Chapter - 5: SUMMARY AND CONCLUSIONS

5.1 SUMMARY

With the approach of new millennium radical changes have taken place in communication technology. As a result of this, a lot of developments are visualized as regards to scientific information and communication. There are continued expansion in publishing sectors, which has heralded to increase significantly the list of journals published both in print and electronic version. At the same time, the web has proven to be a fertile medium for publishing, which has become quite popular like the printed sources of information. The web has promoted an increased publication of electronic journals, databases, conference proceedings, preprint servers and general resources, especially in science and technology literature.

ONGC as a premier oil and gas producing company of upstream sector of Indian petroleum industry, has got its branches spread all over the country with its mission and objectives in the areas of oil exploration, drilling & production, engineering & technology, operations & maintenance, HR development and industrial safety & environment. The heterogeneous activities and operations of ONGC demand continuous flow of information to their scientists, experts and engineers, which helped them to upkeep as the front-runner in business competitive scenario. The scientists and engineers working at offshore and onshore platforms although are not regular in smooth access to real world of information, but they are served with full Internet access of unlimited databases and journals through its most technically...
developed libraries which are attached to all the work stations / projects of the organization. Thus, at present the relative importance of the print media has been gradually depleting. This might have some impact on the information needs and library use pattern of scientists and engineers. Moreover, the information needs of scientists and engineers of industry and business environment seems to be quite different. Therefore, an attempt has been made to study the information needs of the scientists and engineers with the following objectives.

1. To assess the variety of information required by the scientists, engineers and technologists of ONGC as regards to subject, currency, and types;

2. To identify sources of information preferred by scientists and engineers in the research, industry, business, and corporate environment;

3. To find out the extent of use of library services in fulfilling the information needs of scientists and engineers required for R & D work and in oil explorations and production activities; and

4. To ascertain the inclination of the scientists and engineers towards the information needs for electronic sources and formats.

To conduct this study, a questionnaire was designed and distributed among 1105 scientists and engineers of different workstations, institutes and projects /Plants of ONGC, that are scattered all over the country. After repeated reminders and visits, 586 responses were received back with response rate of 53.03 percent. Efforts were made
to collect the responses from each level of scientists and engineers starting from E-0 to E-6. Out of the total 586 response, 33.45 percent are scientists and 66.55 percent are engineers. The results of the study are further, tabulated and analyzed.

As discussed earlier, the concept of information needs has proven to be an elusive one to define, isolate and to measure. Therefore, information needs are frequently studied as information demands and information wants, although they may not be identical. Information needs as seen a subjective and relative concept existing only in the minds of the individual. Information needs are also affected by various factors such as:

- Available information sources,
- Uses to which information will be put,
- Background, motivation, professional orientation and other individual characteristics of the users, and
- Consequences of information use, etc.

So, information needs are purely a cognitive activity but it is reflected through information demand and information use. Therefore, the present survey is carried out at three stages. In the first stage, the respondents are enquired about their background i.e. about their age, experiences, qualifications, nature of job, language known, etc. Then in the second stage the actual information needs are explored as regards to subject, type of documents preferred, sources of information needed, etc. Lastly they are also enquired about the extent of use of library services and documents. After thorough study the following observations are derived.
1. It is observed that majority of the respondents (58.19%) belong to the age of 31-40 years (Table-10). A comparison of the age of both the users' community of scientists and engineers shows that almost equal percentage of four age groups are available in each level. In E-0 & E-1 level maximum scientists and engineers are of the age 25-30 years, in E-2 to E-5 maximum executives are of age 30-40 years, and in E-6 maximum are of the age 41-50 years.

2. Out of 586 respondents, 39.59 percent of the scientists and engineers are graduates in professional disciplines i.e. either in engineering or in applied sciences. Among the executives, 25.93 percent got Masters' degree or even higher degree in engineering, technology and allied disciplines. So, above 65 percent (65.52%) of the executives of ONGC are professionally qualified. Also in each level the percentage of executives with professional degrees are higher than simple graduates. From E-4 and above level the percentage of executives with professional degrees are maximum (Table-12).

3. Among the three categories of experiences (Fig.-17) of scientists and engineers, 42.32 percent are having exclusively research experiences, 30.03 percent got managerial type of experiences, and only 27.64 percent got techno-managerial nature of experiences. Among E-0 to E-6 levels, highest percentage (54.54%) of E-6 level executives has got research experiences. But the
highest percentage (36.78%) of managerial experiences is available with E-4 level and highest percentage of (41.94%) of techno-managerial experiences are spread over the executives of E-1 level.

4. Regarding the awareness about the knowledge of language, it is observed that 26.79 percent (Fig.-21) of scientists and engineers have acquired the knowledge of foreign language other than English. Among the knowledge of foreign languages, the executives of ONGC are aware of only three foreign languages i.e. German (3.18%), French (1.27%), and Russian (1.27%). Besides the knowledge of foreign language, 64.33 percent of scientists and engineers are having proficiency in Hindi and 29.93 percent have the knowledge of other Indian regional languages.

5. Membership in professional organizations/associations (Table-18) is confined to only 252 (43%) executives. Out of these, 86.10 percent are members of associations/societies which belong to their core disciplines and 13.88 percent are members of associations/societies of general nature. Further, in E-0 and E-1 level, scientists and engineers do not take much interest of becoming member of any professional bodies. But with the maturation of experiences majority of them come forward to opt for membership of professional associations/societies. The scientist and engineers also prefer to become members
of at least one professional association/society and one
no-professional association/society.

6. Diversity of information requirements of scientists and engineers are observed with work pattern, professional objectives, and organizational development in R&D institutes and projects/plants (Fig.-26 to 29). The Engineers placed in R&D institutes are nearly 50 percent (49.09%) satisfied in their professional objectives, whereas in Projects they are satisfied more than 50 percent (55.71%) justifying their work pattern. In organizational developments scientists are better than work pattern (61.18%) and professional objectives (62.85%) of R&D institutes and projects respectively (Table-19). Similarly Scientists are better at projects in their professional objectives (47.47%), but in work pattern they are satisfied in R&D institutes (63.91%). In case of organizational development they are well at R&D institutes (74.22%).

7. Regarding personal subscription of journals, out of 586 respondents, 254 (43.34%) executives subscribe some journals for their personal use. Further, out of these 254 (Fig-30), majority of the executives (87%) are subscribers of professional journals and only 12.98 percent subscribe journals of other subjects. Moreover, out of 221 subscribers of professional journals, 139 (62.89%) executives have limited their subscription only to single title and 82 (37.10%) scientists and engineers
are subscribing more than two journals. Among the different levels, maximum scientists and engineers of E-6 level are the subscribers of both professional (72.73%) as well as non-professional (9.10%) journals. One of the remarkable observations is that the top level (E-6) executives are subscribing both professional as well as non-professional journals (Table-20), and executives working in E-2 level onwards are more keen on personal subscription of journals.

8. All the scientists and engineers attend conferences/seminars as per the policy of the organization. But 29.18 percent attend conferences/seminars regularly, 39.25 percent attend often, and 31.57 percent rarely get a chance to do so (Fig.-33). Further, scientists and engineers working in higher level, i.e. E-3 and E-4 mostly attend the conferences/seminars regularly/quite often in comparison to E-0, E-1 and E-2 levels of executives, who are only left to avail it as per chance of availability. It is also observed that maximum number of E-5 (41.38%) and E-4 (38.51%) executives are regular participants of seminars/conferences.

9. It is also observed that minimum number (1.41%) of scientists and engineers of E-0 level have got publications but with the increase of status of level, there are more chances to add publications. It is seen that highest percentage (63.64%) of top level (E-6) scientists and engineers got technical publications. It is also
observed that (Table-25) highest percentage (54.55%) of E-6 level executives have got their publications while working in ONGC. Whereas E-5 executives got their publications prior to ONGC, which is the highest percentage (13.80%) among all the levels of executives.

10. The scientists and engineers of E-0 to E-5 level get only meritorious awards and honours from the organization on the basis of their individual performances. But the executives of E-6 and above are recipient of various types of group and team awards for quality control and safety (Table-26).

11. The scientists and engineers needs information on five broad subject fields such as: Technical, Research & Development, Managerial, Techno-managerial, and Legal. Among all the respondents majority of the scientists and engineers needs information in the technical fields (45.39%), followed by R&D (19.45%), Managerial (18.08%), Techno-managerial (8.87%), and minimum in legal aspects (8.19%) (Table-27). On comparison it is found that maximum number (67.74%) of E-1 scientists and engineers needs technical information (Fig-38). It is also seen that with the increase of the level, the information need is reduced i.e. in E-5 level executive need only 13.79 percent of the technical information. But it is little more in case of E-6 (36.36%) executives. Maximum number of E-5 executives need Managerial type (37.93%) and Techno-managerial type (18.39%) of
information. Similarly, maximum number of E-4 executives needs information related to R& D (30.36). It is also noticed that except Techno-managerial type of information, all other types of information are required in all levels. Moreover, it is also observed that in lower levels more number of executives are interested in a particular field and very few seems to be interested in other fields. But in higher levels i.e. in E-4 and E-6, almost equal percentage of executives are interested to get information in all the five subject fields.

12. Regarding the frequency of information needs, it is seen that almost equal number of executives need information at all types of category of frequency (Fig-41). However, the executives of E-0 level do not need information daily or weekly and the top-level executives (E-6) also do not require information on daily routines. But the E-1 to E-5 executives require information daily, weekly, fortnightly and monthly (Table-31) i.e. almost in all frequency. It is also noticed that except E-6 level equally to all other executives need information at a frequency rate of daily, and weekly (Fig.-42). But majority of the higher-level executives need information fortnightly and monthly. However, it is also noticed that about 76.06 percent of E-0 executives and 36.36 percent of senior executives of E-6 and above are irregular trail of their information seeking behaviour.
13. Regarding the currency of the information requirements, it is observed that almost equal percentage of scientists and engineers require current as well as both current and retrospective type of information (Fig.-43). On comparison it is noticed that the executives in higher rank need current information more than retrospective type of information (Table-33). At the same time, the executives in E-0 to E-2 level are interested in both current and retrospective type of information. However, the percentage of executives requiring both current and retrospective information is less.

14. Majority of the executives (269) are interested to get information (Table-35), because they want to keep abreast of knowledge, followed by the reason to solve immediate problem (262), then to complete a specific assignments (183). It is also noticed that maximum numbers of executives of E-4, E-5 and E-6 have expressed) their views on this aspects of study (Table-34).

15. Regarding the needs of formal sources of information, it is observed that (Table-36) that the scientists and engineers working in E-0 level only need encyclopediac sources, E-1 level needs encyclopedias, bibliographies & gray literatures. Among the top level, scientists and engineers are in need of newspapers' clippings and annual reports. Where as the scientists and engineers at E-2 & E-5 level
need almost all the 17 categories of sources of information. When the sources of information are ranked (Table-37) on the basis of their need among the scientists and engineers, it is seen that the in-house reports got the top position (301), followed by current periodicals (241), annual reports (222), standards & specifications (173) and published reports (161), and so on. The abstracts and indexes although considered as very important secondary sources of information but got quite lower rank as regards to their needs among the executives. Further, among engineers (Table-38), in-house reports (160) got the top rank, followed by standards & specifications (146), current periodicals (124), annual reports (107), published reports (89), and so on. The abstracts, indexes and digests got the lower most ranks. Moreover, it is seen that among the top ranked sources of information, in-house reports (1st rank), annual reports (4th rank) and published reports (5th rank) are being needed by both scientists and engineers of all regions/project centres of entire ONGC.. But standards & specifications (2nd rank) are not used in Delhi and NR regions. Among the scientists (Table-39), the in-house reports (141) got the top rank, followed by current periodicals (117), annual reports (115), conference proceedings (92), and published reports (72). It is also noticed that out of the
five top ranked sources, except current periodicals and conference proceedings, all others are being required in all the regions and project centres of ONGC. Another remarkable feature is that the rank of abstracts as per needs is higher (11) among the scientists.

Among the informal sources of information (Table-40), the scientists and engineers of E-5 level are in need of all the six verities of sources as listed in the questionnaire. But the executives of E-0 to E-2 levels are only in need of telecommunication channels. Moreover, the telecommunication channel as one of the important sources of information is required by all levels of executives. When these informal sources of information are ranked as per their needs by the scientists and engineers (Table-41), it is noticed that the same telecommunication channel (482) got the 1st rank, followed by the informal sources such as: meetings and conferences (341), reprints & preprints (92), unpublished reports (88), correspondences (58), and so on. A level wise analysis of preference of information sources depicts that E-4 and E-5 level executives, who are in the dire need of informal sources of information, the telecommunication channels and meetings and conferences are highly preferred (Fig.-41). Further, among the scientists and engineers (Table-42 &43) the first two informal sources of information are the same i.e.
telecommunication channels and conferences & meetings. But the third rank as per the need of the engineers lies with unpublished reports, and similarly in the same rank for scientists is occupied by reprints & preprints. Among the engineers in MR region, there is the increased need of informal sources of information followed by WR region (Table-42). But for the scientists at the HQ maximum informal sources of information are needed, which is followed by MR region (Table-43). However, except NR region, all scientists and engineers are in need of informal sources of information like formal sources of information.

17. The study revealed that sources of information in electronic forms are needed frequently among E-1 to E-4 executives (Table-44). However, out of the five listed electronic databases (Table-45), full-text databases got the top rank (279), followed by Factual databases (182), Directories in electronic formats (181), Bibliographic databases (130), and Patents information in electronic formats got the last position as per their needs among the scientists and engineers. Further, the executives in E-0 level are interested only in Directories available in electronic form, and similarly the senior most executives in E-5 and E-6 level are interested only in Factual Databases available in electronic format. But out of the electronic formats, maximum number of the executives in E-1 and E-2 level is in need of Directories in electronic
form, which is not at all required in higher level. Out of the four electronic formats, maximum number of the E-3 and E-4 level executives is in need of the Full text databases. Among the E-0 to E-2 level of engineers in (Table-46) and scientists in (Table-47) as per their information needs, Full text databases got the top rank. However, maximum number of engineers in WR region needs information available in electronic form. Maximum scientists of MR region need four varieties of electronic form of databases except patents information available in electronic form, which is not at all required by any scientists.

18. Out of the journals published in languages other than English, it is observed that only 18.43 percent of the respondents are in need of journals in other languages. It may be due to the fact that much less literature are published in other languages in science and technology and also few executives have knowledge of other languages than English. However, it is noticed that out of 18.43 percent of the respondents 78.90 percent (Table-48) of the executives are having the habit of using journals published in Hindi. Further, only 15.60 percent are referring the journals in Russian language and only 4.59 percent are looking into the journals published in French languages. Moreover, the executives in E-0 to E-2 did not responded to this query.
Among the use of the documentary and non-documentary sources of various modes of gathering information, it is seen that in E-0 level, the executives are confined to use only one library's collection i.e. KDMIPE library, and the collection available with the superiors (Table-49). It seems that the junior level scientists and engineers who work in grass root level are not getting involved in information gathering habit, and thus they do not require much information for their work. If needed, they collect from the main library i.e. KDMIPE Library and from their superiors. Similarly, the senior executives i.e. E-6 level and above, besides KDMIPE library, they gather their information sources available with their personal kitty. The other middle level executives use either six or more than six varieties of sources of information such as: different libraries of ONGC, published literature available in the market, internal reports, personal collection, collection available with superiors and subordinate staff, outsiders' collection/resource, and information available with peers, to fulfill their information needs. However, among the different modes of information gathering, Project Libraries got the top rank (Table-50) followed by the KDMIPE Library, IOGPT Library, internal reports, IRS library and so on. It seems that the KDMIPE Library as an individual library is having very good resources, besides the Project Libraries located at Hazira, Uran, Vasudhara Bhavan (Mumbai), Rajahmundry, Jodhpur, Ankleswar, 

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Baroda, Nazira, Chennai, Kolkata, and Mehsana (Table-51). Regarding the use of libraries of parent organization, it is seen that out total 586 respondents, 138 engineers like to consult their own institute/project Libraries, and 248 use the libraries of other institutions/ Projects of ONGC (Table-51). But among the scientists, 117 executives like to use their own institute /project libraries, and 78 scientists prefer to use libraries of other institution/ Project /Plants of ONGC. So, the percentage of engineers using their own institute/project libraries is less than those using libraries of other institutions/Projects/Plants. Most of the scientists at the same time are satisfied with their own institute/project libraries' collection and services, and a few use the libraries of other institutions/Projects/Plants.

20. Out of 586 respondents, 51.36 percent (Fig-51) of the scientists and engineers are having the habit of using the library both categories of once in a week and once in a fortnight, and only 14.16 percent are only rare/occasional users of the library. Among the different levels of scientists and engineers, the E-3 and E-4 executives are more regular users of the library. In comparison to all levels, the occasional visitors are minimum among the E-4 (2.3%) level and maximum in E-1 (32.26%) level and E-0 (29.58%) level (Table-53).

21. The executives of ONGC like to use the library at various convenient timings (table-55) such as: during working
days (20.30%), weekend (23.89%), during fortnight off
days (27.98%), and as & when required (27.81%). The
executives of E-0 and E-6 level mostly do not like to
prefer using the library during working days (Fig-52). But
for others, especially E-2 level, maximum (31.88%) like to
use the library in working hours. Among E-3 and E-4 level
of scientists and engineers, highest percentage of
respondents likes to use the library during fortnight.

Out of 586 respondents, 31.06 percent (Table-56) visit
libraries with the purpose to read journals, borrow
books/journals, consult reference books, get specific
information, etc. Out of these, 17.41 percent visit libraries
to get a specific piece of information, and 30.55 percent
simply to browse the documents available in the library.
So besides the common purpose of borrowing documents
from the library, quite a good number of executives visits
library to simply browse into the existing documents and
peep inside the new arrivals, which is a particularly
known behaviour of all types of scientists. However, on
comparison, it is observed that maximum percentage of
E-4 executives (Fig-53) visit library to consult
books/journals. But maximum E-6 executives visit library
to consult only books of reference nature and information
of quick mention. Whereas, in general maximum
executives of E-0 & E-1 level visit library to borrow books
journals. But 63.64% visit library to get only a specific
piece of information, which are relevant to fulfill their precise information needs.

23. Among the scientists and engineers using library techniques and tools for library accessibility, 28.84 percent carries out self-search of the library, 23.38 percent seeks the assistance of library staff, 22.18 percent consults the library catalogue, 17.24 percent enquires over telephone about information from the library, and 8.36 percent even seeks the assistance of their own colleagues for the use of library (Table-58). So, it seems that the scientists and engineers along with self-search or searching with help of the library catalogue, to some extent depend on library staff. Among the different levels of scientists and engineers, out of 169 executives who prefer to have self search, maximum 46.75 percent belong to E-4 Level. But at the top most level i.e. in E-6 and above level, self-search, searching through library catalogue, and consulting the library by seeking assistance are not observed. So, the senior executives only use the library by seeking assistance of the library staff or collect information from the library over telephone (Table-59). However, executives in all the levels prefer to take assistance of library staff for its use.

24. While analyzing among the ten different types of library services, it is observed that only two services, i.e. latest arrivals and network services are used by all levels of scientists and engineers of ONGC (Table-60). But when
the library services are ranked on the basis of its uses, the newspapers clipping services (244) got the top rank as used by the majority of the respondents, followed by latest arrival services (226), reprographic services (174), network services (115), current content services (114), referral services (104), Inter-library loan services (90), SDI services (32), and so on (Table-61). On comparison of the choice of library services among the E-0 to E-6 level executives, it is observed that among E-2 to E-6 level, highest percentage of scientists and engineers are having the likeness toward availing newspapers clipping services (Fig.-55). But in lower level i.e. E-0 and E-1 most of the executives like referral and reprographic services. However, highest percentage of E-6 level scientists and engineers prefers the use of Fact finding services of the library.

Among all categories of electronic information services, maximum (40.10%) number of respondents prefers to use Internet services followed by on-line access (30.72%), electronic bulletin (14.16%), CD-ROM offline (10.07%), and electronic data services (4.95%). It is also observed that out of the five mentioned services: on-line services, Internet services, and electronic bulletin services are being used more or less by all levels of scientists and engineers. During the comparison of the use of types of library services among different levels of scientists and engineers, an interesting picture is found to
emerge. Although out of the total respondents, maximum percentage of responses is seen among E-4 level executives from on-line access services and Internet services. But on comparison it is seen that both the services are highly preferred by E-1 level executives (Table-63). Similarly, CD-ROM offline services are highly used by E-6 level among all the executives. But one remarkable feature is that out of the five categories of electronic information services, the on-line access and Internet services are used maximum among all the executives.

26. In the study of the use of frequently referred journals (Table-64) by the scientists and engineers, it is noticed that out of 60 titles subscribed in libraries, only 37 (61.67%) are preferred. Further, out of these 37 journals, 13 (35.14%) titles of journals referred both by the scientists and engineers. However, out of 37 titles, 25 (61.67%) journals are exclusively used by the scientists, and similarly, 26 (70.27%) journals are only used by engineers. Scientists and engineers, although refer different journals of their subject domains, but there are some titles, which are used by both the users' community.

It is also found that out of 25 preferred journals (Table-64), among the scientists, AAPG Bulletin (179) got the top most rank, followed by World Oil (162), Oil & Gas journal (160), Exploration Geophysics (152), Chemical
Geology (146), and so on. Similarly, among the engineers the Chemical Engineering (288) got the 1st rank, followed by Chemical Engineering World (269), SPE Production Engineering (258), Process Engineering (253), World Oil (223), and so on.

27. The study about scaling the satisfaction of library services shows (Fig.-61) that 42.32 percent of the respondents are satisfied with library services, 36.86 percent feel library services as adequate, 15.02 percent is contentful within reach, 4.61 percent is partially satisfied, and only 1.19 percent of library users feel the library services inadequate.

But on comparison of the degree of satisfaction among the E-0 to E-6 level (Table-65), it is noticed that maximum 49.28 percent of E-2 level executives are satisfied with library services. But maximum 42.53 percent of E-4 level executives expressed the library services as adequate.

The lower level of E-0 & E-2 executives is not fully satisfied with the library services but do not express it as adequate.

A study on the affirmation of punctuality of the library services (Table-66) shows that 61.60 percent are receiving the information timely, and only 10.75 percent have expressed regarding not receiving information in time. Among all levels, the punctuality of the timely receipt of information, it is seen that E-6 level executives are maximum percentage (81.82%) getting the library
services in time, but the executives of rest of the levels are though getting the library services timely, but the response percentage is nearly 50 percent.

28. Regarding adequacy of library collection (Table-67), maximum 42.32 percent of the executives are satisfied with the collection of Drilling & Production, followed by Oil Exploration (33.78%), Management & Administration (31.74%), and so on. In the level wise analysis, maximum of E-6 executives (23.33%) are satisfied with the collection of the libraries on Oil Exploration. However, the scientists and engineers of rest of the levels of executives are found with less adequacy of collection on all the core subjects except on oil exploration in almost all the libraries.

5.2 CONCLUSIONS

On the basis of the study the following conclusions are derived:

1. With the elevation of positions among scientists and engineers, the age span increases. As a matter of fact that the incumbencies of vertical integration are depending on the work performance and that comes through the maturation of age and status of senior executives up to corporate level.

2. With the maturation of age and work performance, it seems that it is also essential to posses higher professional degrees for reaching higher ranks for the executives of ONGC.
3. Scientists and engineers of ONGC have got both research and managerial & techno-managerial type of experiences at all levels of their postings. But in higher level the research experience and managerial experiences are quite rising.

4. Scientists and engineers are also having the proficiency of some of the foreign languages mainly German, French and Russian other than English and few Indian languages. Among Indian languages more than 60 percent of the executives are having knowledge of Hindi.

5. Membership in professional associations/ institutions is although a part of the policy matter of ONGC welfare scheme for academic excellence, but the situation at lower level is not so encouraging. However, the executives at the top level are mostly availing this facility. This may be because of their increasing needs of information for job proficiency and obligations of business environment of the organization.

6. Diversity of information requirements is tacit in terms of work pattern, professional objectives, and organizational development for scientists and engineers. The scientists are better satisfied in R&D institutes than the projects considering their only trend of 'work pattern'. But in the case of their 'professional domains' of work considerations and correlation, they are much comfortable at projects' placements. The findings are very much crucial to consider in the diversified nature of information requirements. Thus
the information requirements of the scientists are changed considering to their professional objectives in R&D institutes & projects. Scientists are also seen satisfied in R&D with high remarks that their professional objectives are of less manifestation because in ONGC geoscientific researches are based on application pattern for implementation of R&D results to the production sites, which is absolutely different from the holistic trend of fundamental research and developments. Engineers are greatly satisfied in projects extremely towards the interest of organizational developments as they get greater chance to apply their technical proficiency and competencies in fuller extent. The demands of Information needs are thus much higher for engineers those are placed in projects/work centres. In the span of diversity of information requirements, engineers are enthusiastic with work pattern and organizational developments. The diversity of information requirement explicitly appears and it is finally inferred that information needs exists in all spheres of work domain of ONGC in the varied situations of work places. Here, the work pattern and organizational developments are the prime factors that demands information needs of scientists and engineers in almost all the situation of work places, whether these are R&D institutes, projects, onshore site, offshore productions, etc.

7. To fulfill the information needs, about 50 percent scientists and engineers are having personal subscription of technical
journals. Among these, about 60 percent like to get professional journals. So, mostly they are interested to get information related to their own field of activities. But the top-level executives also like to get information and knowledge on other subjects, besides their own field of core domains.

8. The scientists and engineers in general attend conferences/ seminars and collect latest information on their subjects and its future projections. Although ONGC provides facilities to attend the seminars/ conferences to the scientists and engineers, but he executives of E-3 to E-5 mostly avail this opportunity. The scientists and engineers of higher level thus, prefer to have information on latest developments. So majority of them get maximum opportunity to participate and interact with professional experts in more number of conferences/ seminars.

9. The scientists and engineers at the top level have got more publications. The E-6 level of scientists and engineers are having more number of technical publications. So, the top-level executives are in need of more technical information for formalization of their knowledge base and constant updates.

10. In order to motivate, the executives of scientific and engineering groups are getting various meritorious awards under the laid down provisions of the organization. The executives of E-0 to E-4 get normally the meritorious awards and individual awards /honours for their
performance and academic excellence. Apart from these, the sports awards are also given to the outstanding players and amateurs. Mostly the team awards are given to senior executives for groups' performance of quality circle, safety follow-ups and benchmarking.

11. Scientists and engineers in technical matters need technical, R&D, managerial, technical-managerial, and legal types of information. So, it may be concluded that Technical type of information is required by majority of the executives. The information required by E-4 to E-6 scientists and engineers are quite static.

12. In the trend of information seeking behaviour of scientists and engineers, it is concluded that the lower level of executives are resorting to the frequency of fortnightly and monthly basis of information needs. So, the executives of E-1 to E-5 level are more pertinent in collecting the information within frequent intervals of time gap. However, the senior executive of E-5 and above need information at very irregular intervals, as their information needs are not susceptible to single source of physical access.

13. Maximum number of scientists and engineers in higher level need current information. But majority of the lower level executives especially in E-0 to E-4 need both current and retrospective type of information. This may be due to their nature of work under the routines of information support to higher-level executives to their intermittent information needs, demands and fulfillment.
The reasons of information needs of scientists and engineers are varied in nature depending on their work assignments and organizational requirements. The executives of E-4 to E-6 are more serious in collecting information. The lower level executives require information only either to solve immediate problem or for specific assignments. But normally the executives of technical framework need their information for keeping abreast of latest knowledge and updating themselves with the cutting edge of technology.

The executives working in lower most level and top level are not in need of all categories of sources information whereas the executives of the middle levels i.e. from E-2 to E-5 are in need of almost all varieties of sources of information. The in-house reports got the top rank as regards to its need is concerned among both scientists and engineers. But the ranks of other sources of information vary when the needs of scientists are compared with those of engineers. This may be due to their nature of job assigned to them. The current journals are although highly needed by both the groups but abstracts and indexes and other secondary sources are not needed much by both the users community of scientific and engineering disciplines.

Scientists and engineers are in regular use of various informal sources of information available in the organization. The executives also prefer to some forms of informal sources of information, as the formal sources of
information are not always able to cope with the demands of key executives in the judicious manner. But the telecommunication channel and meetings & conferences are the highly preferred informal sources of information among all levels and in all regions/projects.

17. With regard to the information needs of scientists and engineers in the electronic formats, maximum number of E-1 to E-4 executives need electronic databases. The factual databases are more needed among the higher-level executives i.e. in E-3 to E-6 level and Directories in electronic form is only needed among the E-0 To E-2 executives. So, scientists and engineers are in need of information available in electronic databases but their choice of database is different. Full text databases, which got the top rank, is needed by maximum number of scientists and engineers, which are also simultaneously preferred by maximum number of E-3 and E-4 executives. But the top level executives are interested in Factual databases and the lower level executives are in need of Directories in electronic format which got second and third ranks respectively as per their floating needs among the scientists and engineers.

18. Consulting journals is the elementary habit of scientists and engineers for the urge of their nascent knowledge and its updating. Scientific and engineering literature is also being published in the foreign languages other than English. It may be concluded that the scientists and engineers do not
feel necessity of journals published in languages other than English. However, to some extent the executives of E-0 to E-4 level give importance to journals published in Hindi. So, scientists and engineers of ONGC are in need of journals published in English language only. The cases are very rare with the demand of information from foreign language journals.

19. The modes of gathering technical information are important facets of information needs and use behaviour of scientists and engineers. On analysis and study, it may be concluded that the junior most and senior most scientists and engineers are not of much habit of using different libraries and varieties of modes of information gathering and resources/ collections. But the executives in E-1 to E-5 use a variety of libraries along with the other sources, to fulfill their information needs. Among the libraries, the Project libraries located at Hazira, Uran, Vasudhara Bhavan, Rajamundry, Jodhpur, Ankleswar, Baroda, Nazira, Chennai, Kolkata, and Mehsana are quite resourceful in its collection, because majority of the scientists and engineers have expressed the use of Project Libraries in fulfilling their information needs. Besides the Project libraries, the KDMIPE library located at Dehradun is another important source of information among all levels of scientists and engineers working in all the Projects and R&D institutes of ONGC spread all over the country. Regarding the habit of use of own Institute/Project libraries, they use libraries of
other institutions/projects. It is inferred that the scientists mostly get their required information from their own Institute/Project library where they are serving but the engineers, to some extent depend more on the libraries of other Institutes/Projects, besides their own Institute/Project Libraries where they are working. So, the scientists and engineers mostly depend on their own Institute/Project libraries to fulfill their information needs.

20. Regarding the users' attitude of visiting the libraries, the analysis arrives that the scientists and engineers of all levels visit libraries, at least once in a month. The executives of E-3, E-4 and E-5 level are much regular in their library visits to fulfill their information needs. But the top-level executives use their libraries only once in a month. This may be due the fact that their information requirements might be fulfilled through their subordinates. Therefore, it may not be required for them to visit the libraries more often.

21. The convenient timings and routines of library visit for executives are the proven facilities, which scientists and engineers are inculcating towards seeking and consolidating their information needs. So, scientists and engineers are using mostly the library in almost all the slogs of convenient timings depending on the nature of placement duties, i.e. general shift and other odd shifts. But in some cases of offshore duties, on-off duties and deputation, the library visits for them are frequently
fluctuating. Those executives fall in the category of 'as and when required'. However, there are some executives in R&D institutes and projects who resort to visit the library with the preference of specific timings and convenience.

22. While visualizing the purpose of library visit of scientists and engineers, it is concluded that the scientists and engineers at junior level visit library mostly to borrow documents. But there are also few executives in scientific and engineering disciplines, who consult library to browse books/journals, and some senior level executives consult the library precisely for a specific piece of information. So, library has to be careful to in its readiness to fulfill the information needs of all levels of scientists and engineers considering their convenience and changing urges of information with the elevation of their status.

23. On comparison of the use of different techniques applied for the use of library, it is observed that library catalogue is highly preferred at the level of E-0, E-1 & E-3 executives (Fig.-54). But maximum executives of E-4 level carry out self-search and maximum of E-5 and E-6 executives enquire information through telephone/ network. It may be concluded that scientists and engineers working in E-0 to E-3 and above levels prefer to consult the library catalogue. So, it seems that library catalogue is one of the useful tools for the use of library holdings. At the same time the core group of executives prefer to have self-search. Therefore, besides library catalogue, scientists and engineers like to
use library at their own. But the senior level executives either collect the information over telephone /network system or seek the assistance of the library staff. This may be because of their positions and hierarchy. However, the telephone network system is the most popular medium among all the levels of scientists and engineers for enquiry prior to resort to use the library. Although except the lower level executives, all other scientists and engineers take the assistance of library staff to some extent, but the senior executives collect maximum information through the assistance of the library staff.

24. Among all variety of library services that are available in the different libraries of ONGC, the newspapers clippings services seem to be preferred in general by maximum scientists and engineers. At the same time among the different levels of scientists and engineers, the choice of maximum use of a specific type of library services varies from one level to another. However, among all varieties of library services, the latest arrivals, and network services are used more or less by all levels of executives.

25. Electronic information services are obviously upcoming and endearing among all the executives irrespective of their disciplines and work environment. So, on-line access services and Internet services are the two most popular library services in electronic formats.

26. In the case of frequently referred technical journals, there is a need for popularizing the contents of various technical
journals, which are of much importance in one way or other for both the groups of scientists and engineers. Therefore, those journals, which are common to both the groups should be subscribed in more number of copies, so that maximum executives would be satisfied their needs for information. Proper attention should also be given to rest of the titles of journals (23), which are subscribed but not preferred by the executives. So, it may be concluded that the top most ranked journals in the field of Engineering and Science are different. But towards lower rank some journals are common. This indicates that some subjects of study between scientists and engineers are having the common connotations for fulfilling the technical know-how of the organization.

27. The junior level executives are satisfied but they do not freely express their satisfaction about the library services. It is required at the part of librarians that the junior level executives must be brought into the mainstreams with personalized & improved services.

The E-6 level of executives is provided with library services more timely than the junior level executives. So, it is required to stress that the library must make efforts to provide equal facilities to all it's clienteles, with greater attention to junior executives. But in higher level the executives desire more of library services. So, the library services need to be still improved for greater benefits to the users of both scientific and engineering groups.
28. With regard to assess the adequacy of collections of different libraries with specific needs of collection, the efforts must be intensified in development of collections of other core areas of ONGC's business in addition to Oil exploration, Drilling & production. So, it is required to assess the library collections intermittently by involving the participation of scientists and engineers with a view to comprehend the upcoming demands and needs of information in the new frontier areas.

5.3 SUGGESTIONS

On the basis the assessment of information needs of the scientists, engineers and technologists of ONGC holding the various levels of responsibilities in the asset enabled business and corporate environment, the following suggestions are recommended in the light of technological advancement, changes in users' behaviour, variety of information resources, mushrooming of electronic information formats, quality of services of libraries, etc.

1. Collections, services, and up-gradation of libraries may be in consonance with the upcoming demands of organizational developments, changing business ethics of corporate, and global perspectives of the organizational learning processes. Such focus of assessment of this survey would have impact on extraction of much more intangible benefits for the specialists users of ONGC libraries at large.
2. There is a need to give top priority to the procurement and organization of technical publications—be it printed or e-version, so as to make the scientists and engineers to understand and more to incline towards the real value of information and knowledge base relevant to the core needs of their work pattern, professional objectives and organizational interest.

3. Information in oil & gas business is found disjointed in many referral sources and services even on the Internet portals. It is suggested to develop 'information repackaging' which is quite essential with the objectives to serve better to the key executives at top level of management. The Library personnel may make attempts with their professional conscientious in rendering such remarkable services in anticipation and on demand on the basis of specified individuals' information requirements.

4. From the present studies, it is derived to enjoin upon the part of librarians, who may take maximum care in fulfilling the information needs preferably from in-house reports, current periodicals, annual reports, and conference proceedings related to exploration, production, drilling, operations & processes, IT, and corporate management. At the same time efforts should be intensified to increase the habits of using the
secondary sources of information like, abstracts, indexes, reference books on technical publications, etc. along with the informal sources of information such as, proceedings of the meetings, brainstorming sessions, periodical deliberations corporate *vichar* series, and experts lecture series. Therefore, the informal sources of information may be organized in a very accessible manner, so that it can be provided when sought for.

5. Advances in technology and changes in users' behaviour have posed challenges for the library & information services with regards to capturing, storing, retrieval, and delivery of information sources. Out of these, information retrieval matters the most because of status of search skills of individual users in scientific and engineering groups. At the same time for adequate exposures of self-searching, the library may develop such arrangements, which will make the self-search also useful to retrieve relevant information in terms of cost effectiveness.

6. Libraries have to concentrate on how to reorganized the full text databases, may it be for technical articles/literature or specialized standards, along with the factual databases, so that the quest for supplemental information and data could be arrested in time for the key users of ONGC.
7. It is seen that the libraries are maximum used by lower or middle level executives by their physical visits, but the senior executives, due to other pre-occupations and unavoidable circumstances, could not make it convenient to their personal visits frequently. It is suggested that the network system may be developed in such a manner that the top level scientists, engineers, and experts may avail the facilities of Libraries' holdings, latest arrivals, etc. on their table tops, and browse on clicking the system without much efforts, time, overruns.

8. It is suggested that the library may make more efforts to popularize the other important library services such as: referral services, fact finding services, current content services, SDI services, inter-library loan services and newspaper clippings services among all the levels of scientists and engineers. In the projects / plants and regional centres the scientists and engineers must be given opportunities to know about the variety of sources and formats of information for their information needs with the emphasis to reveal the contents and coverage on nascent thoughts, innovative ideas and inventions.

9. With the vast collections and knowledge bases on various aspects of oil industry and business, KDMIPE Library can act as a central hub for catering the needs
of all the scientists, engineers and executives of all the regions/ projects, and R&D institutes. For this, a potential Library network can be devised and managed with the offshoots of IT and ICT, so that all the libraries within the in-house framework may create opportunities to browse and maintain the interoperability of libraries’ resources. In later stage, ONGC libraries can be put to the national and international panorama for accessing allowable information services within the permissible limits. In addition to this, users desire that more thrusts may be given to two upcoming and preferred library services such as: on-line access, and Internet services.

10. Provisions of orientation about the library services, its benefits, and uses may be made at all R&D institutes projects/plants, assets and regional centres where the executives take over the charge for new assignments under the policy of annual transfer, induction, and deputations. More Library professional manpower and up gradation of library services, knowledge wares and infrastructures may be needed to meet out the challenges of future information needs for the organization growth and sustainable business.

11. Like various national information systems and services available in the country, a well planned petroleum information system needs to be designed, implemented,
and proliferated among all the upstream, downstream and midstream sectors of oil PSUs, so that all types of information, data and knowledge bases may be enabled to the reach of scientists, engineers, corporate managers, and key executives of all the oil & gas organizations in India.

12. User driven information model may be developed for further analysis of information needs, use, and changing information seeking behaviour of scientists, engineers, technical experts, managers, and technologists with the pace of accelerated developments of technology, over a period of certain intervals.

13. Now information services and knowledge managements have emerged as strategic resources of any organization that calls for value of information assets. It is required to visualize the tangible inputs for information assets and thereby derive the intangible benefits for the organization in the present competitive scenario.