CHAPTER 5

INFORMATION NEEDS OF DEFENCE SCIENTISTS IN INDIA

National defence gets top priority in any country's policy formulation and planning process. Every nation endeavors to keep its armed forces in the highest level of operational efficiency. In India, the Defence R&D Organisation (DRDO) is concerned primarily with the design and development of new and sophisticated weapons and equipment based on the operational requirements projected by the Services, providing help in their indigenous production and rendering scientific advice to the Services as needed.

Information forms an integral part of any R&D programme. It becomes all the more significant when it is required for strategic areas, such as defence R&D, which are directly linked with the national security. An efficient information system is vital for the scientists to avoid duplication in research efforts and keep up the schedule for completion of the projects through effective utilisation of the information provided by the system at every stage of the project work. Information is equally important for decision-making, planning and control. For purchasing new weapons and equipment, it is only by studying the cost-effectiveness of various systems vis-a-vis operational effectiveness that the correct choice can be made. As per its charter, Defence Scientific Information and Documentation Centre (DESIDOC) serves the information needs of the defence R&D Headquarters (HQrs) and coordinates the activities of TICs attached to the DRDO labs/estts, the Scientific Adviser to the Defence Minister, Chief Controllers of R&D, Scientific Advisers to the three Service Chiefs and Technical Directors at the defence R&D HQrs. The defence R&D labs/estts which are under the control of the HQrs are located at different places and are engaged in various defence R&D activities of the Ministry of Defence. A majority
of the information requirements of DRDO are project-oriented as well as mission-oriented (Murthy and Rangra, 1982).

1. WHY TO SURVEY INFORMATION NEEDS AND HABITS?

The picture of information needs (INs) and use is indeed complex. However, if we could analyse the inherent variation in user behaviour to detect and describe the patterns of information needs and use, it may help the information specialists to improve information services by shaping them to match the needs of individual specialists. The data derived from studies of information needs may be of considerable use in managerial decisions. This information might be useful in discovering the type of improvements that are needed to utilise the existing information services effectively, as well as answering questions such as: What type of publicity is required to make the information services and sources better known to the users? What type of new programmes may be started to bring the services in harmony with the information gathering habits of the users? This type of information may provide clues by which to know whether it is possible to change the information-seeking behaviour so as to exploit the existing resources.

The study of INs and uses is a rational activity when viewed as a means to an end. The objectives of studying INs and uses may be (a) the explanation of observed phenomena of information use or expressed need; (b) the prediction of instances of information use; (c) the control and thereby improvement of the utilization of information through manipulation of essential conditions; the achievement of such objects must be preceded by certain creative activities, (d) the description of observed information use, (e) the definition of convenient and appropriate concepts for describing and dealing with information use, and (f) the theorizing of causal or quantitative relationships between information use and associated factors.

The six activities mentioned above are the essence of rational science of formal information sources (Lipetz, 1965), and age of literature used. INs, it was found, could be related easily to the three broad types: current, specific and exhaustive, which had been recognized by Voigt (1961).
2. INFORMATION PATTERNS

Whether from print or from other sources, a scientist needs information in three identifiable areas (Voigt, 1961):

(i) **Current information**: The need to know what others have done recently or are doing at the moment. Personal contacts are important, but scientists regard literature as the primary source.

(ii) **Specific information**: The need is directly connected with a research or operational problem at hand, the need for a bit of data, a method, the construction of a piece of apparatus, an equation, or an explanation or a phenomenon. This requirement is of vital importance to the scientist.

(iii) **Exhaustive information**: The need to check through all relevant information existing on a subject. This need arises at the start of work on a new research project or when the results of investigations are ready to be reported.

3. VARIABLES INFLUENCING INFORMATION NEEDS

Maurice B. Line (1969), from his studies on information needs of scientists suggests that classifying information needs by function and environment would help to cut across the barriers imposed by the separate subject disciplines. Functional variables would include such areas of endeavor as research, teaching and training, management, social work and administration, the press and broadcasting, politics, business and commerce, study and learning. By 'environment', it is meant whether the scientist is employed in an academic institution, a research organisation, industry, government, professional association, the press, or broadcasting. He also takes into account an extensive set of individual characteristics: not only the usual demographic variables but such factors as persistence, thoroughness, independence, and ability to take in information.

The variables influencing information seeking behaviour are discussed by Mick et al, (1980). They examined variables affecting information behaviour -- individual, work environment, and task attributes (Table 5.1).
### TABLE 5.1
VARIABLES AFFECTING INFORMATION BEHAVIOUR

<table>
<thead>
<tr>
<th>Individual attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography</td>
</tr>
<tr>
<td>Training and professional background</td>
</tr>
<tr>
<td>Organisational role and function</td>
</tr>
<tr>
<td>Attitudes related to work and profession</td>
</tr>
<tr>
<td>Attitudes related to the value of information</td>
</tr>
<tr>
<td>Work environment attributes</td>
</tr>
<tr>
<td>Organisation demography</td>
</tr>
<tr>
<td>Work teams</td>
</tr>
<tr>
<td>Communication networks</td>
</tr>
<tr>
<td>Task attributes</td>
</tr>
<tr>
<td>Basic versus applied</td>
</tr>
<tr>
<td>Diffuseness of the task</td>
</tr>
<tr>
<td>Rate of obsolescence of information</td>
</tr>
<tr>
<td>Phase of the project</td>
</tr>
<tr>
<td>Criteria for satisfactory completion of the task</td>
</tr>
</tbody>
</table>

#### 4. INFORMATION NEEDS OF SCIENTISTS AND TECHNOLOGISTS

Scientists often find themselves in situations where they must make a decision, answer a question, locate a fact, solve a problem, or understand something. In attempting to meet these needs, scientists use, both formally and informally, a variety of information sources (e.g., libraries, individuals, computer databases), via a variety of methods (e.g., phone, letter, face-to-face contact) and in a variety of languages.

Since Bernal (1948) made his pilot study for the Royal Society’s Scientific Information Conference, there have been several hundred reported attempts to investigate the methods by which scientists obtain the information they need and then
put it to use. However, there has been no large-scale attempt to obtain a broad consensus on the total information problem, as seen by the working scientist.

In their efforts to establish and maintain contact with current work, DRDO scientists are continually on the alert for, or actively seeking S&T information relevant to their ongoing or planned work. Further, they watch closely the performance of the system as it operates to disseminate, display and store the fruits of their own scientific efforts.

At least half of the scientists' needs for information are of a kind that can be met by fairly straightforward reference work (Hanson, 1964), by short and partial literature searches, and by the provision of fewer than half-a-dozen selected documents or references. Demands necessitating methodical literature searches of a mass of literature probably account for well under 15 per cent of the total. By studying the habits, traditions and behaviour of those already using an information service, one can adjust library service to give greater satisfaction to those already using the service, adjust service so that it becomes cost-effective and reaches and arouses the interest of the potential users and turns them into actual users.

Paisley (1968) suggests a conceptual framework that places the information user, specifically the scientist/technologist, within a set of systems that might be visualised as almost-concentric circles going from the broadest to the most specific influence. These systems, within which the scientist operates, are his/her culture, a political system, a membership group, a reference group, an invisible college, a formal organisation, a work team, his/her own head, a legal/economic system, and a formal information system. The more senior the person in a large organisation, the less predictable are his/her information needs. Commonly, people do not know what information they need until a particular set of circumstances arises and then they want very specific information instantly.

5. INFORMATION NEEDS OF DRDO SCIENTISTS

Scientists have always sought information relevant to their research, information about research results and methods used to obtain those results (Wert, 1987). A DRDO scientist seeks information to meet three basic needs. Firstly, to know what
other researchers in the same field have recently been completed or are presently being studied. This information keeps the scientists current with the field and provides a broad base to give meaning to their work. This type of information is usually referred to as primary information. The primary sources of information report the results of scholarly research. These include all documents that present new ideas and research findings -- scientific journals, patents, technical reports, conference proceedings, transactions, theses, government documents, and computer output, as well as oral recordings, note books, diaries, archives and manuscripts.

The second need is for specific information essential for the day-to-day research operations that helps the researcher to understand the phenomenon under observation (e.g., physical data, apparatus design, research or experimental methods, explanation of phenomena). This information is needed promptly and frequently. Sources of this type of information include documents compiled from primary sources of information, such as monographs, textbooks, treatises, manuals and guides, encyclopedias, dictionaries, handbooks and directories. These sources of information are referred to as secondary sources. Abstracting and indexing tools are also considered to be a part of this category of materials.

Another need is to identify and locate all relevant information that exists on a subject. This need is greatest when a scientist moves into a new area of research, or when a scientist begins to prepare results of research for publication. At this point, abstracting and indexing services, bibliographies and guides to the literature are usually consulted. These three needs for information are often referred to in the literature as the current approach, the everyday approach, and the exhaustive approach. The relative importance of these three types of needs varies among scientists. The fulfillment of the need for current and exhaustive information tends to be stronger among scientists, while the fulfillment of the need for everyday information tends to be less important.

The INs of DRDO are mission-oriented, project-oriented, and problem-oriented, depending upon the level of management served. Modern management recognizes three levels, which differ in their requirement of information in respect of quality, quantity and mode of its presentation. These levels are:

80
Strategic - This represents the top management in DRDO.
Tactical - This represents middle management and may comprise the Directors of the labs/estts.
Operational - This represents lower level of management and include Project Leaders and Group Officers.

This categorisation into three levels cannot be taken as rigid and some overlap is inescapable. All managers direct the resources to the attainment of the objectives. The strategic level is most interested in direction that leads to the accomplishment of a long-range project, general objectives and wants of mission-oriented information. The tactical level is responsible for execution of the projects and may be interested in more of project-oriented information. The operational level is concerned with immediate successive objectives for progressing the projects and is interested in problem-oriented and project-oriented information. R&D activity in DRDO is highly need-based. For the purpose of this study, the scientists are grouped into three broad categories according to their status:

(i) Junior scientists (JSO and Scientist B),
(ii) Intermediate scientists (Scientists C and D), and
(iii) Senior scientists (Scientists E and F).

To assess the needs of DRDO scientists one should assess the needs of junior, intermediate and senior scientists collectively.

5.1. The Junior Scientist

After receiving degree, the young post-graduate enters government service and is engaged in the activities of a junior scientist. There are cases in which, due to his own traits or lack of opportunities, he may continue to be a junior scientist for the rest of his life. When a young scientist starts his first job in government, very often he feels frustrated. He has completed studies, obtained his degree, but has no experience. On entering an organisation he is overwhelmed by the practical expertise he must
acquire. In most cases he follows his supervisor's advice, asks him questions and observes other workers.

If he is in a project team, he can have contact only his project leader. The project leader is the centre of communication. He explains the job, he demonstrates the equipment and instrumentation, he goes with the young scientist and visits the working places, gives instructions, looks around and at a glance assesses the situation. At the end of each project, the project leader writes reports to meet his obligations towards the organisation. The young scientist by observation of work procedure, by actually working with the equipment and by conversations with the supervisor and colleagues learns a lot.

At the beginning of his career, the young scientist reads as a matter of habit acquired at the university, but as he progresses towards the next stage of the intermediate scientist, the proportion of information acquired by reading slowly diminishes. The reason for this is the constant pressure of time and the need for information which is not readily acquired from a single or a set of printed sources. All young scientists have a similar task: to gain experience. New practical information is of extreme value to them. They observe and repeat simple jobs done by the supervisors. The new information gained is quickly assimilated, compared and contrasted with the knowledge previously obtained at the university and digested into knowledge.

5.2. The Intermediate Scientist

With experience, the junior scientist progresses to the state of the intermediate scientist. In most cases, the intermediate scientist becomes a project leader of lower level technologists, including the junior scientists. He knows considerably more after at least five years of experience. But his theoretical knowledge needs updating. This is the time when many scientists decide to take a higher degree. This is the turning point in the career of a scientist; his specialisation is now defined clearly, either by direction of experience, through an assignment to a particular job or by further education. He has gained the ability to make judgements and decisions, but these are still nearly always reviewed by a higher authority. The development of judgement is very
important in the career of a scientist.

With the advance of his career, he is frequently called on to make decisions, which must be taken even if all factual data is not available. This uncertainty, risk-taking, is part of the scientist's competence. Very often he will be forced to take a snap decision and only later to substantiate this decision with factual and calculated evidence.

At this stage, the scientist communicates with a wider spectrum of other scientists. In a big organisation such as DRDO, the scientist communicates with the Director and with other project officers. This communication among the various scientists is essential for the successful completion of any project. At this stage, the scientist reads less, but has more communication links with other scientists, starts to attend conferences, is sent to visit other places and writes reports and papers. A change of environment, if he moves to other jobs, also influences his horizon. The more senior his appointment, the more certain will he be of the correctness of his judgement.

5.3. The Senior Scientist

The senior scientist has less opportunities for direct use of technical skills and greater need for managerial skills. His preparation is adequate for the first two stages, junior and intermediate, but may not suffice for senior posts. Some scientists return to the university for adult education in management. Some employers recognize the need for additional education and provide the opportunity to obtain it. The senior scientist may be a director or deputy director of an organisation. He tries to maintain his general professional knowledge by reading general reports, attending conferences, or by delegating his junior staff to keep him informed on new developments. Those scientists who are now responsible for the economic soundness of their organisation must put in considerable effort in learning to develop their own managerial skills in order to take decisions involving large expenditures and maintain financial control. They communicate widely with the higher authorities of their organisations and meet many persons outside their organisation. They must have the abilities of a leader; they control the efforts of a group of individuals working for them
in order to achieve some objectives; they plan, organise, direct and control the activities of the organisation; they take decisions on the type and size of practice, the kind of clientele, and methods of operation. They recruit and are responsible for the training of personnel; provide the capital and are responsible for the economics of their establishments.

Whatever be the status of scientists, information is required in all the phases of the lifecycle of a progressing project, namely conceptual, initiation, operational and terminal phases. Information on the progress of the projects is vital for decision-making, planning and control by the HQrs. For example, for advising on the purchase of new weapons and equipment, the DRDO authorities need information on the cost-effectiveness of various systems vis-a-vis operational effectiveness to make the correct choice and for this purpose information services play a significant role.

Until now, the most predictable and justified complaint against user studies has been the defective methodology used. Thus, many performers as well as foes of user studies still falsely identify these studies with opinion polls, and poorly designed opinion polls at that. Others do study the communication behaviour and experiences (as differentiated from opinions) of scientists, but use primitive data gathering instruments, or categories too much tied to specific situations to make generalizations and extrapolations plausible, or they stop short of analysing their data in terms of more than two variables at a time. Even some of the studies that excel in some aspects of their research technique fall strangely short in others: rigorous sampling techniques are wed to crude data-gathering instruments, sophisticated analysis to haphazard sampling, ingenious categorisations of experiences to shot-gun cross tabulations, and so on and so forth.

The literature on INs and uses in S&T is growing in size and maturing in quality. We are moving towards strong guidelines for information system design and evaluation (Paisley, 1968). More adequate theories of information processing behaviour will follow. On the one hand INs have proved to be extremely complex and varied and user studies have so far proved inadequate to the task of completely revealing the nature and needs of information users. On the other hand it is very clear that even if we were to know exactly what would meet users' requirements in full, we would not be able to provide it to all users in all circumstances.
The scientist's need for information has remained the same over the years. Basically the services of libraries and information centres designed to fulfill these needs have not changed. It is the way in which the services are provided that has changed. Methods of providing services will continue to change as the amount of information increases and as new technologies are developed. As libraries and information centres become more electronic, their personnel need information-handling skills to enable them to instruct end-users. They will need to promote awareness about new developments, new techniques, and new sources of information. It will be necessary for them to be knowledgeable about information sources, both internal and external, and document collections. They will act as consultants when the end-user has problems or needs advice on database sources for various types of information. They will also be responsible for developing the information technologies necessary to develop, maintain and access systems of information. Quality and cost of information will be high on their list of priorities. They will need to know the costs of information systems and resources and budget accordingly.

Although more and more librarians and others now appreciate the value of user surveys and are busy carrying out local, regional and national investigations, many of them are not fully aware of the problems and techniques associated with such studies (Wood, 1969). As Line (1980) in her book on library surveys states, 'too often the result of a survey is an indigestible mass of badly interpreted data collected from a poorly chosen inadequate sample by unreliable and invalid methods according to an ill-conceived design'.

85