CHAPTER- 2

REVIEW OF LITERATURE

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Chapter- 2

REVIEW OF LITERATURE

2.0 INTRODUCTION

A literature review is an evaluative report of information found in the literature related to the selected area of study. The review should describe, summarise, evaluate and clarify this literature. It should give a theoretical base for the research and help research scholars to determine the nature of the research. Works which are irrelevant should be discarded and those which are peripheral should be looked at critically. A literature review is more than the search for information, and goes beyond being a descriptive annotated bibliography. All works included in the review must be read, evaluated and analyzed but relationships between the literatures must also be identified and articulated, in relation to the field of research.

In writing the literature review, the purpose is to convey to the reader what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. The literature review must be defined by a guiding concept (e.g. research objective, the problem or issue which is discussing or the argumentative thesis). It is not just a descriptive list of the material available, or a set of summaries.

The chapter provides the wide- ranging of literature predominantly based on survey centered research on ***"Information Use Pattern by Scientists Working at Selected CSIR Laboratories of Northeast and Eastern India: A Study"***, which mainly deals with the usage, perception, satisfaction level, feeling and general view etc. regarding information use pattern inside the libraries and outside the libraries. However, some of the studies are also associated with theoretical, methodological aspects of topics on information needs, information seeking behavior of different types of users, e.g. academics, researchers, scientists, students, engineers, lawyers, journalists, etc.

Considerable amount of literature are available in the area under study. The scholar made an extensive survey of literature available in the concerned field so as to get abreast with the information. A number of literatures in different forms have been scanned from the published documents in the area of the study.

The review of literature of the present study is presented in two major parts. The first part consists of the studies that have been conducted on International level and it is again sub- divided into two parts namely studies on Information Needs, Information Seeking Behaviour and Use Pattern and Studies on Bibliometrics/ Citation Analysis. The second part is consists of the studied conducted in National level and is divided into four parts namely Information Needs, Information Seeking Behaviour and Use Pattern, Studies on Use of Electronic Resources, Studies on CSIR- Laboratories and Studies on Bibliometric/ Citation Analysis.

2.1 STUDIES CONDUCTED IN INTERNATIONAL LEVEL

2.1.1 Studies on Information Needs, Information Seeking Behaviour and Use Pattern

The information needs of scientists are related to the R & D work undertaken in their parent Organization. With the emerging needs and increased fascination of scientific work groups for handling and use of electronic information resources, the information centers and libraries are expected to cope with the present day information needs of changed mindset of the users. Information seeking behaviour and needs of the scientists (users) in the electronic environment has become complex, demanding and very challenging. Library and information scientists should possess knowledge of Psychology, Behavioural Sciences, Statistics, Computer Science and Management. Educational institutions, Universities and R&D special libraries should incorporate these subjects into the curriculum so that the library staff is better trained to meet the needs of the users as efficiently as possible. A few of the important studies that have been conducted in this area are given below: Various interesting studies have emerged on the Information Needs, Information Seeking Behaviour and Information Use Pattern of the scientists. These are as follows:

Eden (1993) has been conducted a study to identify the information needs and seeking behaviour patterns of journalists in Nigeria has clearly depicted specific areas of information needs and information seeking behaviour patterns of journalists in selected Nigerian towns, formal information sources consulted and the role of libraries and librarians in the media organizations in the concerned areas.

Fidzani (1998) conducted a study to determine the information needs, information seeking behavior and the use of information by the graduate students of University of Botswana. The study has been carried out based on 223 part-time and full-time students and questionnaire method has been adapted to gathered data. The study recommended developing more aggressive information marketing strategy both at subject librarian and departmental level to create awareness among graduate students on the available resources and services and show them the benefits they could derive from using them

Marcella and Baxter (1999) in their paper mainly discusses about the information needs and information seeking behavior of a national sample of the UK population. This project was funded by the BLR & IC and questionnaire method has been adopted to study the information needs and information seeking behavior of the citizens of the United Kingdom.

According to **Hertzum and Pejtersen (2000)**, Engineers get most of their information from their colleagues and internal reports. Their study investigates how engineers' information-seeking practices intertwine looking for informing documents with looking for informed people. Based on case studies in two product-development organizations the authors found that the engineers search for documents to find people, search for people to get documents and interact socially to get information without engaging in explicit searches.

Majid and Anwar (2000) investigate that proper knowledge about the information needs and seeking behavior of scientists could play a vital role in meeting their information needs effectively. Libraries are the place where knowledge can be for re-orienting their collections and facilities to attune them to the needs of the scientific community. The study explores information needs and seeking behavior of Agricultural scientists of Malaysia. The study also revealed that scientists preferred using primary sources of information, particularly journal and review articles.

Informal communication with professional colleagues was also considered important for exchanging current research information. The authors found that large number of scientists felt that they had not keep in touch with scientific literature due to insufficient library collections and services. The authors recommend that science and technologies libraries should periodically study the information needs of their users and based on the users need they can improved their collections and facilities and also strengthen their promotional activities.

Marcella and Baxter (2000) reports the results of the Citizen Information research project funded by the BLR & IC, a nationwide survey using personal doorstep interview of the citizenship information of almost 900 members of the UK public. The authors found that public obtains almost all their information on current issues via mass media. The majority of the respondents felt well informed about areas relating to citizenship, but significant proportions were poorly informed in legal right, welfare benefits and local politics. The study results that the public libraries were the preferred source of government information, and were seen as appropriate locations for a range of other types of citizenship information.

Esharenana (2002) reports a study of the use of information for decision making by administrative staff of the Delta State University, Abraka, Nigeria. The study explores the personal characteristics of the staff, their sources of information for decision making, areas where the information is used for official decision making, the frequency of obtaining adequate and relevant information before making an official decision, the problems they have faced when seeking information for decision making, etc. The author identified the following main problems faced by the administrative staffs while information seeking for decision making:

- Many people are afraid of giving information that is needed. Non-availability of the handbook on students matters (in some academic departments).
- Power outages are frequently occur in Nigeria and "frequent NEPA (electricity) blackouts" is the problem they encounter when information seeking, etc.

Kwasitsu (2003) discusses the information sources used by design, process, and manufacturing engineers in an international microchip manufacturing company, and also discusses the characteristics that influence their information source selection and use. The finding shows that there was a significant differences in engineers' information

behaviour and the highly educated engineers were less dependent on their personal memories as sources of information and they were more likely depend on libraries. Finding also shows that the highly educated engineers less likely consider ‘‘personal mastery’’ (information tool mastery) as a source influencer.

Barrett (2005) summarizes an exploratory research study on the information-seeking habits of graduate student researchers in the humanities. The study is an in-depth interview with a small sample of humanities graduate students to know their information-seeking habits.

Dresang (2005) conducted a study by applying the theory of Radical Change which is based on the digital age principles of interactivity, connectivity and access, is suggested as a lens to reexamine existing research on youth information-seeking behavior in the digital environment. Meta-analyses of gender and information behavior studies find that some recent research disputes former conclusions. In the study radical change was applied to an examination of specific facets of Contemporary research in order to demonstrate how new perspectives can be gained. The conclusion summarizes some new points and areas of investigation.

Bawden (2006) in his article review Wilson’s (1981) seminal article “On User studies and information needs” (Journal of Documentation, 1981, Vol.37, No. 1, pp.3-15). The paper was a literature based conceptual analysis. The paper provides a perspective on the development of information science, nature of information, information need, models of information seeking and information behavior.

Gardiner, McMenemy and Chowdhury (2006) aims to information use patterns of academics in British universities in digital environment. This is a research paper based on a nation-wide survey of academics in British universities. Most of the responds were from academics belonging to the three chosen departments, viz., computer and information sciences, management/business, and English language/ literature. The most important uses of information resources by academics in all disciplines in this study were to collect information for research, followed by accessing texts. The use of search engines, e-mail and the internet were relatively uniform for all disciplines. The academics also tended to make higher use of more specialist library resources, such as inter-library loans, microfilm and special collections, but use of these resources are still very low in comparison to other resources.

Matusiak (2006) presents the results of a qualitative study that focuses on search patterns of college students and community users interacting with a digital image collection. The study finds a distinct difference between the two groups of users and examines the role of mental models in information seeking behavior in digital libraries.

Nicholas, et al. (2006) employs a sophisticated form of transaction log analysis which is named as deep log analysis (DLA) techniques, to demonstrate what usage data can disclose about information seeking behaviour of virtual scholars – academics, and researchers. In this the authors have investigated the usages of two digital journal libraries namely Emerald Insight, and Blackwell Synergy. The information seeking behaviour of nearly three million users is analyzed in respect to the extent to which they penetrate the site, the number of visits made, as well as the type of items and content they view. The users are divided by occupation, place of work, type of subscriber, geographical location, type of university, referrer link used, and number of items viewed in a session.

Wilson (2006) responds David Bawden review of Wilson's 1981 paper, "On user studies and information needs". Wilson's paper reflects on the context of the original paper, and on subsequent developments. The paper discusses on a variety of issues relating to information science as a discipline, and its research programme and methods, with specific emphasis on the understanding of human information behavior. According to the author Wilson, David Bawden has provided an excellent, insightful review of the impact of Wilson's 1981 Journal of Documentation paper. Wilson discuss that the "information age" has brought about a "democratization" of interest in all aspects of information production, information flows, information use and information behaviour generally. The worldwide web and its success as a dominant communications system has brought information issues to the attention of governments, research funding agencies, the media, and just about every discipline under the sun. According to Wilson, there may be other research outputs that will help to advance human information behaviour research.

David et al. (2007) delineates and explains an emerging, but significant, form of digital information seeking behaviour among information consumers, which the authors have called 'bouncing'. The evidence for this behaviour has emerged from five years of deep log analysis studies – an advanced form of transaction log analysis – of a wide range of users of digital information resources.

Gonzalez-Teruel and Abad-Garcia (2007) conduct a descriptive analysis of the literature published in Spanish journals and of the papers of conferences held in Spain in the field of information needs and uses during the period 1990–2004. They determine the change in approach described by Dervin and Nilan, among others, also occurred outside the English speaking world. An analysis of the characteristics of relevant publications in this field shows information needs and uses have not yet become a well-established area. In addition, a study of the content characteristics leads to the conclusion that in Spain there has not yet been a change in the orientation towards a user-oriented model.

Marcella et al. (2007) in their study discuss the results of a customer knowledge study commissioned by the Parliamentary Documentation Centre (PDC) of the European parliament. The study revealed that users were frequently uncritical and pragmatic in use of the uncritical and pragmatic in use of the most readily available information. The paper also highlights the evolutionary nature of needs.

Pors (2008) conducted a nation-wide survey of Danish school students and their use of libraries and digital resources. The study was a nation-wide online survey to a sample of high schools in Denmark. In this study the students received a link to the online questionnaire and completed it during a class hour. From the data received from the online survey four groups of library user can be formed:

- One group of students using both educational library and one or more public libraries;
- Another group that uses only the educational library and not the public library;
- A group that uses only the public library; and
- The last group states that they do not use either type of library.

Dresang and Koh (2009) conduct a study on Radical change theory, School libraries and information seeking behavior of the youth in the age of Web 2.0 and of participatory culture. The Radical change theory development will assist in determining what implications the new information behaviors and resources have for libraries, schools, and other information environments and how library and information professionals can better help the youth to seek information in the twenty-first-century digital environment.

Savolainen (2009) in this article elaborate the process of information use by comparing conceptualizations provided by the constructivist approach and the human information processing approach. From the study it is found that both research approaches share the assumption that interpreting, relating and comparing qualities of things is fundamental to the information use process.

A study has been conducted by **Savolainen (2009)** which was a conceptual analysis of major articles characterizing information use and human information processing in the field of information studies and consumer research. Savolainen focuses on the need of conducting comparative studies in various fields to sharpen the picture of information use and human information processing. In addition there is need for empirical studies of information use.

Guruprasad (2010) conduct a study on use patterns of electronic information resources by the aerospace scientists and engineers in Bangalore. In this study the researcher has been determine the types of e-resources, information requirements and needs of the aerospace scientists. He also identified the channels through which information is accessed and also made an attempt to identify the factors motivating electronic information use.

Jamali and Nicholas (2010) evaluate the information-seeking behaviour of scientists from different subfields of physics and astronomy by adopting an interdisciplinary perspective. It investigates the effect of inter disciplinarily and the scatter of literature on two aspects of the information-seeking behavior: methods used for keeping up-to-date and for identifying articles. The sample of the survey was limited to 114 PhD students and academic staff at the Department of Physics and Astronomy of the University College London. The study reveals interdisciplinary differences among physicists and astronomers in terms of their information-seeking behavior and highlights the risk of overlooking the characteristics of information-seeking behavior of specialized subject communities by focusing on very broad subject categories.

Naumer and Fisher (2010) in their writing describe the concept of "information need". The concept of "information need" is discussed in terms of its definition in other fields, evolvement with the user-centered paradigm, and articulation in key models of information seeking and historical evolution of information need research within Library and Information Science.

Nicholas et al. (2010) in their paper present some of the results of the project "Evaluating the usage and impact of e-journals in the UK". Their study evaluated the use of the Science Direct journals database with regard to Life Sciences, Economics, Chemistry, Earth & Environmental Sciences and Physics by ten major UK research institutions by using Software Package for Social Sciences (SPSS). The study aims to investigate researchers' digital behavior and to ascertain whether there and behaviours varied by subjects and disciplines, or in relation to the institutions in which they worked. The main findings of the paper were e-journals proved to be very popular with UK researchers, their use was highly concentrated, information seeking was fast and direct, etc.

A paper is presented by **Nicholas et al. (2010)** which is the part of the project "Evaluating the usage and impact of e-resources in the UK". The particular of research reported in this paper evaluated the use of the Science Direct journals database by the researchers' of the ten major UK research institutions on the areas of Life sciences, economics, chemistry, earth & environmental sciences and physics. The study mainly investigates researchers' digital behaviour, their use varied by subject and disciplines.

Pinto and Fernandez (2010) compare Spanish faculty use of library services and their interest in value-added services and improvement actions. The scholars conducted a survey of 546 faculties in the field of science and technology. The study differentiates between the areas of pure science, engineering and architecture, and life sciences. The result of the study reveals a general trend toward a greater use of virtual services. Findings also expressed interest in increasing collections and also reflect differences among the three groups.

Savolainen (2010) is elaborating the picture of the motivators for information seeking by comparing the conceptualizations of task-based information needs and expectancy-value theories. The article is a conceptual analysis of major articles characterizing task-based information needs and expectancy-value theories developed in. psychology since the 1950s. The findings indicate that psychological theories hold a good potential to elaborate the models of task-based information seeking in particular.

Korobili et al. (2011) in their survey determine the information-seeking behavior of graduate students of the Faculties of Philosophy (8 Schools) and Engineering (8 Schools) at the Aristotle University of Thessaloniki. They also tried to

determine the factors that influence information-seeking behavior Greek graduate students. The study found that the discipline did not seem to affect information-seeking behavior critically. The majority of the sample demonstrated a low to medium level of information-seeking behavior. This survey revealed the need for improving the level of graduate students' information literacy skills.

Mavodza (2011) made a study on database usage patterns of Metropolitan college of New York library users from January 2007 to December 2010. The result of the study suggests the position that database usage statistics can give insight into information behavior and help inform collection management decisions. The database use patterns reflect that their use is only when there is the academic need. Mavodza suggests that one of the best ways to motivate students in the MCNY educational setting is to use practices that help make the learning real and meaningful to them. That approach may boost database usage statistics too, not as end, but an aid in observing database relevance and use. This is because interpreting database usage statistics needs to be done within larger information literacy and resources management strategies.

Michels (2012) conduct an ethnographic pilot study on the experience of information seeking (IS) by leaders of a church in transition, as they seek the will of God for their church. The study begin to create a picture of leaders' information seeking, first for personal faith building and then for corporate decision making, and then consider the impact of new technologies on these processes. The study found that the religious IS did not differ significantly from other everyday-life information seeking (ELIS) experiences, except when subjects were acting in leadership roles. Prominent themes were theological diversity and prayer.

Savolainen (2012) elaborates the picture of the motivators for information seeking by comparing the conceptualizations of task-based information needs and expectancy-value theories. The article is a conceptual analysis of major article characterizing task-based information needs and expectancy-value theories developed in psychology since the 1950s. Expectancy-value theories provide a more elaborate picture of motivational factors by focusing on actors' beliefs about the probability of success in information seeking and the perceived value of the outcome of this activity.

Jiang (2013) conducted an online survey to capture the background and behavior data of regular users Douban, the most influential Chinese language social

library system. Social library systems are Web 2.0 sites where users discover interesting books, movies, and music, etc., collect these resources to their personal libraries, and share their collections with others. Searching, browsing, encountering and monitoring are the four major information seeking modes adopted by social library system users.

Helen (2014) examines the information seeking behavior of the undergraduate students in a research context. The study mainly discusses about what type search engines and search tools are used by the Student. The scholar was recorded the search strategy while the participants used Google and a library (federated) search tool to find sources (one book, two articles, and one other source of their choosing) for a selected topic. The undergraduates in this study believed themselves to be skilled researchers but their search queries and behaviors did not support this belief. The study found that the students frequently visited commercial sites such as Amazon; content farms such as About.com; and subscription databases such as JSTOR. This study suggests for improvement of search interface and pedagogical opportunities.

Julien and O'Brien (2014) in their quantitative content analysis of recently published research in information behaviour are compared with previous analyses to create a 30-year profile of work in the field. The variables of particular interest under the study include research methods employed, user groups studied, relative interdisciplinary, theoretical frameworks applied, attention to affect, and attention to systems design.

Savolainen (2014) discusses in a conceptual analysis of how emotions and feelings are characterized as motivators for information seeking draws on the appraisal theories. The study suggested that emotions motivate individuals by triggering action readiness to approach or avoid sources of information. The findings indicate that emotions and feelings motivate in five major ways: they start, expand, limit, or terminate the information-seeking process, or they lead to information avoidance.

Chung and Yoon (2015) made a study exploratory analysis of International students focusing on information behaviours in the context of everyday life. The sample of the study was collected from one of the fastest-growing student groups within the university in their daily activities. This study investigated four research questions on information needs, information sources, the digital devices used for information searches, and the relationships between information needs, information sources, and

digital devices in international students' daily information environments. The scholar investigated that the international students have diverse information needs and they sought information from a wide range of information sources, including search engines and human-mediated sources, using portable digital devices for their information searches. This study revealed that participants used different information sources and digital devices depending on the type of information needs.

Shim and Park (2015) aims to investigate the use of television (TV) content for scholarly purposes. The authors found that the environment of scholarly use of TV content is unique in terms of the scholars' academic domains, research topics, motivation, and pattern of use. Six academic domains has been identified namely communication, political science, interdisciplinary science, sociology, medical science and law. These are identified as having used TV content to a meaningful degree, and their knowledge structure was presented as a map depicting the scholars' needs for TV content. The paper came to a conclusion that the patterns of using TV content are different in each research stage which is also emerged. The author found that during the problem stage scholars use the TV content to generate ideas and define the problems. During the methodology stage the pattern of use of TV content are focused on data gathering and processing. During the presentation stage, scholars mainly use the TV content to support their arguments.

Tury, Robinson and Bawden (2015) examine the information behaviour of distance learning students based on a case study of the International Programmes of the University of London. A comprehensive literature analysis and comparison of relevant information behaviour models were carried out, supported by a survey of student behaviour. The survey received responses from 649 students, in 81 countries and following diverse study programmes. A variety of inter-related factors were found to influence information behaviour, level and subject of study being most significant. Ease and speed of access and familiarity of sources were predominant factors.

Xu, D Tao and Zeng (2015) examine the differences in uses of social networking sites (SNS) by the Chinese and American researchers'. The study compares their attitudes and behaviours as determined from data collected in an online survey and a semi-structured focus interview. For various reasons, most international SNS are blocked in China, and the authors were curious to see how this influences scholarly online communication.

2.1.2 Studies on Bibliometrics/ Citation Analysis

Some of related studies conducted on bibliometrics / citation analysis on international level are:

Grauwin and Jensen (2011) have developed a set of routines that allows drawing easily different maps of the research carried out in a scientific institution. The tools uses in this study are Open Source elements to analyze bibliometric data gathered from the Web of Science. The study has been conducted on ENS de Lyon, to show how different maps, using co-occurrence of authors, keywords, institutions and how bibliographic coupling can be built. These maps may become a valuable tool for discussing institutions' policies, as they offer different views on the institution at a global scale.

Tsay (2011) has conducting a citation analysis to explored and compared the biblio-metric characteristics and the subject relationship with other disciplines of and among the three leading information science journals, Journal of the American Society for Information Science and Technology (JASIST), Information Processing and Management and Journal of Documentation. The citation data were drawn from references of each article of the three journals during 1998 and 2008. The research scholar has been identified average number of references cited per paper; document type of cited literature and the journal self-citation rate are reported.

2.2 STUDIES CONDUCTED IN INDIA

2.2.1 Studies on Information Needs, Information Seeking Behaviour and Use Pattern

A case study has been conducted by **Garg and Kumar (1984)** and which analyses information gathering habits (IGH) of R & D scientists, mainly physicists, chemists and mathematicians. An attempt has been made to examine the factors which may have some bearing on information gathering habits. From the study most of the scientists collected information writing a review article, preparing proposals for a new project or procedural information for design and development work.

Raina (1987) discusses the services rendered by Wadia Institute of Himalayan Geology (WIHG) library. The author evaluates the users' interest towards library services, information needs and publishing habits of the Geoscientists of WIHG. The author gave suggestions for meeting the requirement of the geoscientists.

Gupta (1988) describes information seeking approaches of Structural Engineers, highlighting the value of user studies in formulating an efficient system.

Sangam and Biradar (1990) discusses the pattern of information use by researcher in the field surgery as indicated by citations in the field of surgery in terms of citation in the M.S. dissertations submitted to Gulbarga University, Gulbarga during 1982-1989. In the study the authors applies Bradford's Law of Scattering.

Saxena (1990) in his paper discusses the current trends in the acquisition and utilization of Japanese scientific and technical information in USA and Europe, the problems faced by them in its acquisition and utilization and the role played by Japan in the internationalization of Japanese information. It is a brief account of Indian scene of Japanese information.

Barooah (1993) discussed the pattern of information use by the scientists in the field of entomology through citation analysis of Indian Journal of Entomology for the year 1989. He identified the various sources of information and their country of origin including ranking of journals in Indian entomology irrespective of their country of origin.

Guha (1995) reports the following 4 user studies conducted in India between 1991-1994: (a) The use of scientific and secondary periodicals in Delhi, (b) The information seeking and communication behaviour of Indian Scientists, (c) The evolution of the environmental information system (ENVIS), (d) and the use of MEDLINE CD-ROM database in Delhi Libraries.

Biradar and Vijayalaxmi (1997) conduct a bibliometric study to identify the pattern of information use by scientists in the field of Neurology. The study indicates citations in the field of Neurology. The study indicates citations in the Dissertations submitted by the research scholars to the National Institute of Mental Health and Neuro Sciences (NIMHANS), Deemed University, Bangalore. The study identifies the average number of references per dissertations, use of different information sources and list of more frequently cited journals by Neurological scientists during 1979-1996.

Reddy and **Karisidappa (1997)** conducted a survey on information seeking behaviour of 160 medical scientists on the use of formal and information channel of communication meant for the disabilities. They highlighted the use of information especially to the mental handicap in India.

Maheswarappa and Havanur (1998) study the importance of information sources among the biological scientists on the basis of statistical tests. The personal attributes of biological scientists such as designation, experience and nature of research in a university environment have bearing on the use of information sources.

Prasad and Tripathi (1998) conduct a study to determine

- The various activities of the scientists and types of information used,
- Use of various formal and informal sources of information and methods used in locating them.
- Use of secondary sources of information and
- Use of material in languages other than English.

The study found that there were significant differences in their approaches, information seeking process, difference of information needs and sources used for satisfying information requirements of Physical Scientists and the Social scientists.

Garg (2000) studied on information seeking patterns of users of Engineering Institutions in Rajasthan was taken by the author who determined the information seeking patterns of users of engineering institutions in Rajasthan by employing multi-method approaches.

Vijayalaxmi and Maheswarappa (2001) study the use of library, its resources and services by the post-graduate lady students of Gulbarga University, Gulbarga. The study mainly analyzes the types of information required, purposes of using information, methods used for keeping up-to-date, frequency of use, the methods used for searching, frequency of visits to other libraries, consultation with library staff, difficulties encountered in access and use of information by the lady students of Gulbarga University, Gulbarga.

Chandel and Saraf (2002) review the scope of information needs and seeking behavior with some significant findings of earlier studies. They discuss the concepts, characteristics and types of information needs and information seeking behavior. The

study found that the users' information seeking behaviour is unpredictable and unascertainable mainly due to varied and changing needs of the users.

Padmamma et al. (2002) in their paper have discussed the information seeking behaviour of 84 Vishweshvaraih Iron and Steel Limited scientists at Karnataka. The study revealed that one third of the scientists visit the information centre to satisfy the information needs of research activity.

Kannapanavar et al. (2004) highlight the authorship trend and collaborative research in chemistry by Indian Chemical scientists during 1996-2000. The study found that team research is mostly preferred by Indian chemical scientists rather than solo research. The authors found that degree of collaboration and average number of authors per paper varies from year to year.

Mahapatra (2006) conducted a study on information needs of scientists and engineers in electronic environment concerning to the field of Indian exploration and production industry. The study explores the habit of use of documents and the library by the scientists, engineers and technologists of Indian Petroleum Industry in the electronic era, in an attempt to correlate the information with the habits of using of library.

Seth and Parida (2006) in their paper discusses about the information needs and use pattern of disadvantaged communities such as scheduled caste and scheduled tribe (SC/ST) in India. The study was conducted in the academic institutions of the eleven districts of Orissa, covering SC/ST students, researchers and faculty. The study reveals that the progress of people from scheduled caste and scheduled tribe in higher education is unsatisfactory.

Singh and Satija (2006) in their study discusses that Information seeking behaviour is an essential component in the designing and developing of need based information centres for meeting the information requirements of users. The study is an output of doctorate research in which a comprehensive review research scanned in international context in the field of agricultural sciences. The study covers various facets related to information seeking behaviour, findings and their conceptual meanings. It includes about sixty five researches undertaken by foreign researchers in the agriculture sector. The findings of the studies are organized into various categories i.e.,

theories of information seeking; information needs; users characteristics; information browsing; information seeking; and information seeking behaviour.

Barik et al. (2007) conducted a study on information seeking behavior in electronic environment by the scientists and research scholars of the Central Salt and Marine Chemical Research Institute, Bhavnagar, Gujarat. The paper discusses the information seeking behavior of the scientists and research scholars in electronic environment which need to be understood to render more qualitative services to user community.

Jochi (2007) in his paper conducted a study on information needs and information seeking behaviour of Ayurveda Information users. He has discussed the need and use of information by the scientists on Ayurveda in Kerala.

Pujar and Sangam (2007) in their study discuss the information use pattern of Indian economists in the present Internet era. They highlight the use of various types of resources, including institutional resources and role of NASSDOC in providing various services to social scientists. It also tries to determine the different approaches and methods used by economists for retrieving information and references from print, electronic and internet information sources. From the study authors found that many of the resources, especially electronic resources and services are used to a lesser extent due to lack of awareness and training. It emphasizes the need for intensive user orientation programme in the libraries attached to the research institutes.

The paper of **Singh and Satija (2007)** was an outcome of the research study conducted by them on information seeking behavior of agricultural scientists working in the ICAR institutions of Delhi and Punjab Agricultural University, Ludhiana. The study discusses the findings of various strategies and procedures adopted by the agriculture scientists in meeting their information requirements. The result of the survey shows that agricultural scientists have largely dependent on their institutional library/information centers in order to meet their information needs. The library/information center is the most preferred source of the respondents for all categories of agriculture scientists. The other most preferred source of accessing information are personal collection, collection of their supervisor and their colleagues.

Singh (2008) in his research paper report the findings of a study of the information seeking behaviour of agricultural scientists working in the Indian Council of Agriculture Research (ICAR) institutions of Delhi, and Punjab Agricultural University, Ludhiana. The agricultural scientists were asked to rank the information sources indicating their order of priority while seeking information. They were asked to use a scale in order to their priority on the basis of I, II and III. The results show that agricultural scientists have expressed great dependence in meeting their information requirement on their institutional library/information centre. Seventy-two per cent of the respondents for all categories of agricultural scientists preferred their library/information centre as the most preferred source. For accessing information agricultural scientists highly depend on the library collection, followed by the personal collection, collection of their supervisor and of colleagues in order of decreasing priority.

Biradar et al. (2009) in their study assess the extent of usage of information sources by the students' of Agricultural Science College library, Shimoga. Apart from knowing the usage of information sources it is also important to know the frequency of use of different types of information sources. The authors also made an attempt to identify the frequency of use of information sources available in the library. The study shows that there is an urgent need of establishing e-consortia among the agricultural libraries in India and also focus on information literacy programmes.

Kumari and Talawar (2009) investigate the use of reference sources through the questionnaire based survey in seven university libraries of Karnataka. The study mainly based on the university wise use of reference sources, Category wise reference sources, university wise frequency of use of reference sources and category wise user frequency of reference sources. The results of the survey reflect a growing interest in reference sources among users in university libraries.

Gaur (2010) made an attempt to study the information seeking behaviour of selected university libraries of Rajasthan. The study mainly focuses on frequency of library, satisfaction with the opening hours of the library, library collection, use of reference services and user's satisfaction while using library services. Based on the study the author has provided some suggestions for enhancing the satisfaction level.

Gowda and Shivalingaiah (2010) in their study have made an attempt to know the information seeking patterns of researchers of various disciplines in the university libraries in Karnataka State. The study identified the preferences of the researchers over channels of information, various modes of literature search, purpose of visit, type of information gathered, frequency of library visit and time spent in the library. The result shows that there is significant difference among the research scholars of various disciplines in the preferences of various channels of information, modes of literature search, purpose of visit to the library, duration of time spent in the library and modes of communication.

Rao (2010) in his book discussed on the design and development of science indicators are now increasingly becoming popular. Numbers of papers, growth rates, impact factors, h-index, etc. are simple indicators. Computations of these indicators are not simple. It requires large data from several databases; it involves high cost and time; other factors such as reliability, validity and availability of data are also important. Keeping this factors in view the author of this book discussing mainly different growth models applicable to growth of literature; Indicators related to scientific productivity of Scientists; and Issues in scientometrics.

Thanuskodi (2010) in his paper describes ongoing work which involves examining the information use pattern of the legal professionals of District Court of Salem and Erode of Tamilnadu. The study found that the District Court Lawyers using a variety of information sources for legal practicing. The majority of the respondent preferred to consult their personal library before resorting to other information sources and agencies. It is clear from the study that electronic resources are useful to legal professionals in District Court Bar libraries. Thanuskodi found that the district lawyers are not aware of electronic resources. They are dependent on bar library collections, services and facilities to meet their information needs.

H. T., Gautam and Vijayaraghavan (2011) analyzes the information needs and seeking behavior of Defence Research and Development Organization (DRDO) scientists working in the nine life science laboratories in India. From the analysis it has been found that the DRDO life science scientists depend largely on their respective library/information centers. They are largely using scientific journals for obtaining specific information and keeping themselves up-to-date. The authors first examine the

information seeking strategies of life scientists. Secondly they identify the information sources and types of publication used by life scientists and thirdly identify the problems faced by the life scientists of DRDO while gathering of information and gave suggestions to overcome the problems. H.T., et al indicates that DRDO life scientists largely use Journals as followed by Books, Monographs, technical/research reports, etc. for acquiring information.

Muthamilarasi and Thirumagal (2011) in their paper describes that the information is the backbone of every person, it is a need of everybody and it can be acquired by reading several documents. Reading is necessary to fulfill everybody's educational requirement, to develop personality, to have latest information in one's field of interest and overall development of a society or a nation. The paper mainly reports the reading habits of the students and faculty members in Anna University Engineering College at Tirunelveli.

Kumar and Shukla (2013) examine information seeking pattern of science and art research scholars of Banaras Hindu University (BHU). For this study the data was gathered by distributing questionnaires among 139 (one hundred and thirty-nine) randomly selected, PhD scholars of science and arts departments of Banaras Hindu University, India. It has been found that both the groups of researchers have some similarities and some dissimilarity in information seeking. Even in this electronic era some research scholars of art discipline depend on print form of publications for their information needs.

Sahu and Singh (2013) examine different aspects of information seeking behavior specifically the information needs and seeking behavior of Indian astronomy/astrophysics academics. They also discusses about the relationship between various variables such as academic, rank-wise statuses, age-wise status of characteristics, and methods for keeping their knowledge up-to-date. The findings of the study shows the differences in information seeking behavior and needs for various academic of Indian astronomy/astrophysics and also highlights the value of information seeking behavior to scientists working in astronomy/astrophysics.

Umesha (2013) describe that the Libraries in health sciences or dental sciences are not just collecting or licensing the information resources. They have various task to match the needs like curriculum based learning, research and point of care. The study

tries to understand the information seeking and searching behaviour of dental science professional of Karnataka. This paper tries to find out the suitable information sources available for dental professionals, the areas in which dental professionals are seeking information, and the barriers they are facing in accessing information.

Chaurasia and Singh (2015) conducted a study to investigate the information use pattern, seeking behavior, purpose of seeking information and barriers met during seeking information by the faculty members and researchers of Psychology at the Central Universities of Uttar Pradesh. During the study the authors found some barriers:

- Non availability of current subject periodicals in the library.
- Non availability of computerized on-line access /Internet access facilities in the library
- Lack of time for searching in the library
- The respondent met the barrier of poor library services while seeking information
- Lack of awareness about the library resources.

Dwivedi and Prasad (2015) analyzes 5011 papers published by ten Asian countries on different aspects of Allergy during 1994-2013 and indexed by Science Citation Index- Expanded indicated that the output increases many folds since 1994 with maximum publications in 2013. The highest number of publications was from Japan as followed by South Korea. From the study highest number of 4999 (50.4%) papers has been published in the subject Allergy followed by Immunology. The average citation received was ~12.9 and total numbers of 64575 citations were received during this period.

Kadli and Hanchilal (2015) in their paper study to examine information seeking behavior of students in digital environment of two law colleges of Mumbai. The study mainly concentrates on frequency of visit to the library, purpose of information seeking, computer acquaintance, amount of time spent on information gathering activities problem faced in information seeking, etc. The results of the study reveal that books are still most heavily used resources by the students. Majority of the students are familiar with using offline and online legal databases. However, the students of both the colleges face the problem of information overload on internet and lack of skills to

search information. Hence, the study recommends that formal users training programme shall be conducted to optimize the use of information sources and services

Prakashan (2013) in his study search, identify, collect and evaluate scholarly papers related information needs and use of healthcare professionals around the world. From the study it is found that professionals especially faculty members, general practitioners, nursing professionals, clinicians, health workers, etc. need training and faculty development program and useful information. The professionals will get the information from the sources like print and e-journals, MEDLINE, Medical Subject Heading (MeSH), web-based consumer health information services, practice-based research network (PBRN), Electronic Medical Records (EMR), index Medicus, etc.

Bhattacharjee and Sinha (2016) in their study aim to propose an overview of the various models of information seeking behaviour and to find out how models are related to each other.

2.2.2 Studies on Use of Electronic Resources

Several studies have been conducted in North East India related to the use of electronic resources by the different categories of users. Some of them are as follows:

Sinha, Manoj K (2004) has conducted a study to find out the usefulness and advantage of Internet in day-to-day life, impact of Internet on the library and information services etc. and explains the aims and objectives of the present survey on the usage of Internet in Barak Valley, methodology used etc. The author highlights the use of Internet in this region is in nascent stage and it has become important to make people of this valley aware for the use of Internet and regarding its potential for having enormous resources of information which can be search instantly.

Haneefa (2006) investigated the extent of use of electronic information resources in special libraries in Kerala, using questionnaire surveys of librarians, semi-structured interviews of librarians and observational visits to the libraries. ICT based resources and services are not reaching the users to the expected extent.

Kaur and Verma (2009) in their paper aim to describe the use of electronic resources and services provided at the Central library of Indian Institute of Technology (IIT), Delhi. The study was carried out to know about the different categories of users, how often they use the services, their information need and the source from where the information can accessed. Also a study has been made to identify between print and electronic journal format which format users prefer more. From the study it has been found that the users use more electronic journals as compared to the print journals and users are accessing these resources from their departments and hostels. Therefore users coming to the library have been decreased.

Sinha et al. (2011) indicates that traditional functions of libraries had undergone various changes in present century and E-Resources have great importance in libraries and amongst the library users. The study has been undertaken with an attempt to evaluate the usage pattern of electronic resources made available in the Assam University Library under the UGC-INFONET E-Journals/Digital Library Consortium of UGC/INFLIBNET amongst the research scholars and teachers of Northeastern Region of India with special reference to Assam University.

Sinha (2012) has been undertaken a study with a view to know the status of ICT and Internet literacy among the Assam University library users for accessing to e-resources available under UGC–Infonet Digital Library Consortium. The study highlights the important survey findings in respect of ICT and internet literacy, e-resources use pattern and attitude of library user towards the use of e-resources.

Sahu et al. (2013) in their study mainly discuss about the institutional repository Eprints@NML and looks at the use of the repository based on the repository log data. The study found that more than 75% of NML scientists/researchers have registered with Eprints@NML and maximum number of 0.27 million hits was calculated in August 2012. It also discusses accessibility of the institutional repository of NML, Jamshedpur on global basis. The top twenty countries accessing the repository were United States, India, Russia, China, UK, Hong Kong, Germany, Netherlands, Iran, Japan, France, Italy, Canada, Korea, Ukraine, Brazil, Poland, Australia, Turkey and South Africa. During the study the authors found that popularizing the repository was a challenge and they also identifies many challenges and the ways how to overcome the challenges. The study comes to result that uncertainty and fear on copyright issue which are overcome

by organizing workshop and training. Also some of the authors were reluctant to deposit their documents in open access NML Eprints which was overcome by personal contact and counseling. Counseling and showing impact in individual's citation value to make sure about who will get attribution, impact and scholarly credit. E-mails were sent to individuals convincing them to upload their paper.

Singh and Prasad (2013) conduct a study on use of electronic resources by the scientist, students, and concerned people of agricultural sciences under Indian Agricultural Research Institute (IARI). The authors found that the users will be using the electronic resources for research and other purpose, because they can access these resources quickly and from, any place. IARI is backbone o f research management of agriculture and the leading institution for agricultural research, education & extension in the country.

Sinha and Chanda (2014) have discusses in their paper about the usage of E-Resources available under the UGC-INFONET Digital Library Consortium and DeLCON Consortium by the scientific community Library Users of Assam University, Silchar representing from Bio-Medical Sciences and Ecology and Environmental Sciences. Survey method has been used using questionnaire as a data collection tool and Interview in some cases. Altogether 150 questionnaire was distributed and 117 responses received. This study was conducted during January 2013.

Bhattacharjee and Sinha (2016) have conduct a study aims to examine the e-resource usage pattern among the library users of the Assam University, Silchar. This study has been conducted to identify the electronic resources that are use to preferred by the users of the university.

2.2.3 Studies on CSIR- Laboratories

Barooah (2002) in his research work tried to giving a model of evaluation of effectiveness of documents and services of special library in terms of users' satisfaction by using bibliometric study at RRL, Jorhat.

Borthakur (2008) in her research work studied extensively on needs of information, information use pattern by the scientists of North East Institute of Science and Technology, Jorhat.

Sakshi et al. (2011) in their paper explains about National Knowledge Resource Consortium and examined awareness and use of the consortium by the users of NISCAIR. 70 questionnaires were distributed to the users and 63 questionnaires were received back for analysis the data. The results of the survey reveal that majority of the respondents were aware of the consortium whereas only 4.76% were not aware of the consortium. 52.38% were moderately satisfied with the consortium and 23.80% were using for writing research articles. Some problems were highlighted while accessing the consortium. Providing training to its users will make maximum use of the consortium and reduce the problems faced by the users.

Jena et al. (2012) intend to analyze the publication trends in Annals of Library and Information Studies, 2002-2010 based on bibliometric study. The authors mainly study the year wise distribution of articles, citation pattern of articles, bibliographical forms of documents; authorship pattern; length of articles; geographical distribution of authors and study the age of documents.

Qasim and Khan (2015) in their study aim to analyze the use of e-journals by the scientists working at CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB), Delhi. The study find out that the scientists are more attracted toward e-journals especially on those provided by CSIR-NISCAIR consortia, NKRC than those available via direct subscription. The study also finds that almost all the scientists have access e-journals from their department not only for research purposes but also to update their own knowledge. There is dire need for training in using e-resources and retrieving pinpointed information from the databases.

Sa (2015) presented the research output of Minerals and Materials Technology (IIMT), India indexed in SCOPUS database during 2004-2013. Based on all the relevant data which has been retrieved from SCOPUS database the author has analyzed the yearly distribution of publication, growth rate, most productive authors, most preferential subject area, most favored document type, most productive journal, most frequent keywords, most productive institutions, most productive country, most favored source type, authorship pattern, degree of collaboration, multiple authors vs. single author, length of the publications, most cited authors etc.

Verma, R.K. and Kalra, Jaya (2015) had conducted a survey of CSIR libraries attached to the 38 laboratories and 3 CSIR units has been made with the main objective of reviewing the current status of the same. For this purpose, the data on infrastructure, resources, and the services provided by the libraries were collected using questionnaire in e-form. It is observed that the libraries are at varying levels and status in terms of infrastructural facilities vis-a-vis status of library staff. Keeping in view the manual guidelines issued by the CSIR during 2008, which renamed libraries as Knowledge Resource Centres, a few emerging issues like website and content development, knowledge management initiatives, institutional repositories have been discussed. A description of some possible future trends, e.g., implementation of knowledge management concepts, use of mobile devices, and changing user behaviours and expectations have also been touched upon. An overview of status, issues and possible trends for CSIR libraries ultimately points out the major responsibility of the librarians which covers the challenge of how to survive and sustain their position as one of the important and crucial stakeholders in the process of S&T information dissemination. It is concluded that the librarians have come out with more and more knowledge products in this competitive information society by making continuous efforts to develop their skills. This may include implementing the various techniques, and methods related to KM aspects including evaluation of websites for streamlining information organization and content development. By adopting this strategy only libraries would be recognized as knowledge resource centres in true sense.

Nishy et al. (2016) have analyzed citations of paper published from CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), Thiruvananthapuram. They try to understand the preferences of authors in choosing the research work for citing. It has been observed from the study that scientists mostly cite articles from journals subscribed by the institute and a number of citations found from open access journals also.

2.2.4 Studies on Bibliometric/ Citation Analysis

Some of the related literature on bibliometrics/ citation analysis has been reviewed by the research scholar are given below:

Barooah (1993) in his study discusses about the information use pattern by scientists in the field of Entomology through citation analysis of Indian Journal of Entomology for the year 1989. The study identifies the various sources of information and their origin. The researcher has been prepared a rank list of Indian Entomology Journals and also prepared another list of journal irrespective of their country of origin in the field of Entomology.

Barooah and Sharma (1999) conducted a study on bibliometric analysis of 4,253 citations collected from doctoral dissertations submitted to various universities by the S & T workers in the field of organic chemistry since 1977 to 1997. The study has been carried out to determine the use pattern of literature in the area of organic chemistry.

Barooah and Sharma (2001) have been conducted a study to evaluate the journal collection of the library of Regional Research Laboratory, Jorhat (RRLJ) and the use of journal titles for publication of research by the scientific community of the Laboratory. The study also ranked the journals on the basis of their use for individual groups and percentage of used journals has also calculated.

Hazarika (2005) while conducting a study on information use pattern of Indian Forestry Scientists discussed the need, type of information and use of scientists in a forest. He also made an extensive bibliographical details relating to the area of his research in his paper. The study is the citation analysis of the research papers published during 2000 to 2002 in the Indian Journal of Forestry. On the basis number of citation received author also prepared a rank list of forestry journals published in India and abroad.

Rao (2009) discussed about the Quantitative methods, especially the statistical techniques have become popular in recent years for evaluating the effectiveness and efficiency of information services offered by libraries and librarians. This book discusses the statistical methods which can be applied in Library and Information Science.

Varghese and Ranjan (2009) analyze 632 publications of scientists of Rajib Gandhi Centre for Biotechnology (RGCB) during 1995-2006. The study shows that the publications of RGCB scientists include journal articles, conference papers, patents, book chapters and PhD guided publications. The productivity of the RGCB scientists shows substantial growth both qualitatively and quantitatively.

Sinha and Singha (2016) conduct a study to find out the Citation patterns in the Master's degree dissertations submitted to the Department of Library and Information Science, Assam University, Silchar during the period 2012 – 2013. This study is based on the 1,302 citations taken out form 62 dissertations of Library and Information Science which were tabulated and analyzed for finding possible relationships between citations, citation patterns of the authors, citing articles and other bibliographic forms. A total of 1,302 citations were collected and from those citations various aspects of citation studies have been carried out which include the observation of the distribution of authorship pattern, bibliographic form, determine the ranks of most popular scholarly journals, publisher, and geographical distribution of cited journals and ranking list of prolific authors. From the study it was deduced that journals are the most utilized reference materials in the dissertations which is followed by books and it was also observed that the highest numbers of citations are from single authored papers/publications.

2.3 RESEARCH GAPS IDENTIFIED BETWEEN THE PREVIOUS AND THE PRESENT STUDY

There are many study has been conducted by various research scholars in the field of Information use pattern by the Scientists. But there seems to be some research gap between the previous and the present study. From the review of literature, it was found that though various studies have been undertaken regionally, nationally and globally, but the researcher could not find any literature confined to the present study area which needs to be undertaken to bridge the research gap by conducting intensive study. In the earlier studies various studies have been conducted to identify the information seeking behavior, information needs and information use pattern by the scientists.

The earlier studies were mainly conducted on information use pattern of scientists in the field of Agriculture, aerospace engineering and other categories of users. But few studies have been conducted to study the information use pattern by CSIR scientists. The present study has been conducted to covering the study of information use pattern by scientists working at CSIR laboratories of two regions, i.e. North East and Eastern India. In the present study the research scholar have conducted the analysis on three phases: analyzing the data collected from the librarian about their library, analyzing the data collected from the scientists and research scholar to know their information use pattern

and also conduct a bibliometric study to identify the publication trend of scientists. These all aspects can make the present study different from the other related studies.

2.4 CONCLUSION

In the above literature reviewed by the research scholar it is seen that the studies carried out by the researchers in different parts of the world, different parts of India and in North Eastern India in many aspects which has reflects many information about the users belongs to scientific and other communities. The studies mainly related with the accessing, user studies, use, need, use pattern, information seeking behaviour, citation analysis, scientometric, bibliometric, trend of publications by the scientists, etc. The research methodology and research design that has been adopted for the present study are discussed in the **Chapter- 3**.