Chapter -1

INTRODUCTION
1.1 INFORMATION: DEFINITION, TYPES AND IMPORTANCE

"Information" is a valuable resource for the present society. It is a fundamental resource, which is used in the creation, maintenance, and development of a society. It is, further taken as the key commodity for all scientific, technological and industrial developments. It is considered as the intensive strategic resource for any organization, or group or community—be it social, humanities, scientific or technological that makes the society to outgrow, the technology to economise and humane to sophisticate. Our present society therefore can be called as Information based society. The word "information" is derived from Latin words "information and "informare". It is defined differently in different context. Webster's Third New International dictionary (1978) defines the term 'information' as "the communication or reception of knowledge or intelligence; something obtained or received through informing; the process by which the form of an object of knowledge is impressed upon the apprehending mind so as to bring about the status of knowing". The Oxford English Dictionary (1991) mentions "information" as verb and gives the following meaning:

1. Communication of instructive knowledge.
2. Communication of Knowledge or news of some fact or occurrence
3. Knowledge communicated concerning some particular fact, subject or event.
Buckland (1991) on analyzing the above meaning as given in the Oxford Dictionary, stated the following three meanings of "information".

1. Information-as-process: When one is informed, what they know is changed. In this sense "information" is "The act of informing; communication of knowledge or 'new' of some fact or occurrence; the action of telling or fact of bring told of something".

2. Information-as-knowledge: Information is also used to denote that which is perceived in 'information-as-process'; the "knowledge communicated concerning some particular fact, subject or event; that of which one is apprised or told; intelligence, news."

3. Information-as-thing: The term "information" is also used attributively for objects, such as data and documents, that are referred to as 'information' because they are regarded as being informative, as 'having the quality of imparting knowledge or communicating information; instructive."

Wellish (1974) identified about thirty-nine definitions of "information". Some authors strived to distinguish between "data" and "information", and have of course, "knowledge". Thus a sophisticated definition emphasizes "information" as both commodity and process. "Information" as commodity has to be acted upon by an energy system in order to make is useful and allow it to be put into action. The conversion of information into usable form involves acquisition of external events, transmission, processing, utilization and transfer.
"Information" and "knowledge" are often used synonymously. But there is a difference. Information may be a single fact or many unrelated facts, whereas knowledge is an ordered and structured information. Information is considered, as the feedstock for knowledge, and knowledge is the sum of many bits of information. Information is also expressed as processed data of value; produced by any segment of the society. "Information" is believed as logically arranged data, which convey the meaningful knowledge to use in practical life. To some, information is considered to be a step in the process of conversion of data into knowledge. Data are the accumulation of unrelated facts or results. Information is also defined as a thing, a process, and an unobservable mental state or process. It may be defined broadly to correspond to the way the word is used in ordinary discourse, or narrowly, to fit the needs of a particular kind of investigation. "Information" is further stated as a relative term, since it is information to one person, however that is data to another. So, information has numerous definitions and there are attempts taken by information scientists to derive a single concept of information for information science. However, the problem seems to lay not so much with the lack of a single concept but with a failure to distinguish among alternative, common-sense meanings of the word "information". According to Wilson (1980) information can be variously understood, in the context of user-studies research, as a physical entity or phenomenon (as in the case of question of relating to the number of books read in a year, the number of journals subscribed to, and so on),
as the channel of communication through which the data are transferred or as the subject data contained in a document or transmitted orally. "Information" may also be understood as factual data objectively transferred, or as advice or opinions in to which value judgment enters.

Information has many uses. It can be categorized in to four types such as: Strategic, Tactical, Operational and Statutory Information (Rajaraman, 2000). The strategic information is required for long term planning and directing the course of business of organization and its inter-operable activities. This type of information is required to take decision regarding how to expand a particular research project to decide whether to expand a business stock by producing new varieties of products in the industry. Such information cannot be obtained by mere processing of data. Because for this, one has to obtain information on trends, cost reduction of products, impact of advertising, etc. Information of this category is less structured. The volume of information in strategic planning is small and is difficult to obtain. The strategic information is most important for long range development of an organization, but is difficult to quantify and process from available data, and consequently its volume is small. The tactical information is needed to take short-range decision to run the business/ research effectively. Tactical information requires specifically designed processing of data. Most of it is obtainable easily from day to day collection of routine data unlike strategic information. The third category of information is operational information needed for day-to-
day operations of industries and research and business organization. The operational information is usually easy to obtain by straightforward processing of data. The volume of such information is much more than tactical information. The last category i.e. statutory information and reports are required by law to be sent to government authorities are normally specified and required straightforward processing of data. These categories of information are also having significance in industry. The uses of this type of information are observed in both R&D and project work centers of industry. The organizational structure of the industry is normally worked at three levels: Top level, Middle level, and Lower level. Top-level managers are expected to formulate policies and prefer strategic information, whereas middle level managers are to direct and control the functioning of the industry to achieve the optimal target and performance. Middle level managers use tactical information in which they monitor for better production and maintain the operability of the various functions of the units of the industry. They also control and execute the policies and norms set by the top-level corporate managers/ key executives. The lower managers are operative strength responsible for specific tasks of day-to-day operations and they implement the decisions of middle management. For this, they need operational information. The statutory information, which can be related to the legal aspects and regularity implications of industry and R&D institutes, is dealt with top and middle level managers within the legal framework. Statutory information is frequently sought in the area of personnel management, production management, financial
management, and materials management, marketing management, and research, design & development management.

Hughes (1991) noted three developments of importance of information. First, information is now treated as 'scientific' concept. Scientists are now saying that nature must be interpreted as matter, energy, and information. The second development is characterized as 'information age', which is regarded as 'capital good.' Information has become an economic commodity. The third concept is that information has got powerful enabling effect.

The scientific information now seems to have top seven trends (Missingham, 1999). These trends are: continued expansion in publishing, the rise of the web as a delivery tool, move to desktop/universal access, plethora of interfaces, decrease in the importance of print and changing cost of information. In recent years there has been visualized the unabated increase in publication of scholarly information both in print and electronic media. The Web has also proven to be a fertile medium for publishing. It has promoted an increase in publication of electronic journals, databases, conferences, preprints servers, and general information resources. The turn of millennium has, further increased new expectations among user community with provision of full Internet connections, searching skills, and a desire to have unlimited access to major databases as well as electronic journals. Networking in many organizations, together with the adoption of Internet protocols, has led to the production of Intranets with the suites of corporate or organizational information. The plethora of interfaces and the developments of instant and easy access of information have
brought a vast array of difficulties to use. After using Web of science, Dialog, e-journal packages and library catalogues, users are generally left confused. It is now quite difficult for the users to remember the truncation symbols used in each databases or what is actually in the fields or understand fully the contents of databases or fully conversant with the software required to read full text products. At the same time when for many years scientific communications, to a large degree, has to be dependent upon publications of papers in scholarly journals in print media, but there values are slowly reducing due to the introduction of many high quality electronic journals. The introduction of some e-journals in the Current Contents and their evaluations in Citation Indexes of ISI (Institute of Scientific Information) has shown added importance of these journals among the scientific community.

The costs of providing access to electronic information can be broken down into hardware and software costs, communication costs and content costs. The content cost, which is most important item that the user may have to bear, will be less in comparison to print media. The working styles of scientists, technologists and industrialists and their information pattern are also changing significantly. The work intensification, widely reported in general workforce, has affected the total scientific and industrial environment. They are now working on a wider range of projects often with very tight deadlines. These people in general now have high IT skills, operating specialist equipment as well as all basic software, including databases and Internet. So, there are more expectations of getting electronic information sources in terms of timeliness, content, and accuracy.
1.2 INFORMATION NEEDS: GENERAL OUTLINES

Information need involves a cognitive process, which may operate at different levels of consciousness, and hence, may not be clear even to the inquirers themselves. It is also seen that a user could rarely specify what is needed under defined conditions. As such the act of defining a need is an important part of creative process. Under some conditions it is also observed that an information need may not be specifiable as indicated by Crawford (1978). According to Havelock (1979) "Needs" are very "significant messages within the human system". It is presumed that "Information needs" arise when a person recognizes a gap in his/her state of knowledge. They are the dynamic forces, which create instability within the person-system and which lead to a cycle of behaviours that will ultimately correct this instability. So, need is stated to be a physiological statement, which seeks to be relinquished through commodities, which can be objects or being. At the same time it is known that all people do not have information needs for every types of work, rather when they experience some problem or difficulty or are under some pressure, then they try to meet their "information needs". The concept "information needs" is related to users study such as demand, wants, and requirements. The literature points out a dilemmatic situation about the concept of information needs and uses. This confusion is mainly due to the failure of majority of researchers in the field of users' studies to distinguish between information use, needs, demands, wants, and requirements. The reason for this
shortfalls lies as Wilson (1981) observes with the troublesome concept of information.

The Information need operates at different levels of consciousness and to some, it may be difficult to define and work out, i.e. to isolate and measure. Whereas the other related terms such as ‘demand’ and ‘use’ are easy to define. Information use is stated to be a kind of behaviour. The demand of the users on an information service can be recorded. Similarly, the use made of services and documents can be noted. However, different processes such as information seeking behaviour, demand on specific information services, etc. may help to access the users information needs. In other words, information use is that seeking behaviour, which leads to the use of information in order to meet an individual’s needs. According to Nicholas (1996), one can build upon these definitions of information needs by adding that it is beneficiary to meet the individuals information needs to have to do their job effectively, solve a problem satisfactorily or pursue hobby or interest happily. It may be assumed that for people to perform efficiently, effectively, and safely etc. they need to be well informed, i.e. their information needs should be fulfilled. It may be said that “Information Needs” and “Information Seeking behaviour” are related concepts. Because information seeking behaviour results from the recognition of some needs perceived by the user (Wilson, 1981). Information seeking behaviour may take several forms where the user may make demands upon formal systems that are customarily defined
as information systems, such as libraries, on-line services, information centers, etc. The user also seeks information from other people.

1.3 INFORMATION NEEDS: DEFINITIONS AND FEATURES

The concept “information needs” has been felt to be difficult to define. “Information needs” is defined as “what an individual ought to have for his work, his research, his edification etc.” In other words information needs may be studied by information seeking behaviour, which, further may be assessed from information use studies. The satisfaction of information needs however, does relate such effects, in terms of individual’s receiving and processing of transmitted and previously communication to his needs (Babu, 1994). It is also remarked that “information needs” is complicated by the necessity to distinguish among expressed, unexpressed, or unfelt needs, the latter being the most difficult to identify. A difference may be available between what an individual may perceive as a need and the way it is expressed. This approach seems to indicate that formulation of an expression is influenced by some perception, which is a preconceived idea, about the source as much as the problem. Therefore, it may be difficult to differentiate when a need is realized and how it is expressed.

Information need is a subjective and a relative concept existing only in the minds of the experiencing individuals. Therefore, it can be said that any piece of information may be available in any form, that a scientist /technologist may need in connection with their studies, research and teaching purposes, may be defined as information needs of the scientists and technologists. In the process of information searching,
at "initiation", a person first becomes aware of or lack of knowledge or understanding, feelings of uncertainty and apprehension. At this stage people show the need for information (Kuhlthau, 1991). The information needs are perhaps implied by demands and information seeking behaviour. Menzel (1966) has argued to study needs and uses, it means primarily to study the behaviour and experiences of scientists and technologists in confrontation with information channels. The information needs of users are identified to have eleven major characteristics. They are: subject, function, nature, level, viewpoint, quantity, quality, date, speed of delivery, place of publication /origin, and processing and packaging (Nicholas, 1996). Some of these like subject, date and language are familiar to all. Subject is considered as the most obvious and immediate characteristic of information needs of all users. This is probably central to nearly all information need statements. The trouble with the subject is that, too often, information professionals expect information needs to be described on subject terms alone. Therefore, the key terms of the subject are to be determined. Another problem is that except few persons, most of the persons need to have information on more than one subject. At the same time in this multidisciplinary and multitasking world the number of subjects that people are expected to keep in touch with, is ever on the increase. Along with this the extent of depthness of subject of user is another question before the information science professionals. The assessment of information needs of users should find out whether the user is interested on general materials, key words or the term,
including the details of the items. To define the subject aspect of information need of users is not so easy. The major problems are:

1. The generalization or simplification of the subject request by the user,
2. The vagueness with which the user describes the subject, and
3. The problems encountered by both user and intermediary in translating the users' key words into those employed by the information systems.

When the users try to communicate to the intermediary the subject of their concern, they frequently generalize the topic due to varied reasons. The users also sometimes frame some closely related vague questions on the subject of their search. Then lastly, there is also a problem in translating user-generated key words into the retrieval language of the information system.

The next feature of information need is related to use to which the information is put. Different individual and different community of users put the information to work in different manner. Their end products are different and so, also is the way they use information. Each organization has their unique use of information as per the role and the specialization of the individual scientists / workers those who are employed in the organization. However, in general people need information on following broad functions. These are:

1. Providing answers to specific questions (the fact-finding functions),
2. To keep up to date (the current awareness functions),
3. The investigation of a new field-in-depth (the research function),

4. To obtain a background understanding of an issue (the briefing function), and

5. To provide ideas or obtain stimulus (the stimulus function)

The nature of information need refers to the essential qualities of information that is needed, i.e. whether it is conceptual or theoretical, historical or descriptive, statistical or methodological type of information. In any given subject information will be found written up in all these forms and some of these forms may not be suitable to the users. Nature, like levels, is very much tied to the readership/audience for whom information is intended. The feature and intellectual level characteristics refer to the minimum extent of knowledge, and sometimes the level of intelligence required by the user to understand the information. Information, especially in the social science is written up from a particular point of view, angle or approach, and user may require information in sympathetic to the views that they subscribe to. Bloug (2002) depicted the information needs in different way. Each user has a different type of information needs depending on what he's trying to find and why he's trying to find. He described information needs analysis as a design tool, because it is difficult to determine users' common needs.

Modern society requires to be more informed than ever before. The presence of vast quantity of data in every form provides its own form of encouragement. Motivation, diligence and the amount of time available
to digest the information are all influential factors in determining the amount of information consumed. The chief problem is that the huge amount of information now available in all the disciplines. The quality assessment of information needs is considered to be highly subjective. The quality ranks very high in the minds of the users. The selection of quality of information can be highly of personal decision. So, information need has a number of basic characteristics that help in designing a perfect ISRS (Information Storage & Retrieval Systems). Mabawonku (2001) observed that the wide range of types of information is required for capacity building for national development, client demands information on socio-political issues, the economy, education, technology, and agriculture, among other subjects. Policy makers in public and private sector, in particular also desire timely information for decision-making.

Rhode (1986) expressed about the three embedded concepts of information needs: studies of users, their environment, and information use. Rhode further, made the viewpoint that the methodology used for most studies were found inadequate for uncovering users’ real needs, which would be difficult to discover, measure and classify. Devadason and Pratap Lingam (1996) illustrated that in order to identify information needs one should adopt various methods to gather information on the various factors that influence information needs. They studied the information needs with several techniques necessary under the given environment of users’ needs. They presented information needs
 identifiers as a bye product, several ideas, tools, methods, and
techniques of satisfying the users in meeting their needs.

1.4 TYPES OF INFORMATION NEEDS AND USES

Information needs are of different types. Information needs are internal and varies with the individual and situation. It may be affected by many factors such as: range and knowledge of information sources/facilities available, varieties of users to which information will be put, the background, motivation, professional orientation, discipline, type and area of work and other specific individual characteristics of the user, social, political and economic conditions, etc. Due to this nature, it is impracticable to take one generalized one-time conclusion about information needs of users. Of all the factors influencing or determining the users need, two factors, which may not always be matching, are the corporate objectives of the organization where the user is employed, and the needs of the individual user. Therefore, user behaviour and expressed demands are the point of study under the subject information needs. It is also true that all the individuals may not necessarily experience information needs. Rather one feels the necessity of information when one faces any problem or under some pressure. It is seen that information needs may arise out of the three basic human needs (Nicholas, 1996).

1. Physiological needs (need for food, water, shelter, etc.),
2. Psychological needs i.e. emotional or affective needs (need for domination, security, etc.), and
3. Cognitive needs (need to plan, to learn skill, etc.).
It is derived that all the three categories of personal needs are interrelated. For example, physiological needs may trigger affective and/or cognitive needs; affective needs may give rise to cognitive needs, and problems relating to satisfaction of cognitive needs (such as a failure to satisfy needs, or fear of disclosing needs) may result in affective needs (e.g. for reassurance). This interrelationship further depicts that as part of the search of satisfaction of these needs an individual may engage in information seeking behaviour. In this context Wilson (2000) has suggested that it might be advisable to use information-seeking towards the satisfaction of users' needs instead of using the term information needs. But information need is still the most popular field of study under the library users study.

The very need of information of the user studies decides which information is more relevant to be accepted. The selection or reception of the information seems to depend on the individual conception as well as individual needs. At the same time it is also argued that there is a need to create information needs among users if they do not exist, and those information seekers may be ignorant of the information that would be useful to them. Studies relating to information need categorize needs as of different types such as: perceived needs; immediate needs, and deferred needs, continuous needs and discrete needs, regular and irregular needs (Ramesh, 2001). According to Nicholas (1996) the information needs are broadly categorized as of two types i.e. dormant need and unexpressed needs. These types of information needs are based on the situations /conditions that create
the awareness about information. The dormant need for information is expressed only when a person is exposed to certain information, which is felt to be worth to him/her. Here people do not know what their needs are. Even they do not feel that they have an information gap. But that information, which is received, may be helpful to a person. Such kind of information needs, which is of dormant type is difficult to be taken care by an Information Storage and Retrieval System (ISRS).

The other type of information needs i.e. unexpressed needs, where the users are aware of their needs but do nothing about them, either because they cannot or will not get the information. This may be due to the fact that there may be some obstacles and constraints for which information could not be collected. Therefore, information needs could be unexpressed or expressed /articulated, felt or unfelt, dormant or deliquescent. In addition to this information needs of users, can be expressed in terms of time (i.e. urgency), content and amount or quantity of information. On this basis information needs are classified as needs for single facts or exhaustive information, up-to-date, historical or current information, technical or business information. However, information needs are frequently grouped as type of documents needed, nature of information required, purpose of its use, etc. Cronin (1981) identified information needs as three types. These are:

1. Expressed needs/ articulated needs, which represent the gap in current knowledge and that is expressed. This type of
need can be fulfilled easily by any library or information centre,

2. Unexpressed needs, which can be fulfilled only when it is converted to expressed needs. It depends on the ability of one's part to break the mental sets, or alternatively the invention of a perspicacious information provider,

3. The third type is deliquescent or dormant need. Here users of information services may have information needs, which they are totally ignorant but the information service provider may be able to bring to light.

Thus, Nicholas and Cronin more or less have common views on types of information needs. Therefore, the information needs of individual scientists and technologists involved in various research institutes and industries may have the following basic needs:

1. The need of information to keep abreast of new developments on one's field of research work,

2. Information required deciding on the introduction of new equipment or process, and information required for solving unforeseen difficulties after introduction of this,

3. The need for specific information that is directly connected with their research work, or the problem at hand relates to the every day need. The every day need arises in the course of the work requiring specific piece of information, a bit of data, a method, and information about any investigation, etc., and
4. The need for almost all literature on a given subject available in print and non-print sources of information. The need for such exhaustive search arises when the scientists/researchers work on a new investigation. This activity becomes more urgent when the investigator takes initiation to publish it.

Information use on the other hand mean information that is actually being used. Use is considered as more than satisfied demand (intended use). Information, sometimes as pointed out earlier may be discovered accidentally/unintended, while browsing through the literature and thus may be used. Some people browse because they have no choice. These people also cannot articulate their need until something reminds them of it. It is also studied that the difference between intended use and unintended use is significant in terms of information system design. Thus, exposing users to information is an important task for information professional. It is also indicated that use of data is very valuable as it points out most directly the needs experienced by people. Simultaneously, it is recorded that use is a fairly concrete and honest indicator, which offers a very limited view. Whereas need is greater than use or demand. It is experienced that use data is a poor substitute for needs data. It is also studied that use of data is very important as it points out directly to some needs experienced by people. Use and demand data can only help an information system to improve on what it is already doing, and in itself that is no bad thing, but there is no guarantee that it is on the right lines.
in the first place. Use data will not be helpful to build a system, which requires introducing new things. But for library use studies this is not taken in to equation. Information use also works at various levels. In the first level of the use simple involves determining whether something is worth using in the first place. The second level is the consumption of information that is determined as being relevant. In both the cases user may lead to other people being alerted to the potential worth of the information consumed (Nicholas, 1996). Kunz et al (1977) stressed to study each of the individual users and their needs. They distinguished four types of individual users: potential users, actual users, expected users, and beneficiary users. Baba (1998) highlighted over the priority of IT, which is a combination of information science, computer technology, communication technology, and management science. Discussed about the activities of information production and the reason why information is under utilized. For which assessment of information needs of organizations and strategic information management is required.

Bloug (2002) tried out three types of techniques of information needs, in which ‘extrapolating information needs from search logs’ was very much popular. Bloug referred such type of information needs as ‘directional information needs’ devised by Keith Instone.

1.5 INFORMATION NEEDS vs INFORMATION WANTS vs INFORMATION DEMANDS

As stated in the earlier paragraph information needs, information wants and information demands look somewhat as if similar concepts. But
there is some difference between these terms. *Information wants* are defined as “what an individual would like to have”. The difference between the *information needs* and *information wants* is clear by simply expressing that there are so many obstacles and factors, for which it is not sure that “not all that is *needed* is *wanted* and not all that is *wanted* is *needed*”. For example, job satisfaction may be a determinant of whether individuals go ahead and attempt to meet the information needs fully. For this purpose, one likes his job, one will want to do it well, improve it, and keep self up to date. This will be an inevitable mean going out of one’s way to meet his information needs. Mahapatra and Das (1998) referred that the matter is subjective domain, where personality, time and resource make themselves felt the difference. Thus, the individuals may not be motivated to chase information, not having the time to look into or have the skills to locate information or may be just do not have access to the necessary information resources.

On the other hand *information demand* is “a kind of request for an item of information believed to be needed or wanted.” At this situation information seeking starts and the user first encounters the information professional where the user interacts with an information system, source (human or documentary) or intermediary. People may also demand the information sometimes that they do not need even they may not be aware that the information is available. So, demand is partly dependent on expectation, which in turn depends on existing
information provision (Nicholas, 1996). It is, further stated that information need must be greater than demand.

1.6 INFORMATION USERS
All the libraries have been able to provide good services to their users as a result of technological changes. Adele Hoskin et al (1982) observed that most laboratory scientists are not familiar with the procedure of accessing the several databases currently available. Scientific users' quest for information is unending and their expectations for services continue to grow. The trend towards cheaper, more versatile hardware coupled with more user-friendly software will allow delivery of library services to converge on a display terminal in the scientists' laboratory. The organizations recognize the need to keep pace with technological change and are surveying their users' community to try to anticipate their needs. The scientific community consists of many kinds of information users whose needs range from the accumulation of bibliographic background or historical information necessary to start a new research project.

As information users grow in computer literacy, the information management function must grow with them. Drake (1997) investigated that old assumptions about users' information needs and information gathering behaviour are also abandoned and replaced by data derived from marketing research and analysis. Customer satisfaction is not equated with a visit to the library or providing answer to the reference question. White (1980) has pointed out that users' studies that simply ask patrons what has been provided evoke only a self-fulfilling prophecy. Thomas (2000) observed that consumers of data could be
any one from an executive to middle-level manager up till CEO (Chief Executive Officer). The concept of Groupware technologies can be used in the workplace to enable employees to share ideas, information with their team members via computer network rather than one-on-one meetings.

Earlier studies indicate about the impact of the work environment on the information seeking behaviour of the users. Mahapatra and Das (1998) observed that the nature and types of institutions /organizations invariably affect the users in different ways, the communication structure, the users jobs, and the time pressure under which they work. The personal hierarchy, management structure, forms of information absorption, exchange and communication tools, and methods of planning and organizing affect the method of acquisition of knowledge. The relationship between the physical distance and technical communication separates the quest for information needs and brings about its skepticism. Among other factors, the motivations, persistence, thoroughness, orderliness, independence awareness of sources and language influence the individual information-seeking attitudes.

The organization pressure for economy and vulnerability of information /data diffusion and its subsequent osmotic nature of percolation, assumes to undergo the categorical assessment of information requirements within the given work climate. Since, the present is the cost intensive information seeking phenomenon and thus, the economy access and retrieval of precise information holds the preferable standpoints. So is the leveraging in terms of packaging and
repackaging of information resources and services that demands the renewed way of information needs and its furtherance.

IT has brought many avenues for librarianship to increase their own capabilities in organizing and retrieving information in 21st century. Mahapatra and Das (2000) described the information needs of user community and the overall changes that have taken place due to need based adoption of IT, the work in libraries necessitated implementation of appropriate changes in library and information curricula.

Ruthowski (2002) identified that there are major challenge for web developers to observe their users and potential users. Web developers must do their research and analyze the needs and the habits of their target audience. Ruthoswki further indicated that assessing user needs is not a quick and easy matte; it is very complicated and time-consuming process. However, it is best if user needs are considered prior to the construction of a web site. Prior consideration of user needs will save time, money and involves much less frustration on the part of the user, the designer and the client. Bishop and Bishop (1995) discussed the potential role of user-oriented studies of computer networking. They pointed out that the existing policy at the national, regional or local level might even mandate attention to user needs. They made the case for user input as an ongoing and intrinsic component of networking policy and strategic planning, achieving increased effectiveness of the networked system.
1.7 INFORMATION NEEDS OF INDUSTRIES AND SCIENTIFIC COMMUNITY

Human behaviour is a complicated phenomenon; the factors that affect its implicit objectives need be studied thoroughly and carefully. In general, information needs vary from subject to subject and its orientation. The subsequent use behaviour in selecting a particular information source by the individuals or users groups give rise to another impact of applications under such study.

Information occupies a special place in the daily life of scientists, technologists and others who are engaged in Research and Development (R&D) works. The scientists, engineers and technologists are special types of information seekers and creators. They epitomize the new knowledge workers in many ways. Because science is a supposedly rational and logical exercise, it is often assumed that information-seeking behaviour of scientists will follow similar logical, rational lines (Palmer, 1991). They depend upon the information developed over many years by their predecessors in various disciplines as well as on contemporary information. Scientists and technologists are not only the users of information but are also responsible to create information and knowledge by utilizing information already available in different sources and forms and of their own knowledge and work experiences. In this regard Palmer (1991) stated that the scientists are not "empty buckets"; they are individuals who not only collect, store, retrieve and use information, but also create it. The information produced by them is published in the form of conference papers, print
papers and as reports. The scientists and technologists mostly use the information systems at their disposal to carry out their investigations.

Unlike scientist whose main preoccupation is in the furtherance of knowledge, an engineer's main occupation is creating material objects or purposeful services by utilizing such available knowledge, as the engineer might need in a given situation. The information needs of scientists and engineers involved in industrial organizations are also quite different from other similar persons engaged in simple research works in different research institutions. Industrial information itself is a broad-based topic. Therefore, Industrial information is broadly divided into following groups: (i) techno-economic (including marketing of information), (ii) technological, (iii) request for bibliography, (iv) regulatory, (v) managerial, (vi) financial, (vii) referral types, (viii) consultancy, (ix) queries on machinery and equipment, (x) on training (Karki, 1982). The techno-economic group of information is very vast and it may include even market information and any other information on financial aspects. The techno-economic group of information is, further subdivided into information related to manufactures and suppliers of any product or raw materials, capacity of the organization, production figures, target, demand, etc. The market information is divided into export and import data, prices and market potential. Further, technological information fall into information related to technology, R&D or know-how, process and products and patents and specifications. The demand for bibliographies seems to be less in industrial organizations. Consultancy type of information is related to
technical assistance in setting of industries or information related to solving a problem. Subhashini (1994) identified various types of industrial information and attempted to assess the information needs of entrepreneurs, and described the existing institutional framework for development, regulatory, technological and market information for the benefit of entrepreneurs. Also discussed the proposal for evolution of national network for industrial information.

It is also important to note the information needs or information seeking behaviour of scientists and technologists in electronic environment. In order to study this, it is useful to review the scientific communication cycle and scientist's expectations of information access. Scientific communication includes the use of information by scientists and their contributions to the information of others. It can be grouped under two broad categories, i.e. (i) information sought for specific research objectives or projects, and (ii) browsing. The first one searching for information for specific research is a complex and laborious process in print environment. But the development of electronic information has significantly reduced the time and efforts required to undertake this type of searching. While using an information system or a library, the scientists and technologists can at best report their conscious wants for various services. The large number of studies in this context have made many authors confident that the information needs of scientists, engineers and technologists can be simply and easily listed and their behaviour quite safely be predicted. These studies also have assumed that information is a discrete, even concrete reality. It is a commodity to
be required and can be contained in discrete visible packages of roughly equal value. It is also assumed that use of this commodity can be counted or measured to represent the totality of information behaviour. Information system in science and technology are often designed on the basis of such user studies. Because the information seeking behaviour of the scientists and technologists may reflect their information needs. Sieving (1991) contributed on thematic issues of information seeking and communicating behaviour of scientists and engineers. Several techniques or types of behaviour can be observed among the scientists seeking to meet specific information needs or coping with the excess of information presented to them. Sieving-Pamela presented taxonomy to be applied to these techniques, and suggestions to meet the perceived needs.

1.8 ROLE OF LIBRARIES & INFORMATION CENTRES

Libraries are collections of books, manuscripts, journals and other sources of recorded information. They commonly include reference works; such as encyclopedia that provide factual information and indexed that help users find information in other sources, other factual reports, and periodicals publications including magazines, scholarly publications. CD-ROMs, audiotapes, and videotapes increased the type of library collections. Libraries were involved early in information technologies. For many years libraries have participated in cooperative ventures with other libraries (The New Encyclopedia Britannica, 1997). Although Libraries have changed significantly over the period of history. Libraries remain responsible for acquiring, and providing
access to books, periodicals and other media that meet the educational, recreational, and informational needs of their users. Libraries are the place where the toddler can hear his first story and a scholar can carry out his/her research.

The Libraries have been intimately involved with the increasing impact of scientific research on many areas of knowledge, including Library & information science itself. Busha and Harter (1980) explained that library phenomena are based solely upon the collective experience and know-how of practicing professionals. The scientific research in librarianship is a careful process by which librarians can acquire more accurate knowledge and understanding of libraries and librarianship. Library science research is a cognitive endeavour concerned in a large measure with the study of library methods for the acquisition, cataloguing, storage, and dissemination of books and other media of communications. By and large, the scope of library and information services is broader in scope than inquiry in traditional librarianship. Its focus is upon the service techniques whereby information is created, used, and communicated in right perspectives. Butler (1951) noted that modern library has come into existence, spontaneously and almost inadvertently, by a cumulation of immediate empirical procedure". A technology has changed and allowed ever-new ways of creating, storing, organizing and providing information; user expectation of the role of libraries has increased. In a mention, Libraries has responded by developing more sophisticated on-line catalogues that allow users to find out whether or not a book has been checked out and what other
libraries have it. Libraries have also found that users want information faster; they want the full text of a document instead of a citation to it. In response, libraries have provided SDI (Selective Dissemination of Information) services in which librarians choose information that may be of interest to the specific group of users in anticipation.

Many authors speculate on the future role of libraries in electronic age. Buckland (1992) discusses what libraries should do to hold on to their enduring values while adapting to technological changes. Birdsall (1994) provides an informed and insightful consideration of the impact of electronic information services on social, cultural, and political role of the library.

Traditionally libraries were the gatekeepers to information, knowledge and learning, the custodians and organizers of the cultural and intellectual record. Bruine (2003) experienced that under the new framework, libraries will have to integrate themselves into the networked society and cooperate with other cultural institutions like museums and archives. They will have to develop new economic strategies, better understand user needs and demands, develop skills of staff and users, and develop new services. Further, Fryer (2003) pointed out the role of libraries in the learning society. Libraries can be key players in the learning society in dissemination and application of information, by means of new technologies. Learning has to take new forms, characterized by ubiquitous change, uncertainty, globalization, information explosion, contested knowledge, challenge of sustainability, and dangers of division and conflicts.
Gracio (1997) focused on the role of specialized libraries in the economic and social context. In a given society of culture, libraries of any kind constitute documentary instruments, which make possible the development of networks for social communication. Many countries are reoriented their strategies on these new bases of industrial revolution, and many authors have proposed the idea of a post-industrial society, based fundamentally on the service sector, in particular that of information. According to Gracio, the specialized libraries possess a wealth of specialized documents in the various branches of knowledge. Their contributions to research and scientific developments are confirmed in the generation of knowledge. Gutierrez (1982) pointed out "the library only can be socially useful if its operations derive and are harmonized with the understanding of how knowledge is engendered and flows through the means of communication of social and intellectual organism, which is in constant evolution; and it is this changing social structure that greatly determines how knowledge is translated into action". The industrial and technological revolution has made an effect on the creation of specialized libraries in the present century, in order to satisfy a great variety of research necessities, through the services provided by these information centres.

The library has a major role to play by providing printed materials in the form of books, journals, and other documents, including access to electronic information. Through the library's resources (human and physical) information (printed and electronic) can be accessed from
other sources. Mabawonku (2001) described it as effective partnership
and interrelationship or collaboration between two or more individuals,
libraries, and establishments and to capacity sharing.

Information centres are no longer bottomless pits in which investments
are sunk without any visible development. The discipline is also
receiving entrepreneurial attention. Users have come to realize that the
jobs of information handling are not at all that simple and require
professional skill and training. Lochmann (1997) advocated the
investments on information and preferably on IT for more technical
transactions. The growing field of information science and technology
draws on fragments and fringes of a number of sciences, technologies,
arts, disciplines, and practices. Broko (1968) indicated that the
element that provides whatever degree of cohesiveness now exists in
the field is a shared deep concerned with ‘information’—its generation,
transformation, communication, storage, retrieval, and use.

In the last two decades the LIS profession has witnessed the
exhilaration of unparalleled rapid growth of librarianship & information
science. Alema (1989) visualized the role of librarians as managers,
policy makers, and disturbance handlers in the organization. The
success of the library may well depend on whether librarian is able to
infuse the whole organization system with energy and imagination, or
allows his library to stagnate. Humbaire (2000) visualized that libraries
and documentation centres are facing two trends: the rapid
advancement of information communication technology (ICT), of which
the internet is most visible; and the political & institutional changes.
Pringgoadisurjo (1991) observed that new breed of librarians needs to be recruited as a consequence of the new demand for services. Their role has become more stringent than that of information intermediary. Libraries and information centres should become more client-oriented and active information providers.

The concept of value added information services has been recently much discussed. The rising costs of library materials have much impaired the ability of libraries to maintain comprehensive collections. Jones (1991) investigated that libraries have tended to remain the domain of the literate and more educated sectors of society. Zhang (1998) observed that in a campus community the role of libraries in information access and the Internet was increasingly becoming an important source of information. According to Zhang, in order to meet the information needs of faculties, and staff, it is necessary for LIS professionals to seek new better ways to deliver value added information services to users. Lindquist (1997) advocated that library must reach out more towards the sources of information. To meet the users' needs in the world of digital information libraries must revise their policies and their way of working. Libraries are one of the institutions in the traditional value chain. Their main role has been to provide logical and physical access to information. In the transition period it is necessary to find a balance between the efforts on describing the traditional forms and the electronic forms. Lindquist further, estimated that cataloguing electronic work is more expensive than for traditional one. Mahapatra and Das (2002) assessed the
problems of cataloguing and difficulties of handling electronic materials while cataloguing. In another paper Mahapatra (2002) emphasized that about ninety percent of libraries are required to continue with traditional management and organization of their activities. In Indian environment there will be two types of library configurations: digital and conventional. Sacerdote (1994) visualized the changing roles of institutions with the value chain. Today much attention is given to the control and ownership of content, as witnessed by research programs and by commercial activities of acquisitions and mergers in the information industry. Technological convergence is an example of how traditional roles change and how the business sectors are in competition with each other.

Bruine (2003) further, emphasized on the roles of libraries in the information society. It is characterized first by the developments in the technology field, like data compression and broadband technology. Secondly by convergence in the information industry characterized by digitalization and multimedia. Thirdly by competition in the information market through internationalization and deregulation, and fourthly by the increased choices for the users.

Holland and Powell (1995) visualized during their survey study that corporate librarians and information managers should realize that engineers might be very much interested in learning about electronic access to information. They stressed that professional societies have come up with renewed role in the delivery of technical information career development training to enable them to solve their technical
information needs. They added that academic librarians, and corporate counterparts should consider collaborating to develop a continuum of services for newly graduate professionals.

1.9 REVIEW OF LITERATURE

A Library or an Information Storage and Retrieval System (ISRS) should be planned as per the information needs of the users. Therefore, since 1960's a lot of works have been carried out by the librarians and information scientists in the field. Menzel (1966) made a detailed review of literature on information needs and uses in science and technology, and attempted to establish the working definition and concept of Information needs. According to Menzel, "the way in which the scientists and engineers make use of the information systems at their disposal, the demands that they put to them, the satisfaction achieved by their efforts and the resultant impact on their further work are among the items of knowledge, which are necessary for the wise planning of science and information system and policy". The main purpose of the investigation of information needs is to study about the experiences of scientists and engineers in conformation with information channels. Menzel also reviewed the literature on preference, demand and experimental studies on information needs of scientists and engineers where journals were given top rating for the most demanding activity, than books.

Agrawal, Manchanda, and Lal (1984) discussed the scope of user education and the value, methodology and assessment of user education programmes, describing international and national level of
developments in user education, and proposed the formation of a national policy on user education and a national agency to administer its programmes. Satyanarayana (1988) asserted the regular users' education turning around the technological usherings and various formats of information sources and services to assess the real value of their information needs. Allen and others (1967) have described about the communications stars that serve as "gatekeepers" and facilitate the flow of information from outside and transmit it to their colleagues. Auster and Choo (1991) proposed a conceptual framework for studying the information-seeking behaviour of executives when they scanned the business environment and literature. The framework could be especially useful in designing research to investigate some basic questions about executive scanning behaviour. The questions address issues such as what information do executives require, which sources are used by them to obtain the information, and how is environmental information used in decision making? Auster (1982) studied the area of organizational behaviour and the areas of information seeking, being separate fields that have produced literatures relevant to librarians. Neither of these fields, however, is concerned with librarians as their primary focus nor does the literature of librarianship generally take into account the findings from these disciplines. Ellis (1993) described an approach to the design of an information retrieval system for academic social scientists and attempted to determine their information-seeking patterns conducted by the Department of Information studies at the University of Sheffield by
means of informal, semi-structure, in-depth interviews. The six characteristics appeared in the patterns and at the same time to provide a framework for a flexible model to underline recommendations for information system design and, evaluation. These are: starting, chaining, browsing, differentiating, monitoring and extracting.

Itoga (1992) presented an interdisciplinary study of research into the social aspects of information communication by bridging the existing gap between cognitive and phenomenological views of information needs and uses. Limberg (1995) intended to understand the interaction between information seeking and learning outcome in education. The hypothesis of the study is that what students learning about the subject content of an assignment are affected by the way the student searches and uses information for the assignment. Studies have been carried out on upper secondary and college level. Lonnquist (1990) reported in a project designed to study the information-seeking behaviour and information needs of scholars in the humanities from a holistic perspective. Sixty-four people from Denmark, Finland, Iceland, Norway and Sweden were interviewed, and the result shows that scholars in the humanities do not have a homogeneous information-seeking behaviour or homogeneous information needs. Compared to other information channels research libraries turned out to be of greatest importance for scholars seeking information and printed materials for their research. The study also showed that scholars used bibliographies only to a small extent and their bibliographical awareness was rather low.
Sasikala (1994) reported results of a study of the information and library use behavior of 436 managers in three groups (senior, middle, and junior) from 20 industrial organizations in Andhra Pradesh. The result of her study depicts that managers seldom visit libraries; that they try to satisfy their information needs from other sources as well as from libraries; managers need data type information firstly and descriptive information on specific topics secondly; managers collect information to keep abreast of current knowledge to solve immediate practical problems; and additional information relating to the job. Savolainen (1995) offered a framework for the study of everyday life information seeking (ELIS) in the context of way of and mastery of life. The way of life is defined as the 'order of things', manifesting itself, for example, in the relationship between work and leisure time and models of consumption, and nature of hobbies. Mastery of life is interpreted as 'keeping things in order'. The four types of ideal mastery of life with their implications for ELIS are outlined, namely optimistic-cognitive, pessimistic-cognitive, defensive-affective and pessimistic-affective.

Two major dimensions of ELIS were reviewed: seeking orienting information and seeking practical information. The research framework was tested in an empirical study based on interviews with eleven teachers and eleven industrial workers. Discussed the main features of seeking orienting and practical information and made suggestions for refinement of the research framework.

Selden (1992) described the research patterns of social science researchers and humanist scholars, and assessed the state of
business studies. Discussed Kuhlthau's model (1993) of information searching and presents a behavioural model for information system design based on information seeking activities. Examined the conditions for research and researchers' use of libraries. Discussed the research career and the information-seeking career covering information socialization of the junior researcher, steps in the research career and information outcomes of the research career. Contrasted the structure of science and engineering information with that of business researchers and humanities scholars. Stam (1989) studied the information-gathering activities of art historians from three different perspectives: in terms of the books they use; through their own accounts of their working processes; and by informal, systematic observation, written up is 'user studies', by art librarians. While observation implies objectivity, a distance exists between observers and observed in practice. Art librarians are very much involved with the art historians in the work of art history and in the development of its methodologies.

Wiberly and Jones (1989) described how humanists in a small, interdisciplinary group seek information, confirming findings of previous researches, although with significant variations. They ignored on-line databases and seldom consulted reference librarians, but they did rely on archivists and special collection librarians. Their use of formal bibliography was limited to 1 or 2 sources and occurred only when exploring new topics, their preference being to find information by going to the person or location that could supply it. Devarajan (1995)
described about the factors that influence the information needs of users. Devarajan presented the reasons for users studies: (1) to judge the limitations of library system and services, (2) to identify the levels and kind of users needs, (3) to exploit library resources with less money, time and energy, (4) to enhance the quality of acquisition and collection, (5) to identify the limitations or problems which seem to discourage the use of library, (6) to predict the future information demands and requirements, and (7) to design and develop need based and user oriented information system.

Considering the state-of-the-art-review of historically contributed literature on information requirements, users needs, and information seeking in various fields are dates back to 1920s. These studies appeared first in the United States in the late 1950s. While Merton (1973) was known for his pioneer intellectual work in this area. Menzel (1958) was the first to produce a research reports in the scholarly communication brought out by Bureau of Applied Social Research. Columbia University. It is worth noting that the early period of scholarly communication studies was largely concerned with the users of scientific and technical information. According to Martyn (1974) this situation was inherent with the fact that use of scientific and technical information has traditionally been the area, in which information problems were most generally felt and in which information workers were most active. In the second stage, part of the attention was paid to social sciences. However, only recently, have these studies concentrated on the humanities.
Rouda and Kusy (1995) presented the systematic approach of 'needs assessment' in *Tappi Journal* in 1995-96. During their course of study of needs assessment, they adopted mainly four steps, viz: perform a gap analysis; identify profiles and importance; identify causes of performance problems and opportunities; and identify possible solutions and growth opportunities. They also stressed over the techniques for investigating organisational and personal needs. Atanasiu and Teodoru (1985) carried out a survey of information needs in Rumania to reveal differentiation among information users related to their professional orientation. They presented the results in information use according to professionals, such as scientists, engineers, managers, etc. Raitt (1985) carried out the project to ascertain the communication, information seeking and use habits of scientists and engineers of multinational, multi-cultural governmental organizations. Raitt provided research methodology, choice of organizations, and survey techniques. Reviewed the major findings of the research project relating to library and information Centre and its services; information needs and services of the scientists and engineers; the organization and its communication flow; the reading habits of scientists and engineers; and barriers to communicating. Gupta (1988) asserted the responsibility of information scientists to disseminate relevant and up-to-date information to those involved in research, and described the information seeking approaches of structural engineers, highlighting the value of user studies in formulating an efficient information system. He further reiterated that
information scientists should possess knowledge of library and information science, statistics, computer science, management and psychology and behavioural sciences.

Brown (1981) in his study brought together various aspects of information-seeking behaviour, projected over an organizational and behaviour framework into a general survey of the literature. Three dimensions of information-seeking behaviour were determined: the conditions, the context, and the process including the interaction among these dimensions. Selected barriers to information-seeking behaviour are reviewed. Burdick (1996) described an exploratory study of the impact of gender on information seeking. The study took place during the fall trimester of 1994 at the laboratory school of a large university in the USA. The sample consisted of 47 females and 56 males enrolled in 4 English classes (one an honors class) in 10th, 11th, and 12th grades. Addressed the importance of investigating gender issues; presented a conceptual framework; reviewed research questions methodology, and study site; presented a brief summary of findings; and outlines implications.

Chatman (1991) reported a study in which gratification theory (essentially, that certain populations live in an environment in which the emphasis is on immediate gratification and satisfaction of needs) was applied to an information-seeking behaviour of a lower-working class population. Chatman concluded that, although members of this population expressed a number of areas in which they needed information (e.g., employment, everyday coping advice, etc.), they
were not active seekers of information outside their most familiar social milieu. Findings indicate that a possible explanation for this was the perception that outside sources were not capable of responding to their concern. Thus, there was little motivation in exploring the relevance of these sources. Moreover, items most interesting to them were those things that were accessible, had a firm footing in everyday reality, and responded to some immediate, practical concern.

Ocholla (1996) analyzed information-seeking behaviour by university academics at Moi University, Kenya. A pilot study was conducted and data collected through questionnaires and interviews among 27 academicians randomly sampled from: health sciences, information sciences, environmental studies and education faculties. Ocholla reported the results which covered: departments and faculties where academicians belong rank and position in the academics, information resources frequently used by academics gaining knowledge of the existence of information sources, generation of professional ideas, reasons for looking far, where the academics get the information resources they use, and dissemination of information. Ocholla made recommendations to support information provision capacity in a university. Oliver and Oliver (1997) tested the hypothesis that information-seeking activities based on contextual and social purposes would lead to higher levels of knowledge acquisition and learning than those achieved through activities where the purpose and context was absent. They concluded that there was tacit support for hypothesis. When students participated in information-seeking activities and tasks,
the context and purpose of the activity influenced the amount of knowledge gained and retained.

Osiobe (1988) reported a study undertaken at Port Harcourt University Library, Nigeria, which investigated students' information seeking behaviour. According to Osiobe, browsing is the prevalent source of reference to the literature among undergraduates followed by faculty staff and the library card catalogue in 2\textsuperscript{nd} position, and the subject librarian in 3\textsuperscript{rd} place. Further, it was reported that Abstracts and indexes were poorly used and ranked 6\textsuperscript{th} in the study. Prentice (1980) summarized the interview findings of the five papers in this special section. Each individual has his special information needs and each works in a field in which current information is both essential and often hard to locate. Co-workers were the most often consulted information sources, and libraries were rarely if ever used for on the job needs, perhaps there was little or no role for the library in this sphere for many workers. Library staff too consulted co-workers when planning the libraries reference activities. Potential users were aware what their need existed and Librarians needed to know the extent to which they fulfill those needs.

Since, human behaviour is a very complicated phenomenon, the factors that affect it cannot be otherwise. Hence, there are other factors that may influence the users in selecting a particular information source. Paisley (1968), in a very often cited paper, observed that information needs are affected by the following factors:

1. The range of information available,
2. The use to which the information is put,
3. The background motivation, professional orientation, and other individual characteristics of the users,
4. The social, political, and economic systems surrounding the user, and
5. The consequences of Information use.

Yates (1986) studied the information needs of the human beings met by the librarians. According to his studies, the information requirements of the individual may change as a result of sociological and economic factors. Singh (1979) defined and differentiated the term 'needs' and 'users', and reviewed the techniques used for this study. He pointed out the non-availability of need and use studies in Indian environment. Several studies drew attention to the impact of the work environment on the information seeking behaviour of the user. According to Slater and Fisher (1969), the institution may affect the users in different ways. They presented with examples of the nature of institution in which the users work, the communication structure within the institution, the users' job, and the time pressure under which they work. Sovenyhazy (1975) mentioned the climate of working within the hierarchy, methods of management, forms of stimulation, information exchange, communication tools and channels, and method of planning and organization as external conditions affecting the method of acquiring knowledge. Other investigations highlight the impact of personal factors on the use of information sources. Line (1969) mentioned about motivation, persistence, thoroughness, orderliness, independence,
awareness of sources, and language understood as factors belonging to the category of personal factors affecting the information seeking of the users. Martyn (1974) suggested that the users' reactions to and judgments of service are often based on subjective impressions. Thus, the physical appearance of information service may increase or decrease the users' confidence in its quality.

Among other studies, Rosenbloom (1967) suggested that factors such as experience and seniority are potentially related to information seeking behaviour. Bernard et al (1964) reported that older scientists used the literature for the purpose of choosing research topics, while younger scientists leaned on informal discussions. This is attributed to the fact that younger scientists are often under the supervision of senior scientists with whom they are in close contact. Bernard's study also suggested that young scientists tended to keep in contact with individuals they respect in their field through reading the literature, while older scientists used informal sources, such as phone calls, correspondences, visits, and contact at meetings. Zaltman (1968) observed that younger scientists/technologists had less access to informal communication and relied more on printed sources. Visvesvaraya (1975) studied about the engineering information needs and services in Indian context and proposed for evolution for Information System for National Development. Also indicated the need for attention of engineering information under the framework of NISSAT). According to Korah and Devarajan (1991) in a study of the information needs and use pattern of scientists using
literature on rubber technology, the scientists adopt use patterns of
different types of materials, the adequacy of library collection and
library services; information strategies, etc. Singh (1981) attempted to
study about the information resources, services and information needs
in chemistry and chemical technology, and proposed the need for
developing NCL library into National Information Centre for Chemistry
and Chemical Technology.

Huber and McDaniel (1986) provided eight guidelines on nature and
design of organizational change. They suggested to adhere to these
would make feasible new organizational structures and processes.
Further, they suggested three characteristics of the organizational
environment, which make change necessary—more, and increasing
information; more and increasing complexity; and more and increasing
turbulence. Huber (1984) in an earlier paper described the nature and
design of post-industrial organizations, and noted four changes that
could be expected to derive from adoption of advanced communication
and computation techniques.

Bernard et al (1964) found that the need and demand of geoscientists
and engineers for and use of information is greatest in the initial period
of each project. Thus, an engineer engaged in a new research project,
initially conducts an extensive literature search and seeks out possible
sources for ideas as well as components. The literature search quickly
decreases; however, an important finding is that as the project
progresses the document search is replaced by person-to-person
communications. Outside consulting is relatively high initially, but is
considered, in general, an important factor in all phases of the project. Raina (1983) ascertained the information needs and habits of Indian geologists. Raina also highlighted the trends of research outputs and publication activities of Indian geoscientists. Singh (1981) attempted to study the information needs of engineering scientists in India by using citation pattern, with a view to prepare the foundation for active documentation in the field of engineering science in India. Singh also presented some guidelines for the librarians in the selection, acquisition, organization and dissemination of information in this field. Allen (1966) in his studies of communication patterns among engineers and scientists in the R&D teams found that the use of information sources varied from one phase of the research projects to another. Rahman and Binwal (2000) studied that the usage pattern is influenced by their background variables, such as: age, gender, qualifications, and status. The analyses showed that the socio-economic background variable influence the use of libraries and information centres. Information systems can also play tacit role in technology transfer and scientific communication among scientists and engineers. Bishop and Peterson (1990) studied about the technology transfer and role of libraries. Also discussed the role of information in technology transfer and presented key findings from research on the information needs and communication patterns of scientists and engineers. They displayed the implications of the research for design and management of scientific and technical information system including libraries and computerized systems. Communication in engineering and science is
fundamentally different. Commutation pattern differs because of the social systems associated with the two different disciplines Holmfeld (1970) underlined that the characteristics of social system affect the communication behaviour of engineers and scientists. Holland and Powell (1995) made an exhaustive work during the survey of information seeking and use habits of engineers, and their communication in technical aspects. They estimated that among engineers the searching and reading habits of information seeking would have been at the average of ten hours more per month rather searching the formal sources of libraries.

Skelton (1973) found that the most important methods used by physical scientists to retrieve information were respectively: citations, abstracting and indexing journals, personal recommendations, and chance. Skelton's study reveals that scientists used abstracting journals mainly for current awareness rather than for retrospective searching. On the other hand physical scientists did not seem to find reviews particularly useful for locating information. Based on these findings, Skelton concluded that physical scientists often found information by chance rather than by formal use of bibliographic tools.

Shaw (1956) observed that physical scientists spend more time with library materials and subscribed to more journals that did engineers. In the case of reading habits, Packer (1975) found out that scientists and engineers spent their two to five hours per week on awareness activities. Mostly scientists of R&D institutes are regularly ardent to visit libraries of attached institutes or projects on daily basis during
working days, and weekend. Mailoux (1989) highlighted the certainty of knowledge production and transfer to engineering work. Mailoux further reports that 20 percent of an engineer’s time is spent in the intellectual activities of engineering—conceiving, sketching, calculating and evaluating—with the 80 percent spent on activities associated with creating, reviewing, manipulating or transferring information.

The relevant studies falling within the purview of the user needs in the context of electronic information reviewed are as under:

Barry (1997) reported the results of the Information Access project, funded by King’s College London and the British Library Research and Development Department, set up to examine the effects of information technology, the electronic library and the Internet on the information seeking behaviour and research behaviour of academics in higher education. The project studied a team of theoretical physicists over two years using a qualitative, context situation, and user-centered methodology. Electronic resources, primarily electronic bulletin boards and electronic mail, were used to access information in 80 per cent of the 48 research projects, usually in conjunction with traditional methods. Discussed the changes in information activity, changed boundaries and speeding up of the work of the research community: increased visibility for researchers; formalization of the preprint process; replacement of formal with informal peer review; improved access to more current information; and the use of libraries. Drawbacks reported include: limitations of electronic mail communication;
information overload; limitations of reliance on single information sources in terms of their focus; and the reduction in creative active information seeking. The main electronic information source for the high-energy physicists used in the study, was the High Energy Physics Theory (HEPTH) pre-print bulletin board: a service designed to provide rapid access to written research information available before it is published in periodical form.

Burke (1990) examined the extent to which microcomputer availability has affected the level and nature of use of traditional information sources. Burke discussed the results of two field surveys, which were carried out in order to examine the current and potential use of microcomputers for information handling activities. The survey populations include electronic bulletin board users in the USA and university staff in Eire. There appeared to be extensive use of microcomputers for non-library oriented information retrieval activities, but less use for traditional bibliographic applications. The library can continue to have a positive role in an electronic environment, if it accepts the responsibility of catering for two types of users, the information technology rich and the information technology poor.

Chapman (1981) focused on statistical analyses of on-line searching patterns and compared the usage of a query language by various groups of searchers. Data were gathered by an experimental project, Individualized Instruction for Data Access (IIDA), Unconcerned with developing and testing a system which serves as a teacher and assistant to users of Lockheed's DIALOG system. Sequential listings of
user commands were classified by corresponding state codes to represent phases of searching. Zero- through 4th-order Markovian analyses of individual commands and strings of like commands were performed to compare searching procedures used by three classes of users. Estabrook, (1983) studied the social and psychological effects on users of the introduction of on-line catalogues in libraries. Within this framework, the argument is put forward that users' access to information is inextricably bound up with the social context within which it is made available. Hallmark (1995) examined the process of scientific communication in all disciplines with an emphasis on the Internet. A review of the wide variety of information resources offered on the Internet for one particular discipline, chemistry, is followed by descriptions of general applications, including collaborators, electronic publications, online conferences, document delivery, and data and image access and retrieval. Specific Internet resources include: listserve, newsgroups, preprints, periodical articles and abstracts, text databases, numeric and other data, newsletters, conferences, indexes and tables of contents, and reference and document delivery. Hallmark suggested some problems and issues, which were arisen in connection with scientists' use of technology and proposed factors which might encourage (or discourage) the use of new technological options. These include differences among disciplines; specific individuals in the organization who lead the way the commitment of the organization to new technology, cost and ease of use, geographical location, and corporate policy.
He and Jacobson (1996) reported the results of a survey conducted by the State University of New York at Albany Library regarding the effects of gender, college status and prior Internet experience on the use of Internet resources. The subjects were 96 randomly selected users using the Library's Internet terminals during the first two months of 1995. Respondents felt strongly that the Internet is useful, and were an important resource for their research and assignments. Users had high expectations of searching capabilities, while they felt neutral or disappointed with browsing. They concluded that libraries should provide access to the Internet and suggested that libraries should take the lead in developing searchable indexes and making databases better organized for the ease and effectiveness of browsing. Holland and Powell (1995) revealed in their studies that many engineers had access to the tools needed for electronic information retrieval, and that while few received formal instruction in their use.

Hendry and Harper (1997) studied about the effective information seeking in an electronic library, offering a large multi-use information space of materials and services, requires searchers to coordinate their reading, information seeking, and writing activities. Most interactive displays however, do not help people monitor their problem solving. They described a display, called SketchTrieve, which stresses the 'ease of expression' above all other design options and that gives prominence to information seeking material, rather than 'retrieval controls'. Jandt and Nemnich (1997) studied the use of Internet and the World Wide Web in job search and career information.
Klobas (1991) compared librarians' strategies for finding out about developments in information technology with those of computer professionals. He also compared the importance placed by each group of professionals on different sources of information about information technology, and the extent to which each group was satisfied with their information-seeking strategies for securities analysts, institutional and retail investors, schools of library and information science, and practicing information professionals. Klobas further visualized computer-based systems being used in a variety of organizations for sometime now, and there were many studies of their effects upon organizations. According to Burton (1988) in the 1980s, the concern has centered more on the introduction of IT, which may be briefly defined as the combination or integration of computer, telecommunication, and information systems. This convergence of technologies provides a greater impetus for information transfer at both the inter- and intra-organizational levels. On the macro level there is growing interest in and concern over the wider socio-economic effects, such as work pattern, information access and individual freedom, and privacy. In the book of Porter (1985), most authors from the industrialized nations are agreed that failure to take organizational advantage of IT will lead to the loss of competitive advantages in the commercial environment. Organizations fail to use IT in both production and decision-making capacity will be unable to react as fast to wide variety of commercial pressures as those organizations, which make effective use of IT. Kuntz (1998) investigated the role of online/
electronic resources in the information-seeking behaviour of university students doing a research assignment. This work is based on interviews that were conducted at UC Berkeley during the academic year 1996-97. Marchionini (1992) discussed and illustrated the essential features of user-system interfaces designed to support end user searching. Marchionini presented examples of interfaces to support the following basic information-seeking functions: problem definition, source selection, problem articulation, examination of results, and information extraction. Marchionini argued that present interfaces focus on problem articulation and examination of result functions, and research and development, which are needed to support the problem definition and information extraction functions.

Marchionini and Dwiggins (1990) studied information seeking behaviour of end users in electronic environments and compared those users having expertise in a topic area and those with expertise in online searching. Computer scientists and on-line search specialists conducted assigned searches in a HyperCard database on the topic of hypertext. Both groups of experts were able to conduct successful searches and outperformed a novice control group. Search specialists took slightly less time than the domain experts, modified queries by adding terms found in the text, and tended to focus on query formulation. Domain experts focused on the text and used their domain knowledge for further answering questions. Marchionini, et al (1993) undertook a study to identify and examine the roles that information-seeking expertise and domain expertise were playing in information
seeking in full text, and end user search systems. This forms a part of and to characterize information seeking and to determine how it is affected by interactive electronic access to primary information. They distinguished between the approaches of search experts and domain experts, and finally made recommendations for systems design. Hull (1991) contributed on thematic issue on information seeking and communicating behaviour of scientists and engineers. The research-intensive university requires science and engineering members of the university community. Lull-Harry defined some of the differences between the information needs of students and those of the research. The work proposed that horizontal organizational structures, emphasis on the team concept, and the electronic library environment come together in a synergetic way to assist librarians in providing information services in an environment of conflicting priorities. Salasin and Cedar (1985) in their study of information seeking behaviour in an applied research/service delivery setting described the sources that were used to obtain information about various topics and the use, and value of these sources by or to individuals in various work roles and settings. The findings demonstrated the importance of person-to-person communication; differences in the sources used; and the value placed on these sources, by individuals in different work roles and settings; and that information seeking episodes generally involve using multiple sources to obtain information about several topics. Milligan (1986) conducted a survey at the Institute for Medical Literature (IML) under the aegis of South African Medical Research
Council for the purpose of providing research workers in biomedicine with access to computerized information services using the MEDLINE database of the National Library of Medicine in the USA. The information-seeking behaviour, work activity, and age of users and non-users of this computerized bibliographic retrieval service were investigated by means of a questionnaire administered to a sample of user and non-user groups. Results indicated that workers in the biomedical field who used computerized search services such as those offered by IML were more likely to be involved in research rather than patient care. This finding was also evident when the work activity was investigated. Age variations were also recorded. Further, Morehead and Rouse (1982) investigated the user-system interface with a totally computer-based information system. The focused on the effects of the computer on the users' information seeking behaviour and more specifically, how the characteristics of the database and the nature of the search question affect the users' search strategy. The also considered the effects of on-line aids whereby the computer can help the users to utilize the structure of the database more effectively. The experiment employed DBASE (Data Base Access and Search Environment) designed for the project.

Rouse et al (1982) indicated that the strategies, heuristics and tradeoffs involved in on-line searching of bibliographic citation networks. An experimental environment called DBASE was discussed and its use in two studies of human information seeking behaviour were considered. Variables were examined in these studies including
the nature of the search question and the interconnectivity of the database. Schwartz (1995) examined how physicians and biomedical scientists in India learn information-seeking skills; and indicated that these were learnt through their mentors. Further, Schwartz reported that none received instructions from a librarian. Training was needed to enable librarians to use computerized information technology and CD-ROM technology, which has the potential for enabling important breakthroughs. Wang and Liebscher (1988) focused on the effects of a system's interface on fact retrieval in a hypertext environment. Results from two experiments were presented. One looked at the effect on user performance of searching electronic versus paper versions of a full text database. The other examined the effect of two distinct search strategies, index use and browsing in the electronic version of the same database. Marchionini (1995) elaborated information seeking in electronic environments, with exclusive emphasis on information seeking processes, interactivity in electronic environment, studies of users of electronic retrieval systems, analytical search strategies, browsing strategies, human computer interaction.

Nicholas (1998) studied the potential impact of the introduction of the Internet into the workplace. Nicholas deliberated that the particular interest will be the empowerment of end-users, the changes in work practice that the Internet may bring about, and the effect these changes will have on information professionals as intermediaries in the information-seeking process. Bruce (1998) examined Australian academics' satisfaction with information seeking on the Internet and
the effect of training, frequency of use, and expectation of success on that measure of satisfaction. Bruce concluded that the users had high expectations of success and were satisfied with their information seeking results, regardless of frequency of Internet use or receipt of formal training. Explained the reasons for high expectations of success for Internet information seeking was needs.

Herman (2001) examined the transition to electronic information era from the published literature in the wider context of the impact of changing information environment in three major aspects: creation of knowledge, preservation of information and communication of knowledge and information in the conduct of research, and identified its influence on information needs. Herman also attempted to portray as how users would have started harnessing the new technologies to scholarly information gathering endeavours.

Chen (1982) indicated the results of a study supported by the Office of Libraries and Learning Technologies, US Department of Education, of the information needs and information seeking patterns of New England residents. The 400 residents in six each of the New England States were interviewed over the telephone by researchers at Simmons College, Boston. The detailed questionnaire covered information searching both in workplace and in personal life during the previous month and the results were reported statistically in tables, charts and graphs.

Hemer and Hemer (1967) conducted a survey on the information requirements of the social scientists by the Bath University library.
group in England and described the different sources of information according to their usage. Also the use of informal channels for locating relevant references and keeping up with the current research was described. The study revealed that older and more experienced researchers tend to use fewer libraries than others do.

Pinelli (1991) studied on the information seeking habits and practices of engineers and stated that the information seeking habits and practices of engineers as distinct from scientists. Pinelli derived evidence, which indicated that traditional information services and products might not be meeting the information needs of US engineers.

Bishop and Peterson (1990) discussed the role of information in technology transfer and presented key findings on the information needs and communication patterns of scientists and engineers. Santosh (1988) from the study on materials covered by the 'information needs and uses', derived that researchers tend to rely chiefly on the most readily accessible sources, which usually prove satisfactory for their immediate purposes.

In a study of Aucamp (1977) on information needs and usage patterns of South African Water scientists and engineers revealed that water scientists had adequate access to library that respective information is needed monthly, answers to requests were required within a week and most scientists were interested in current awareness and information techniques. Use of information sources by the two countries differed in that the Australian water scientists placed more importance on commercial journals while South African users ranked reports and
specifications higher importance. Raina (1987) made a user study and derived the information needs of the geoscientists of Wadia Institute of Himalayan Geology (WIHG). He concluded that one of the main channels of getting the desired information outside the library is procurement of reports by requesting the author and scientists spending 50 percent of their research time in literature search.

Ellis and Haugan (1997) explored the role of information and information seeking in research and development of an international oil and gas company. They analyzed the requirements for different types of information in an environment where the need for internal and external sources were intertwined and compared the features of the information seeking patterns of engineers and research scientists. The result of the study was that although there were differences in the features of the information seeking patterns of the research scientists and engineers, the behavioural characteristics were similar. Adedibu and Adio (1997) conducted the survey of information needs and information seeking patterns of medical students at Ladoke Akintola University of Technology (Lautech), and found that more than 60 percent of the respondents take the assistance of library staff in the course of searching for books of their choice. Lalitha (1995) made an important study on the information seeking behaviour of medical and engineering personnel of India and derived that neither professional group seemed to have completely understood the complex nature of their information needs nor their information sources. She emphasized
the need for user education for medical and engineering personnel of India.

1.10 SCOPE & OBJECTIVES OF THIS STUDY

The scientific information now seems to have top seven trends. According to Missingham (1999) these trends are: continued expansion in publishing, the rise of the web as a delivery tool, move to desktop/universal access, plethora of interfaces, decrease in the importance of print, and changing cost of information. In recent years there is unabated increase in publication of scholarly information both in print and electronic media. The Web has also proven to be a fertile medium for publishing. It has promoted an increase in publication of electronic journals, databases, conferences, preprints servers, and general information resources. The turn of millennium has, further increased new expectations among user community with provision of full Internet connections, searching skills, and a desire to have unlimited access to major databases as well as electronic journals. Networking in many organizations, together with the adoption of Internet protocols, has led to the production of Intranets with suites of corporate or organizational information. The plethora of interfaces and the development of instant easy access of information have brought a vast array of difficulties to use interfaces. After using MEDLINE, Web of science, Dialog, e-journal packages and library catalogues, users are generally left confused. It is now quite difficult for the users to remember the truncation symbols used in each databases or what is actually in the fields or understand fully the contents of databases or fully conversant with the software
required to read full text products. At the same time when for many years scientific communications has been to a large degree dependent upon publications of papers in scholarly journals in print media but there values are slowly reducing due to the introduction of many high quality electronic journals. The introduction of some e-journals in the Current Contents and their evaluations in Citation Indexes of ISI has shown added importance of these journals among the scientific community. The costs of providing access to electronic information can be broken down into hardware and software costs, communication costs and content costs. The content cost which is most important item that the user may have to bear, will be less in comparison to print media. The working Scientists, Technologists and Industrialists and information patterns are also changing significantly. Work intensification widely reported in general workforce, has affected the total scientific and industrial environment. They are now working on a wider range of projects often with very tight deadlines. These people in general now have high IT skills, operating specialist equipment as well as all basic software including databases and Internet. So, there are more expectations of getting electronic information sources in terms of timeliness, content and accuracy. In this context, it is very important that Information needs and its use, constant demands and extent of its fulfillment should be considered as the basic parameters for planning for the entire information industry and knowledge management and its development to strive for the sustainable and substantial growth. There always exists inexplicable information needs in almost all the
spheres of scientific and human transactions. But the recognition and assessment of information needs in such sector of business dealings becomes necessary to reorganize the existing services and knowledge bases to ensure its readiness for sustainable development.

Being the premier oil and gas producing company of upstream sector of Indian petroleum industry, the Oil and Natural Gas Corporation Ltd (ONGC) is 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. There also exists the increasing opportunities of joint ventures for exploration and production of oil & gas within Indian and abroad. The ONGC’s R&D institutes are engaged in reinventing the new oil & gas finds and other alternative options of energy and bio-fuels to percolate the benefits to the common people of the country. The drilling engineers and scientists working at offshore and onshore platforms are not in regular and smooth access of real world of knowledge due to the nature of work and routines.

The heterogeneous activities and operations of ONGC demand continuous flow of knowledge and information to upkeep as the front-runner in business competitive scenario. The challenge of energy crisis and its threats has imposed to venture into typical options like, deep sea drilling, coal bed methane, gas hydrates, etc. The quench of basic knowledge base for affirming the scientists and engineers in their areas of nascent micro subjects and specialized competencies has
demanded to access relevant information, and ascertain their information needs to meet the upcoming challenges.

The upstream, downstream and midstream companies of Indian petroleum industry have not so far witnessed such studies to realize information needs of their key executives of core areas to accelerate their business performance. The present study has been designed to assess information needs of engineers, geoscientists and corporate executives working in R&D institutes and projects of ONGC across the country. Since the transformation campaign has made radical changes in organizational set up and thus, these projects and work centres have been made asset based towards corporate responsibility and accountability. It can be noted from the review of literature and other published works that there has been very little attempt made as yet, and that too is dealt with the situation of Middle East countries. But in India there is no such attempt made in upstream sector of Indian petroleum industry. Therefore, a serious study on information needs of engineers, geoscientists and corporate planners of ONGC in particular has been felt very much ardent to reorganize and develop the information centres as per the current demand of its users.

The objectives of this investigation are as follows:

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 inclinations of the scientists and engineers towards the information needs for electronic sources and formats.

The present study will therefore, be of much help in designing the future information system in the field of oil and natural gas production, which has now become a leading economically rich corporate sector among important Navaratna PSUs of the country.