in a field:
b) analyse and evaluate this information; and
c) make it available in a form and language and on a level keyed to the needs of specific groups of users.

In the United States, several hundreds of such centres are sponsored by the Federal Government, usually in connection with mission-oriented programs; a number of others, also outside the United States, operate under private or local sponsorship.

The potential benefits of expanding the number and scope of information analysis centres were emphasized in the well-known "Weinberg-report" (3), published in 1963: "Ultimately we believe the specialised centre will become the accepted retailer of information".

Naturally, certain problems of management arise in relation to all forms of scientific and technical communication. Most information services have advisory boards of expert consultants and also hire professional groups to make periodic user studies and surveys. Additionally, members of the operating staffs meet regularly to discuss methods for improving their information services. Many other methods are used, and should be; obtaining critical feedback and keeping services tuned to user needs is a continuous process, and its importance cannot be overemphasized.

Therefore, prospective users must be made aware of the existence of the component information products and services if the process is to operate smoothly and usefully. No matter how good information is, the advantages of having created it are lost or greatly reduced unless this marketing function receives sufficient attention.

The User-System Interface

Apart from a number of systems requirements like administrative, organisational, production and operational requirements there are in an information system certain user-oriented requirements which specify the kind of users to be served and the needs of these users. In 1967 System Development Corporation (4) made a study of some 450 publications on user studies, selecting 58 of them for further quality analysis. The main findings of this analysis are as follows:

1. *Principle of least effort:* people in general expend as little energy as possible in pursuit of their particular goals. Significant departure from this behaviour pattern when seeking information cannot be expected.

   System implication: The system should be easy to use. It should optimise providing the right number of documents in the right form to the right person at the right time with the least effort on the part of the user.

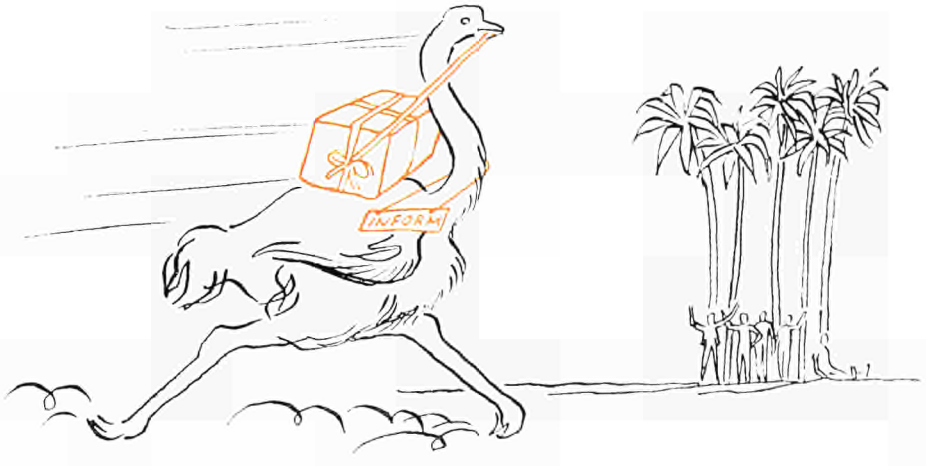
2. *Resistance to change.* Except in cases in which a man is highly motivated, changes in his behaviour occur rather slowly.

   System implication: Changes in the system which directly affect the user should be evolutionary, not revolutionary, unless a critical need is perceived by the user or the system change is clearly easier to use.

3. *Quantity of information consumed:* There is a wide range among users in the quantity of information needed or consumed. This variability is related to such factors as individual motivation and capacity, nature of tasks, etc.

   System implication: The system should be designed so that the range of its services meets the needs of the most, as well as the least, motivated and productive members of the community or need group.

4. *Information lag:* About 20% of scientists and practitioners admit to information gaps or duplication of works caused by the lack or inability to locate information in informal and formal publications.



System implication: The system should make provisions for disseminating information about current research projects and unpublished reports, and reduce the time lag in formal publications.

5. *User's needs vary:* Information requirements vary with the individual scientist, practitioner, and engineer as to his role, discipline, project and environment.

   System implication: The system should be capable of supporting a variety of different user configurations.

6. *Quality of information:* The quantity of information available in many fields is exceeding the capacity of the individual to consume it. There is an expressed need for better rather than more information.

   System implication: The system should provide for an improvement in the quality of documentation produced, the condensing of information, and the purging or retiring of files and document stores of unused materials.

7. *Awareness of information services:* Many users are unaware of information sources, how to utilise them, or what services are available to aid them with their problems.

   System implication: The system should be designed and operated so that its retail services and responsibilities can be clearly understood by the scientific and technical community. It should provide for the educating and training of users and prospective user in its services.

8. *Quality of services:* The user often is disappointed with the quality of service rendered by libraries, information agencies, and their associated personnel. Collections are sometimes inadequate.

   System implication: (a) The system should provide a mechanism for obtaining competent qualified personnel. This should include periodic review of position descriptions, specification of training requirements, review of manning levels, and sponsoring of training program development, both within the system and in the academic curriculum. (b) The system should provide for quality assurance programs designed to measure the efficiency of its service.

9. *User studies:* Research programs to determine user needs have been hampered in the past by lack of funds, lack of co-ordinated planning, lack of quality and lack of sufficient recognition of their value. Programs for the systematic study of user patterns are almost non existent.

   System implication: The system should provide for a broad program of research that includes particular attention to determining user needs and user satisfaction. Such a program should strive for improving techniques for measuring user behaviour as well as the behaviour itself.

10. *Foreign publications:* Users frequently find difficulty in obtaining foreign documents and translations of these foreign publications.

    System implication: The system should provide for easy access to all important foreign publications, preferably with translations in English, French and German.

Responsibilities

It is unlikely which information needs that certain professional groups have in common can be met efficiently and effectively by the management of the institutions to which they belong. Therefore, it is believed that the hand-tailored services of greatest assistance to such groups in coping with their information problems must be established on the basis of common *professional* interest, rather than common *employers*. However, if the information requirements that define need groups are to be met, both formal and informal organisations must participate in meeting them. Scientific, technical and industrial societies whose member-

ship include significant numbers of potential users of information should also take major responsibility for identifying needs for critical reviews and data compilations, furthering their preparation, fostering awareness of their existence and stimulating education in their use, where possible also with the help of for-profit organisations.

There is no doubt that governments and regional governmental structures with executive power like the European Communities are accepting their share of the responsibility to satisfy the user of information, if only because they are large-scale users themselves. However, governments tend to look at problems broadly. Indeed, it would be foolish for them not to make full use of the potential of an inventive and expert information industry, whether acting on its own initiative or partly under government sponsorship : for instance the urgent need for more progress reports and the potentials of audio-visual means offer great possibilities here. The more closely information becomes tailored to user needs, the more it will follow the normal economic pattern of any other useful commodity. But industry should realise this as well and play its full rôle here, in a complementary rather than a competitive position. For governments, economic profitability cannot always be the only yardstick when assessing the usefulness of an information service to a need group. They may have to accept the burden of subsidies, in the hope of long-term quantitative as well as qualitative economic benefit, particularly in providing information for small and medium industry and for other non-paying parts of the information transfer process. The assumption of this kind of responsibility by government inevitably leads to increasing government influence on those activities, for instance to the creation of large data banks capable of acting as "wholesale reservoirs" which the user-oriented retail services can tap.

Ways will have to be found to establish, at the national as well as at the regional international level, a continuing dialogue between governmental information/communication foci and the representatives of users and user groups, be they governmental, industrial, scientific or professional. Not only will the expression of user needs in one form or another be an indispensable, indeed prime ingredient in the formulation of information/communication policies, but also the user's needs will be better served by healty pressure on government's thinking and financing. Good communications between the public and private sectors are therefore vital.

Bibliography: 1) Scientific and Technical Communications; a report by the Committee on Scientific and Technical Communication of the National Academy of Sciences - National Academy of Engineering. Washington D.C., National Academy of Sciences, 1969. 2) Committee on Scientific and Technical Information of the Federal Council for Science and Technology, Executive Office of the President of the United States of America. 3) Science, Government, and Information. A report of the U.S. President's Science Advisory Committee. Washington D.C., The White House, 1963. 4) National Document-Handling Systems for Sciences and Technology, edited by System Development Corporation. New York, 1967.