Chapter-- 3

MATERIALS AND METHODOLOGY
OF THIS STUDY
3.1 INTRODUCTION

Information need does not have a constant feature. It is known that information needs are highly personal, varying even amongst those doing the same nature of work in the same organization. In general, they are affected by factors like, subject or field of study; range of information sources available; use to which information is put; background; motivation; professional orientation, and other individual characteristics of users; the social and economical system surrounding the user population; the consequences of information, etc. Moreover, information needs of a specific community of users are based on human behaviour, which is a complicated phenomenon. Therefore, any research on this topic has to take all these conditions into consideration. The present work on information needs of scientists and technologists of ONGC has been designed on the basis of all these aspects. Maximum care and efforts have been taken to collect information from the scientists and technologists working in the organization.

3.2 CHOICE OF THE SAMPLE

3.2.1 Characteristics of the Sample

The study explores the information needs of scientists and technologists of ONGC and extent of use of library facilities by them. The ‘scientists’ are executives having expert knowledge of one or more sciences, especially in natural or physical sciences), whereas
'technologists' are specialists in technologies" (American Heritage Dictionary, 2003). Similarly, engineers are persons who are trained or professionally engaged in a branch of engineering. Further, it clarifies that engineers are to plan, manage, and put through by skillful acts or contrivance, maneuver (AHD). They are involved in industrial competitiveness and technological innovations.

In ONGC, the technical professionals comprised of scientists and engineers (technologists). Here the category of scientists, as a part of target sample includes geologists, geophysicists, geochemists, reservoir engineers, surveyors, and seismic data analysts. The engineers belong to disciplines such as oil production, drilling, electrical, mechanical, instrumentation, well work over, electronics & telecommunication, and data transmission. Technologists as the target of the part of sample of this study are comprised of corporate groups of various disciplines that carry slog of executions (E5 to E9). The corporate executives form the part of decision making group, corporate planning and policy making groups in the process of technological upgradation, restructuring, transformation, capitalization, techno-economic thrusts, prospective vision of oil and gas production, value added products, bench marking, quality culture, and over all sustainable developments of organizations. The duties and responsibilities of scientists and engineers vary in accordance with the organizational needs across the entire macrocosm. The specialization of individual scientists and engineers are prone to deviation of various functioning according to the demands of regional centers/work
It is obvious to essentially venture for deviated demands of performance other than their own specialized area of interest. The core areas of ONGC functioning need core competency of scientists and engineers where their performances are absolutely in tune with their specialized proficiencies in specific areas. These core groups have, in turn to perform some interrelated jobs in cohesion with other non-technical processes like bidding, resource allocation, budgeting, procurement, technical auditing, tender floating, bid evaluation, coordination, etc. They are known as techno-managerial groups.

3.2.2 Sample Selection Strategy

A good sample is considered to the index as its resemblance to its parent population. It is also large enough to allow generalizations, within measurable limits of accuracy, to the subject group from which it was selected. While planning the study the most important thing is to decide the size of the sample to be investigated. The size of sample varies greatly in different work groups. Chen and Hernon (1982) considered a total sample of 2400 people from six states. Cobby (1980) collected data from 2003 individuals from 46 towns. Amey (1983) considered only a sample of 292 persons among class of Canadian Urban centre. Bichteler and Ward (1989) collected 56 geoscientists' interviews in 8 states with concentration in East, Midwest, and Southwest. According to Busha and Harter (1980) the more homogenous or alike a population is with respect to pertinent characteristics or variables, the smaller the sample can be.
The scientists and engineers of this organization work in the industrial and business environment of a national level. As mentioned in the earlier chapter the organization has got 22 work centers/projects in addition to 9 integrated R&D institutes which are spread all over the country with its headquarters at Dehradun. The basic objectives of the organization are to prepare scientific plans for oil exploration, development and production of crude oil, natural gas and other value added products. So, these technical executives are involved in variety of operations and activities of the organization.

The total manpower strength available in ONGC is quite high in number. The technical executives (scientists and engineers) are about 20305, also quite large in population, and they are scattered over various offices and projects of ONGC across the country. So, the present work has been designed to carry out this study with the selection of a suitable sample. The selection of the sample for the present work is based on the following criteria:

1. Scientists and engineers posted in R&D institutes /projects of ONGC.

2. Projects/Work centre/Assets have been chosen where the concerned library services are rendered.

3. Scientists and engineers engaged in corporate planning, policy and decision-making.

4. Scientists and engineers executing various co-ordination work among the middle management, top management of asset managers and project managers.
The total population of scientists and engineers of this study is 11,165 (Table-6), which are 54.99 percent of the total strength. Out of the total population, a sample of 1,105 (9.89 %) comprising of scientists and engineers are selected at random on the basis of above-mentioned criteria. The distribution of population of the study is as follows:

Table—6: Target Population of Scientists & Engineers

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Regions/ Projects</th>
<th>Target Population</th>
<th>S.No.</th>
<th>Regions/ Projects</th>
<th>Target Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HQ (Dehradun)</td>
<td>143</td>
<td>14.</td>
<td>Mumbai Region</td>
<td>3717</td>
</tr>
<tr>
<td>2.</td>
<td>Dehradun—Co-ordination</td>
<td>60</td>
<td>15.</td>
<td>Mumbai—IOGPT</td>
<td>102</td>
</tr>
<tr>
<td>10.</td>
<td>Dehradun—IMD</td>
<td>31</td>
<td>23.</td>
<td>Ankleswar</td>
<td>133</td>
</tr>
<tr>
<td>12.</td>
<td>Assam Region</td>
<td>2214</td>
<td>25.</td>
<td>Mehsana</td>
<td>410</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,165</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

However, there are various expressed limitations of inaccessibility of respondents of target population due to remote locations of work places, restricted areas of operations, rare vicinity of business centres, administrative and legal prohibitions, etc. have forced the researcher to squeeze the target population to cover to the utmost extent of 11,165 (Table-7).
### Table—7: Region wise distribution of questionnaires and rate of responses

| S.No. | Regions | Engineers | | Scientists | |
|-------|---------|-----------|--------------------|----------------|
|       |         | Sample / Distribution | Responses | Percentage | Sample / Distribution | Responses | Percentage |
| 1.    | WR      | 150       | 110                | 73.33       | 75               | 42         | 56.0      |
| 2.    | MR      | 190       | 122                | 64.21       | 75               | 30         | 40.0      |
| 3.    | ER      | 95        | 50                 | 52.63       | 70               | 26         | 37.14     |
| 4.    | SR      | 100       | 36                 | 36.0        | 40               | 22         | 55.0      |
| 5.    | HQ      | 75        | 40                 | 53.33       | 70               | 47         | 67.14     |
| 6.    | CR      | 45        | 14                 | 31.11       | 30               | 6          | 20.0      |
| 7.    | NR      | 15        | 10                 | 66.67       | 10               | 5          | 50.0      |
| 8.    | Delhi   | 15        | 8                  | 53.33       | 50               | 18         | 36        |
| Total |         | 685       | 390                | 56.93       | 420              | 196        | 46.67     |

### 3.3 METHODS OF DATA COLLECTION

Data collection usually involves measuring some research phenomena, whether it is a process, or human subject's behaviour. Data collection has to be given long and hard considerations, for both cost and quality. The data gathering method determines the type and quality of the data collected and to obtain a comprehensive and accurate picture of information need, it is necessary to select the method with care. The choice of methods is determined not just by the issues (problems) being studied (user needs), but also by the user group being investigated. Busha and Harter discussed various methods for data collection and also concluded that researchers should be aware that no single method is appropriate for all types of investigations. Ellis (1997) observed the change in the nature of data collection from a macro approach, studying a large group via questionnaires or structured

Adams and Rood (1978) applied a developed technique to query massive audiences; these studies use one or a combination of standard methodologies as questionnaires, personal interviews, critical incident techniques, or observation of behaviour.

Nicolas (1996) recommended four methods for collecting data for investigating information needs; i.e. interviews, Questionnaires, Diaries, and Observations, and also predicted that these four methods may yield high value data. In a relevant study, Nkereuwem (1984) used Questionnaire method for surveying the information use by the scientists and engineers in petroleum industry of Nigeria.

In the present study it was required to select suitable methods of study to get a comprehensive and accurate picture of information needs of scientists and engineers of ONGC. The collection of data on information needs from the target respondents of this study is not an easy task because of the following reasons:

- Busy schedule due to nature of work and routines, meetings, technical discussions.
- Being occupied with highly placed position and accessibility is not easy.
- Lack of acquaintance with such queries and problems.
- Change over of duties, movements and transfers of technical officers.
- Expanded business activities across the country and wide range of projects/ work centres/ R & D institutes.
- Fear of revelation of individual's identity.
- Refusal due to latent caveats.

Moreover, this type of study needs co-operation of the respondents. It was therefore, affirmed that a single method cannot be appropriate to collect the data from all levels of scientists and engineers of ONGC. So, finally the three potential methods: Questionnaire, Interviews, and Observations were applied to collect the data from among the target population. The selection of the technique for a specific group of target respondents was finalized on the basis of their position and incumbencies. The observation method applied for mostly those scientists and engineers who are quite busy in the operational activities and other oil & gas production and drilling processes. The observations were made on the same lines and formats of the questionnaires. Here, instead of inquiring the respondents, the desired information was filled by the researcher on the basis of their activities and information seeking behaviour. The necessary data was recorded in a specified manner and thus, 38(3.44%) of the target sample of scientists and engineers were surveyed by the observation techniques. The courtesies of concerned libraries of the projects/plant/ R&D institutes were extended to accomplish these exercises. This was carried out for
over the period of six months. The following projects /work centres /institutes were surveyed to collect the data of this type.

1. Mumbai Region-------- WOB
2. Western Region--------Baroda, Ahmedabad project, Mehsana, Ankleswar.
3. Eastern Region--------Nazira, Jorhat project
4. Central Region--------Silchar project, West Bengal project
5. Southern Region--------Rajahmundry project, Chennai Assets
6. HQ--------------------- Dehradun establishments.
7. Uran------------------- Uran plant

Besides the observation technique, the Interview method was applied by the researcher in 91(8.24%) cases following the necessary appointments, permissions and routine procedures. This was done mainly with E-6 to E-8 level of corporate group of scientists and engineers. The level E-9, a leading slog of senior corporate executives is rarely accessible to interact for this purpose. The questions asked in the interviews of the same format of the questionnaires, were used for recording the data. The interview generally lasted for about 30 to 45 minutes for each case depending on the availability and accessibility of these corporate executives.

Finally, the most potential technique of data collection the 'Questionnaire method' was used to collect the necessary data from 976(88.33%) of total sample of scientists and engineers, which was the highest among the three techniques of data collection exercises. The study was made on random sampling with the care to involve all the levels of scientists and engineers. For this, a preliminary draft of the
questionnaire was prepared and circulated to 30 executives and the feedback was collected; that was very much encouraging and reflected the enthusiasm of respondents. The final draft of the questionnaire was thus, prepared on the basis of the preliminary feedback received. Finally, the designed questionnaires were handed over to the majority of scientists and engineers personally with a request to return the same within a fortnight. This exercise was done at different periods of research as some of the questionnaires were also mailed to various offices of distant locations. These questionnaires were mailed to following work places/centres

1. Southern Region-Chennai
2. Rajahmundry project-Rajahmundry
3. Central Region-Kolkata, Silchar
4. Western Region- Baroda project, Mehsana Project, Ankleswar Project
5. IRS-Ahmedabad
6. IPSHEM-Goa
7. Eastern Region-Nazira, Jorhat
8. Uran plant-Uran
9. IOGPT-Panvel
10. IEOT-Panvel.
11. RTI—Panvel

For this work, the researcher traveled personally to Chennai, Rajahmundry, Uran Plant (Uran), IOGPT, IEOT, RTI, Panvel work centres where the most of questionnaire could not be received.
Holding the personal interaction with typical respondents, the two percent objective of collection of data was accomplished by diffusing their doubts & fears. The questionnaire was also handed over to the scientists and engineers, and received personally at the following local establishments:

1. KDMIPE-Dehradun
2. IDT--Dehradun
3. IMD-Dehradun
4. Anveshan Bhavan-Dehradun
5. Tel Bhavan--Dehradun

The advantage of the collecting data personally by hand through this method was found little easier because of person involvement of the researcher. The researcher’s presence was also vital in the way to those difficult but important respondents (2%), who were not easily ready to provide the data due to their own reasons. However, in the first attempt only 176(18.03%) respondents returned the questionnaire out of 976 circulated. Thereafter a gap of 2 months researcher again pursued the responding engineers and scientists, and could be able to collect 281 questionnaires. Thus, total number of questionnaires collected was 457. The total responses received through observations, interviews and questionnaire methods were 586(53.03%). The distribution of response of the questionnaires as per their age is given in table-8 and the institute /project wise distribution is listed in table-9.
Table—8: Age wise Distribution of Responses

<table>
<thead>
<tr>
<th>S.No</th>
<th>Age groups</th>
<th>Engineers</th>
<th>Scientists</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>25-30</td>
<td>57 (14.61)</td>
<td>23 (11.73)</td>
</tr>
<tr>
<td>2.</td>
<td>31-40</td>
<td>221 (56.66)</td>
<td>120 (61.22)</td>
</tr>
<tr>
<td>3.</td>
<td>41-50</td>
<td>96 (24.61)</td>
<td>45 (22.95)</td>
</tr>
<tr>
<td>4.</td>
<td>51-60</td>
<td>16 (4.10)</td>
<td>8 (4.08)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>390</td>
<td>196</td>
</tr>
</tbody>
</table>

Table—9: Institutes / Project wise Responses (E-0 to E-9)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Institutes</th>
<th>Engineers</th>
<th>Scientists</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>KDMIPE</td>
<td>10 (2.56)</td>
<td>23 (11.73)</td>
</tr>
<tr>
<td>2.</td>
<td>IDT</td>
<td>11 (2.82)</td>
<td>12 (6.12)</td>
</tr>
<tr>
<td>3.</td>
<td>IMD</td>
<td>8 (2.05)</td>
<td>6 (3.06)</td>
</tr>
<tr>
<td>4.</td>
<td>GEOPIC</td>
<td>11 (2.82)</td>
<td>6 (3.06)</td>
</tr>
<tr>
<td>5.</td>
<td>IOGPT</td>
<td>28 (7.17)</td>
<td>4 (2.04)</td>
</tr>
<tr>
<td>6.</td>
<td>IEOT</td>
<td>16 (4.10)</td>
<td>2 (1.02)</td>
</tr>
<tr>
<td>7.</td>
<td>IPSHEM</td>
<td>4 (1.02)</td>
<td>8 (4.08)</td>
</tr>
<tr>
<td>8.</td>
<td>IRS</td>
<td>15 (3.84)</td>
<td>27 (13.77)</td>
</tr>
<tr>
<td>9.</td>
<td>INBIGS</td>
<td>3 (0.76)</td>
<td>6 (3.06)</td>
</tr>
<tr>
<td>10.</td>
<td>RTI</td>
<td>4 (1.02)</td>
<td>3 (1.53)</td>
</tr>
<tr>
<td>11.</td>
<td>Projects/Plants</td>
<td>280 (71.79)</td>
<td>99 (50.51)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>390</td>
<td>196</td>
</tr>
</tbody>
</table>

3.4 QUESTIONNAIRES

Questionnaires are often used in surveys as the primary data collection instruments. The utmost care is taken to develop the kinds of question,
or surveys items, in view to accurately measure what the researcher was aimed to investigate. The purpose of the research by applying questionnaires is to obtain valid and reliable data, so that the objective laid down in the initial stage could be fulfilled. For this, the researcher conducted a thorough search and literature reviews related to the topic under study. For designing the questionnaire the researcher had consultation / interactions with experts and competent authorities in the areas of petroleum business, so the first hand additional insights, suggestions and necessary inputs could be formalized. While giving shape to the questionnaire, the over all aspects of information needs of scientists and engineers and their information seeking behaviour, organizational activities correlating with information resource potential, services of libraries, in-house information sources, and internal information generation opportunities were kept in mind.

The questionnaire used for this study is basically divided into 3 major sections i.e. A, B, and C. These sections carry the distinct purposes to extract information from the respondents of the target samples as enumerated below.

**Questionnaire: Section A:**

This section offers the various attributes of respondents: their identifications, level of understanding, personality characteristics, academic excellence and contributions, and psychological framework of mind. The factual question of this section provides factual information, opinion and attitude, self-perception, and standard of action. These questions specifically pertain to respondents' age,
In this section opinion and attitude questions are designed to inquire respondents' beliefs, feelings, values and related concepts like frequency of attending conferences /seminars, personal subscriptions of journals, vicinity and professional socialization with academic organization to receive complementary copy of publications. Motivational questions are also framed such as: academic contributions, awards /honours, appreciations received during their working and earning experiences.

Purposes of this section are:

1. to determine the relationship between respondents' characteristics and the object of the study (dependent variable); Factors associated with the experience & attitude,

2. to obtain measures of the direction and intensity of research subjects and opinion about a topic or attitude object,

3. to inquire respondents' individual awareness and updating attitude within their professional societies,

4. to identify the background and educational status of respondents in their specific areas,
5. to correlate length of experiences earned in specialized areas to respond intelligently to a series of survey questions, and maturity of understanding,

6. to assess academic habits of technical writing that provides the respondents' degree of information needs of subjects and its development,

7. to evaluate the scientific communication and sharing of knowledge of scientists/engineers by way of various platforms of technical conference, seminars and meetings, and

8. to inquire about the respondents' holdings of language commands for communication and interactions to gather knowledge from the information sources of languages other than English.

**Questionnaire: Section B:**

This section was designed basically for identifying the information seeking behaviour of respondents and information needs coexisting in their areas of dealings. The attributes of information needs fall within the purview of subject area, present work, information requirements other than regular work, frequency of information gathering, reasons of information needs, formal and informal sources they consult, electronic formats of information sources, journals, languages other than English. The questions of this section are of structured type that produces fixed responses. Such structured questions do not allow to elicit unpredictable responses, and thus the respondents are bound to
answer within the fixed parameters, which are predefined by the researcher. Multiple-choice questions are also enumerated in this section to widely account for their information needs in varied area of business. Intensity questions are also asked, that allows respondents to show the depth of their feelings and their work culture. Since, this part of questionnaire is absolutely aimed at deriving information needs and information seeking behaviour in their respective areas of ONGC's activities, opinion and attitude questions, and open-ended questions are not appended.

The purposes of this section of questionnaire are to derive:

1. The core thrusts of the investigations from the respondents' information needs.
2. Information seeking behaviour of respondents with respect to formal /informal information sources and electronic formats.
3. Interrelated relationship among the realistic conditions of information requirements of individual /group of scientists and engineers, and the objectives for searching the specific information sources.
4. to identify the distinguishing features of attitude of scientists and engineers to rectify themselves on the given fixed parameters.

**Questionnaire: Section C:**

This section is an important part of the questionnaire from the point of view of use of library and its services by the engineers and scientists working in heterogeneous environment of organization. The section
entails about the libraries of ONGC to fetch information, frequency of library visits, reasons of library visits, mode of familiarization with current knowledge, accessibility of electronic information services and facilities, technical journals and knowledge base. The section offers the respondents' opinions on library status and its service quality, evaluation of library activities, library holdings and collections. It measures the library development trends in terms of organizational needs and economy.

The questions of this section are of intermix nature; enlisting structured questions and open-ended question. The most significant part of this section is to provide scaling fixed responses that give numerical values of parameters. The projective questions and self-perception questions are also appended to receive the in-depth opinions of respondents for the futuristic projections.

The purposes of this section are:

1. to identify the use of libraries by the scientists and engineers in the given environment of work place,

2. to ascertain the frequency of visits of library users and how the library management facilitates the services to the users in accordance with their convenience,

3. to determine about the familiarity of library's modern services, e.g., Internet, CD-ROM offline, on-line access, and knowledge of use by the respondents,
4. to enquire the growth of relevant subject collection and adequacy of information sources and services being offered to scientists and engineers of different regions /institutes,

5. to assess the library professionals’ attitude and communication skills towards fulfilling the information needs as the object of study, and

6. to ratify their opinions to reflect the gap between information needs and information sources and services of ONGC libraries and other parallel centres.

3.5 RECORDING & TABULATION OF DATA

Mere collection of data does not lead to arrive at any ideal situation of inferential interpretation of the study, unless that is properly classified and tabulated. Before adopting the tabulation pattern of data, it is important to put all the forms of data on classification for orderly arrangement and for subsequent sorting of attributes with the representative of characteristics of group or mass. According to Hansraj (1984, Quoted P.V. Young) “the researcher in addition to some common sense classification, will begin to sort out his/her data in terms of (a) essential similarities and dissimilarities in them, (b) cluster of related factors which can be observed repeatedly with consistent regularity, and (c) recurring sequence of events. The aim is to discover the series, sequences, and relationship, which will throw light on uniformities on one group of data and on the differences in another. For the sake of convenience they have suggested the classification on four
ways: (a) Qualitative basis, (b) Quantitative basis, (c) periodical basis, and (d) Geographical basis.

The researcher of this study adopted to classify all the collected data on the basis of quantitative pattern and put all the questionnaires first by the attribute of existing levels of respondents followed by their position /designation in abbreviated codification. Since, these two elements are mutually exclusive, so the regions /business groups or place of posting was taken to concentrate the identity of groups or class of respondents. On this basis all the questionnaires containing the unprocessed data were classified for the respondents distinctly for scientists and engineers. This pattern of classification has yielded the researcher to further, move for tabulation in easy manner.

The objective of tabulation remains to clarify and simplify the data collected so as to make it easily understandable and draw the inferences from various interrelationships of variables and parameters. The basic idea of tabulation is to put the whole data in concise, precise and logical order. In other words, tabulation involves the orderly and systematic presentation of numerical data in a form designed to elucidate the objectives under consideration.

The present study has adopted One-way table, Two-way table, and multifold table patterns. The multifold table gives information about different mutually related attributes. Similarly, the two-way tables depict the strength of scientists and engineers vs age groups. The responses received were also tabulated for the scientists and engineers in the pattern of age groups. The one-way table was
designed to show the discipline-wise and level-wise strength of engineers and scientists with exclusive identity.
The basis of tabulation was kept in mind while classifying the data, and therefore, the simple and complex tables were designed, wherever necessary. In the case of multiple choice responded, such tables were kept with the attributes of mutually exclusive data to interrelate information for the study.
The data from questionnaires, observation and transcripts of interviews from respondents was transferred to the separate sheets for each entity of questions, which were speculated to be vital for drawing the inferences for specific problems under study. Thus, the scores and tally sheets were prepared by selecting figures of different levels and positions of scientists and engineers and putting them together on separate sheets. These tally sheets are simply blank table with properly labeled 'stubs' and 'caption' in the columns and rows respectively. The frequencies were properly counted with meticulous care of classified attributes and characteristics.
In the cases of small samples the tabulation and posting of data can be done by hand. Since, the present study was carried out with large population and as a result huge data was collected, the machine tabulation became necessary just to ensure accuracy and speedy calculations. Undoubtedly, the researcher has taken utmost help of computer in sorting and counting, and of course, in drawing various tables, charts and presentable formats.
In order to alleviate any sort of vague connotations, the researcher has provided necessary footnotes and asterisked notes along with the tables, wherever required. Finally, the tabulation work was done following the massive statistical calculations based on the data provided by the scientists and engineers from their work places / regions / R&D institutes. While transferring the data into the tabulation formats, the constant care was taken to keep the objectives of study in mind, so that its analysis and interpretation could arrive at inferential end.