Chapter 2

REVIEW OF LITERATURE
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2.0 Introduction

The Literature search plays a very important role in research activities, as it forms the very first step of research pursuit. A thorough review of related literature is very essential in conducting a new research. The main functions of review of Literatures are to determine the work both of theoretical and empirical, which has been done before, should assist in delineation of problem of area. It provides a basis for conceptual framework, insights into methods and procedures, suggests operational definitions of major concepts and also provides a basis for interpretations of findings.

The results of Scientific and Technological research are published in a number of information sources. Scientist/engineers may need any type of information sources at any time. But it is rare to have to consult more than a few types of sources on any one occasion; nearly all of them are needed over a period of time. Much of the expertise of searching for information lies in choosing the most appropriate sources to consult in each case and the best order in which to them. The right choice is normally that having the highest probability of yielding the information required with the least expenditure of time and effort often the information required is contained in each of several sources. It is necessary to find out the most useful sources of information used by the engineering college faculties. Scientist/researchers, whose main preoccupation is in the furtherance of knowledge and in the generation of new knowledge. Here an attempt has made to present a brief review of literature in relation to information generation, communication patterns and use of information sources by engineering faculty.
According to Best and Kahn¹ “Since effective research is based upon past knowledge, review of related literature helps to eliminate the duplication of what has been done and provide useful hypothesis and helpful suggestions for significant investigation. It is valuable guide to defining problem, recognizing the significance; suggesting and premising data gather devices, appropriate study of design and source of data. This also helps to sharpen and understanding the existing knowledge in the problem and provide background for research project. Hence review of related literature forms an inevitable part of any research study. Further, the remark made by Van Dale² in this context is worth recording. “The review of educational research gives you an excellent overview of the work that has been done in the field and helps to keep up with recent developments. It helps to move further in the right direction”.

It is extremely difficult to review the entire literature done so far, many significant contributions have been made by psychologists, sociologists, behavioural scientists and others in addition to library and information science personnel. As a result, the literature is scattered across many disciplines and varied collections have to be scanned for location of literature.

A number of reviews and bibliographies cover various aspects of information seeking behaviour conducted prior to 1972. The significant works are those by Menzel³, Davis and Bailey⁴, Barnes⁵, Paisley⁶, Coover⁷, Elman⁸, attempted to investigate the various aspects of information seeking behaviour. However, not many studies have attempted to investigate specifically and precisely the information generation of engineering faculty comprehensively. For the purpose of a clear understanding the various concepts related to information generation, seeking behaviour and communication patterns of engineering scientists, researchers. The review of literature findings have been organized into following categories:
1. Information concepts, needs, seeking behaviour and generation;
2. Information communication and User studies of engineering/technological personnel;
3. User studies related to the research topic; and
4. User Studies Conducted in India.

2.1 Information Concepts, Needs, Seeking Behaviour and Generation

Flanagan's (1954) conducted an interview for engineering students about their information seeking behaviour relating to their final year project. Each participant was asked to describe what they did in seeking information for their project and the sources they consulted. When seeking information for their projects engineers turned to a variety of library resources including technical handbook, library guides and leaflets, library catalogue, library staff, journals, online database, previous students projects, however similar to other studies of information behavior of engineering professionals.

Taylor (1962) this paper discusses the area of the question—its generation, its relation to the retrieval system, and its effect on the inquirer. Four levels of question formation may be isolated and analysed: the actual, but unexpressed, need for information; the conscious within-brain description of the need; the formal statement of the question; and the question as presented to the information system. Input and output characteristics of systems are examined for their effect on the inquirer's decision to ask a question and on the form the query takes. Investigation of six parameters governing question type and ambiguity argues that he may be placing too much emphasis on syntactic matching of inquiry and store of answers. The inquirer's state of readiness is defined as the "state of mind" which allows a selection to be made from a series of messages. A major objective of information systems is to make commonplace the point of maximum usefulness where three coordinates cross: level of question, state of readiness, and available
answer. This paper was published in the Journal of the American Society of Information Science (JASIS) now known as Journal of American Society of Information Science and Technology (JASIST).

Chen\textsuperscript{11} (1974) studied how a research-oriented population meets its information needs, how pure sciences researchers looked for information. The finding of this study was that academic physicists rely heavily on formal and informal sources of information in the course of their day-to-day work.

Bowden and Bowden\textsuperscript{12} (1971) conducted a survey of information sources used by 400 psychiatrists of selected members of the American psychiatric Association through questionnaire. Seventy four percent responded. Journals and books were the most important information sources. The average number of journals regularly read was 4.3. An average of 9.1 books had been read during the preceding twelve months. 28\% of books were obtained through a library. 69\% of the respondents use a medical library at least monthly. Important difference were found by type of practice i.e. academicians reported reading almost 19 books the preceding year; private practitioners 6.4. Authors concluding that a major aim in the postgraduate education of psychiatrists should be instruction in the use of all information services. In addition, abstracts and an authoritative annual review should help psychiatrists keep up in areas outside their special interest.

Line\textsuperscript{13} (1971) revealed that among social scientist 3\% of them never used monographs and periodicals. Also microfilms (93\%) and other non-books materials are useful for them. Book (57\%) was most useful sources. Research reports (28\%), Theses (11\%), Newspapers (16\%) are made rarely useful.

Garvey and Griffith\textsuperscript{14} (1972) Conducted the Studies of the information needs, behaviour and media use of scientists and social scientists. This research attempted to study interdisciplinary and variations of sources use. Major finding are information needs vary from stage to stage of scientific work; they also
showed that factors such as experience and area of specification had a significant effect on information seeking behaviour.

**Katherine**\(^1\)\(^5\) (1972) conducted a study on 'where is the library researcher' he emphasized the need of user research in the parent organization and stated that a 'review of library literature revealed that the amount of library research being done by librarian at his institution is not his professional responsibilities. He further suggested that library research should begin and continue right in the parent institution, as this bottom- upward approach can only provide a solid foundation for national information systems of developed and developing countries.

**Conway, et al.**\(^1\)\(^6\) (1974) in this paper attempt has been made to investigate many diverse opinions under the general concept of information generation. They give tentative definitions of information and information generation: information is anything that affects the stuff and structure of knowledge; information generation is the act or process of producing information. A series of information processing activities can be conceived of as falling into the domain of information generation activities such as creation, analysis, evaluation, interpretation, correlation, prediction, etc.

**Pauline**\(^1\)\(^7\) (1975) in his study indicated that accurate and up-to-date knowledge about users and their information behaviour is one of the essential ingredients for designing an information system.

**Vickery**\(^1\)\(^8\) (1976) attempt had been made to define the information needs of earth science engineers: mining, engineering geology, soil and rock mechanics. The methodology of his work was based on questionnaires, interviews, visits to organizations, study of correspondence and dairy, analysis of citations and evaluation of two abstracts journals which exist in the field. To investigates the needs in relation to the environment in which the engineer lives and works, his
organization, team and leadership, and partly to his own traits. The role of engineers as researchers, linkers and practitioners are defined. The SPSS package was used for analysis of the results of questionnaires. In conclusion, recommendations for a viable information retrieval system are briefly discussed.

Mick (1980) in his study examine the factors effecting individual information behaviour in a corporate environment focused on attitudes of employees toward information forms and channels. This study finds the situational variables play a greater role in determining information behaviour than individual variables.

Belkin and Wilson (1980-1981) have also advocated the importance of information needs and utility. They stated that it becomes increasingly important that the success of information centres is more likely to be achieved through adjusting the services to meet the specific needs of an individual rather than trying to accommodate the individual user to match the wholesale output of an information system.

Leuplot (1983) pointed out that the Information needs and information requirements are mutually interdependent and the requirement is the reflection of the objectively existing information need. Further the relation between information need and information requirement is to be seen in the light of the fact for satisfying the information needs. It is necessary to meet the information requirements corresponding to that information need.

Krikelas (1983) conducted a study on information seeking behaviour, patterns ad concepts. He investigated that individual information seeker has its own personal hierarchy of the types of information sources they prefer.

Yates (1984) has divided the information needs into four basic segments. The empirical knowledge encompassing fields such as science and technology,
which is ultimately necessary for human survival. Personal human experience is the quest for personal identity that is the most basic pursuit of the enquiring individual, to satisfy this need, use can made of the other people’s experience through literature. Corporate human experience that has several dimensions it can be extended in space, in such disciplines as sociology and geography or extended in time as in history, and diversion the search from an escape from the monotony, physical and mental exhaustion, frustration, confusion, conflict, failure and disappointment of the working. Further he also suggested that the individual’s information requirement may change as a result of sociological and economic factors and amongst the many predictions made about the remainder of this century there are recurring themes of this nature.

Erdmann\(^{25}\) (1990) conducted a survey and revealed that, because of the nature of legal and engineering work, students need to be able to find information on current development through tout their caress. Therefore in order to equip students for effective information gathering and seeking they need to be given certain skills in order to plan search, use a variety of materials, locate materials and use citations, and to validate an information sources, a first step is to ask libraries to provide this training to students, however a more important step to incorporate information seeking as a part of the curriculum.

Maheswarappa and Nagappa\(^{26}\) (1990) have studied information needs of Indian social scientists and reported, that book and monographs (91.34%) and periodicals (72.15%) were the most frequently used formal sources of information by the scientists followed by research reports (68.10%) News-paper (45.57%) abstracting and indexing journals (35.44%), Government publications (35.44%) and theses and dissertations (30.38%), conference proceedings (20.25%), Discussions with colleagues (67.09%) were the most frequently used informal sources of information. The most frequently used methods of locating information were reference or bibliographies (69.62%) the library catalogues (63.39%)
discussion with colleagues (56.96%), subject bibliographies (37.97%), Librarians (34.18%).

**Kuhlthau**\(^{27}\) (1991) study focused on information search process, which emphasizes feelings, thoughts, and understanding of a situation that they need to resolve task, problem, or topic. This particular action led to the action of people as they seek the meaning of useful research in providing a framework for improving information search.

**Prasad**\(^{28}\) (1992) The Information need or need for information is a factual situation in which; there exists an inseparable interconnection with ‘information’ and ‘need’. The information originates and is generated because there exists a need or an interest. The content of information is of primary concern. The basic objectives of studying information needs and use may be:

i) the explanation of observed phenomena of information use or expressed need;

ii) the prediction of instances of information use; and

iii) the control, and thereby improvement of the utilization of information manipulation of essentials conditions.

**Kuhlthau**\(^{29}\) (1993) conducted a study and pointed out that the whole information seeking process consists of six stages:

- Initiation: when a person becomes aware of lack of knowledge or understanding and feeling of uncertainty and apprehension are common;

- Selection: at this stage the task is to identify and select the general area to be investigated or the approach to be pursued;

- Exploration: the task is to investigate information on the problem in order to extend personal understanding;
• Formulation: this is the turning of the whole process, when feelings of uncertainty diminish and confidence begins to increase the task is to be form a focus from the information encountered in exploration;
• Collection: the task is to gather information pertinent to the focused problem; and
• Presentation: when the search is completed with new understanding enable the person to explain or her learning to others or in some way put the learning to use.

The principle of uncertainty is a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence. The principle is expanded by six corollaries: process corollary, formulation corollary, redundancy corollary, mood corollary, prediction corollary, and interest corollary.

Hayes (1993) this paper presents and discuss implication of a set of measures of information, with in the framework of the definition of the term: information is that property of data (recorded symbols) that represents and measures effects of processing them. As a context for this definition, the paper discusses colloquial use of the term and of other relevant terms, the historical development of measurement theories related to them, and the problems that have to this point been unresolved in reconciling colloquial and theoretical use of them.

Kuhlthau (1994) conducted studies on the users perspective of information seeking in libraries and the common patterns in users experience were identified and a mode of the information search process was developed. The concept of process in the holistic sense that the user experiences seems to be some what outside of the paradigm of information retrieval system. The following concepts emerging from this research may be useful for designing information retrieval systems that support innovation creativity and learning; concept of process, uncertainty, complexity, enough. This study addresses information use as
well as information seeking. It does not stop at locating information, but it is concerned with interpreting and using it. This research becomes more pertinent as researchers and system designers begin to turn their attention to the consideration of more user-centered approaches. User-centered systems will need to accommodate users beyond the interface, as people seeking information to create, learn and innovative in the context of their daily lives.

Khan and Simons\textsuperscript{32} (1995) the Study revealed that library/information seeking behaviors and problem among lady postgraduate students taking as case study. Here an attempt has been made to know the information seeking behavior and library utilization by women’s.

Gary\textsuperscript{33} (1997) reveals that the information seeking as a process in which humans engage to purposefully change their state of knowledge. The process is inherently interactive as information seekers direct attention on adapt to stimuli, reflect on progress, and evaluate the efficacy of knowledge base of the information seeker. Information seeking is thus a cybernetic process in which knowledge state is changed through inputs, purposive outputs, and feedback.

Wilson\textsuperscript{34} (1997) in a study of the information seeking behaviour in multidisciplinary subjects has been identified four basic categories of information seeking and acquisition i.e., Passive attention such as listening to the radio or watching television programmes, where there may be no information seeking intended, but where information acquisition may take place nevertheless; Passive search which seems like a contradiction in terms, but signifies those occasions when one type of search results in the acquisition of information that happen to be relevant to the individual; Active search which is the type of research most commonly thought of in the information science literature, where ‘an individual actively seek information; and ongoing search where active searching has already
established the basic framework of ideas, beliefs, values or whatsoever, but where occasional counting search is carried out to update or expand one's framework.

Ellis and Haughan\textsuperscript{35} (1997) have studied on the information seeking patterns of engineers and industrial research scientists working in different projects and in different projects phases. They identify eight major information-seeking activities or characteristics namely surveying, chaining, monitoring, browsing, distinguishing, filtering, extracting and revealing.

Bhattacharyya\textsuperscript{36} (1997) in his paper author made a systematic strategy for formulating a definition of the term/concept information, communication, self communication. He finds self communication plays the most significant role in information communication; and it involves several psycho-intellectual processes, such as, that of perception, analysis, classification, knowing, remembering, etc, and also a close relationship between the essence of communication and knowledge and data in some specific senses. Conclude that medium of expression is always a language and message is conveyed by a language, or by its accepted or acceptable substitutes.

Ocholla\textsuperscript{37} (1999) Conducted the study on information seeking behaviour of academics in relation to the productivity of academics in University of Zululand through survey of 105 Humanities and Science faculties through questionnaire, (32.1\%) responses had been received, 89\% uses journals, 68.5\% seek information for professional needs and occupation, 86.6\% uses library for information sources. The study finds the information ignites the fuel for academic productivity and production in research publication.

Kuruppu\textsuperscript{38} (1999) discusses briefly: information needs, information seeking behaviour, methods used in studying information needs and seeking behaviour, especially in research organizations, and the importance of such studies. The use of the findings of the studies in making decisions relating to the
design of information systems and services is also touched upon. The impact of emerging information technology on information users and their information seeking behaviour is mentioned.

Natarajan\(^3^9\) (1999) explores the anatomy of innovation, and attempts to identify the key success factors promoting innovation, also barriers and impediments to innovation, and managing innovation requires a well-planned strategy and commitment from top management.

Chakrabarty\(^4^0\) (2000) in this paper, designing of information activities and the different systems of information handling have been highlighted. It also discusses the functions/characteristics of different agencies engaged in information handling work. Finally, the paper stresses the need for the application of Database Management System or Computer Readable Data Base as a tool for automatic information handling system.

Kathy\(^4^1\) (2000) conducted a bibliographic instruction program to help undergraduate students in World Regional Geography locate current and historical resources to create answers for the midterm examination is described. Student papers were analyzed by citation analysis to determine what types of resources students used to gather information to create the answers. Students used a wide variety of sources in print and electronic formats to gather information for the test. The fall semester students cited print sources 62% compared to citations from electronic sources at 36% and lecture notes at 2%.

Yates-Mercer and Bawden\(^4^2\) (2002) in this paper author try to evaluate the activities and initiatives relating information and knowledge; assess the usefulness of approaches and programmes for managing information and knowledge by setting them in a context of wider philosophical and pragmatic issues; evaluate that, which concept is to be followed i.e. explicit or implicit, to understand, how information and knowledge may be managed and valued with in the organization.
It identifies some paradoxical qualities of information and knowledge in this topic, which must be factored into any valid evaluation of knowledge management.

Satija\textsuperscript{43} (2004) made an attempt in his paper to highlight the importance of information in the information society; its relation with data, knowledge and wisdom; its importance in communication, social and economic development. The properties and the scope of information are also defined.

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 covers various facets related to information seeking behaviour, findings and their conceptual meanings.

Krishnamurthy\textsuperscript{44} (2004) describes various factors of information sources and information seeking behaviour of library users. The information is the basic material for the decision making process. The essential purpose of every decision is to transform information into action efficiently and effectively. Information seeking is a kind of communication behaviour, which would be influenced by many factors. Concluding that, from the users point of view, information seeking behaviour study is nothing but the study of flow of information among the users and information system.

Gopinath\textsuperscript{45} (2004) discuss in the era of information technology there is a growth of knowledge in leaps and bounds, the process of knowledge management consists of generation, acquiring, storing, organizing, retrieving and transmitting knowledge leads to knowledge engineering. He concludes that knowledge engineering is a process of system-stages in development of knowledge. It has capabilities to improve knowledge creation and knowledge utilization,

Further he discusses the innovations; inventions and discoveries of knowledge are land marked for their newness and applicability. Researches in the
systems, devices, techniques and methodologies lead to generation of new knowledge.

**Shih-Wei and He** (2004) this study investigated the interrelations among four categories of knowledge assets and four knowledge creation process i.e. Socialization, externalization, combination, and internalization. In order to categorize the relationships among four knowledge assets and four knowledge creation processes, they employed Pearson and canonical, correlation, ANOVA, and regression analysis. Thus, concluding that knowledge-creating process may be facilitated effectively by adopting an appropriate tool or context, i.e. knowledge assets and future research may focus on extending and refining the taxonomy and content of knowledge assets.

**Dhiman and Rani** (2005) this book provides information about the information: concept, need and purposes, services, sources of information, bibliographic services, and documentation and information centers and their activities. Further it discuss that information is the product of different types of human activities and events, or incidents. Some of the important activities, through which information is generated, are: research and development; it is a highly organized activity throughout the world which continuously creates a large mass of new information, survey and censuses, government activities, etc.

**Jannica** (2005) conducted a study on ‘Fast surfing, broad scanning and deep diving: The influence of personality and study approach on students’ information seeking behaviour. The study is based on the five dimensions of personality (i.e., neuroticism; extroversions; openness to experience; agreeableness; and conscientiousness). The study finds the personality characteristics of a information seeker greatly influence the information seeking behaviour of seeker.
Shukla\textsuperscript{49} (2005) discussed in the present world the most vital competitive edge for long term survival of organizations is their, core competency of creativity and innovation, as also, for individuals their ability to unleash their creativity as production of novel ideas that are useful and appropriate to the situation and innovation, which involves novel and useful ideas.

Palanki and Rao\textsuperscript{50} (2007) presents the teacher is expected to be a part of the solution and not apart of the problem. Learning is an active process of investigation and creation based on learner's interest, curiosity and experiences and should result in expanded insights, knowledge and skills. This paper presents the teaching techniques and examines the various methods of teaching and suggests some solutions for the existing problems.

Information can be elaborated, consolidated, and used for varied purposes. The Information generation is a human process that requires adaptive and reflective control over the different actions of the information generator, i.e. researcher, engineer, teachers etc.

The Information seeking behaviour resulted from the recognition of some needs, perceived by the user, who as a consequence makes demand upon on formal system such as libraries and information centers, or some other person in order to satisfy the perceived information need. The information seeking behaviour essentially refers to locate discrete knowledge elements. It is concerned with the interactive utilization of the three basic resources namely, people, information and system. Further in order, to satisfy the information needs, the user actively undergoes the information seeking process. The attempt of the user in obtaining the needed information results from the recognition of some needs, perceived by the user.
2.2 Information Communication and User Studies of Engineering / Technological Personnel

Communication is fundamental characteristics of human societies. In fact, it is one of the basic instincts of man. Communication is an integral part of teaching learning process. Through communication teachers and students exchange interaction, knowledge ideas, concepts, feeling etc. many a time, communication is impeded by a number of factors. These affect the individuals, groups as well as, organizations. Some of the literatures have been reviewed related to this study.

Herner\textsuperscript{51} (1958) conducted a study with 450 medical scientists on the use of formal and informal channels of communication which showed the majority of them got the idea of a new project through personal contacts/discussion with their colleagues and the remaining got the same from their own personal work.

Menzel\textsuperscript{52} (1966) conducted user study and defined information seeking behaviour from three point of view:

- when approached from the point of view of scientist or technologists, these are studies of scientists' communication behaviour;
- when approached from the point of view of any communication medium, they are use studies; and
- when approached from point of view of the science communication system, they are studies in the flow of information among scientists and technologists.

Hence, the terminology depends much on the approach and the angle from which one sees.
Menzel\textsuperscript{53} (1968) interprets the results of several recent studies of the total information seeking activity of scientists and technologists in terms of complementary relationship between an extremely flexible and many sided interpersonal communication system, on the one hand, and a formal communication system, on the other hand. The formal system is able to compete with the informal system with respect to only a few of the many information needs of the individual. Among the information needs identified are: ‘promptness of acquisition of certain information, selective dissemination of information, screening and evaluation of information, indication of implications, retention of unscholarly but subtly important details in digest, and rapid feedback. Newly initiated and proposed activities such as information analysis centers and selective dissemination of information are seen as moves to formalize and improve upon functions long served by information communications.

Shaw\textsuperscript{54} (1981) pointed out that informal and formal communication processes are documented in the primary journal. Both the process imposes structures on the authors who publish their research and the formal processes a structure on the journals, which publish scientific papers. In this paper, it is shown that information theory can be applied to these structures for the purpose of evaluating the contribution that authors and journals make to the communication of scientific information. Results identify the most communicative authors and journals in an area of active research.

Lacy and Busch\textsuperscript{55} (1983) In order to determine the informal scientific communication among the public sector agricultural researchers with the objective that the formal and informal channels constitute the two mutually dependent elements of the communication, importance of the informal channels is often ignored. They have found that informal scientific regarding research was infrequent and primarily limited to contact the scientists in one's own department,
scientist’s communication with scientists outside their department, clients, and extension staff was limited to less than once a month.

Bandyopadhyay, Ghosh and Mittal\(^56\) (1986) discuss the influence of factors like political, languages, financial, currency exchange, ignorance etc., on the accessibility to information, its transfer and ultimate use. They suggested that, there should be a consensus among the nations about free flow of information, clear policies should be formulated at national and international level, the developing countries should be conscious about the value of information and should avail of the emerging technologies through information transfer.

Goel\(^57\) (1986) emphasis the modification of communication technology so as to make the communication of information speedier and efficiently through various forms of electronic modes of communication such as e-mail, computer network using distributed data processing, videotext, teletext, satellite communication, Tele-conferencing, etc. The impediments to free flow of information are highlighted and suggestions are made for overcoming them.

Parthasarathy\(^58\) (1996) in this paper he discussed and examined role of scientific communication system evolved; the practice of the scientists to disseminate information about their work to their peers for getting their critical evaluation; the varieties of communication methods evolved for dissemination of information at various stages; and the barriers to the flow of information resulting from the rapid growth in the volume of publications, information pollution, time lag due to delays in publication, acquisition, processing, accessing, etc. The language barriers, the increasing cost of information, and unfamiliarity with the use of new information tools emerging from the application of modern information technology.

Bavakutty and Salich\(^59\) (1999) conducted a study at Calicut University. Which show that students, research scholars, and teachers used the Internet for the
purpose of study, research and teaching respectively. The purposes of Internet use were: sending and receiving e-mails, downloading images and communication with the peer groups.

Kooganurmath and Jange\(^6\) (1999) conducted a study, which revealed that majority of the users used the Internet for communication followed by the access to information. More than 70% of the users used it for higher studies and only 39% used it for discussions with peer groups.

Anderson et al., \(^6\) (2001) investigated 872 US aerospace scientists and engineers how they select information carriers. When considering oral and written information carriers, the least effort was supported with a strong preference for oral communication over written communication. Respondent’s decision to use or not to use a written carrier was found to be primarily a function of the perceived importance of the carrier’s information to a person’s work. Task uncertainty and complexity were found to be significant. The perceived quality and accessibility of written carriers were not found significant. The findings reinforce the need for firms to hire knowledgeable employees, to provide them with comprehensive training programs, and to develop formal and informal communication networks.

Arya and Sharma\(^6\) (2002) this paper discusses the some of the hindrances, which acts as major barriers in the free flow of and very quick access to the relevant and desired information at right time, further it suggest some of the solutions to overcome barriers on information communication.

Liu\(^6\) (2003) this article explore trends in transforming scholarly publishing and their implications, it examines how older documents are used under today’s network environment where new information is easily accessible. Understanding these trends would help us design more effective electronic scholarly publishing systems and digital libraries, and serve the needs of scholars more responsively.
Bhadauria and Gore\textsuperscript{64} (2004) explain the importance of communication techniques in higher education. Communication is an integral part and plays an important role in teaching learning process. It further explain it may be necessary to use new and appropriate teaching learning techniques so as to educate student to become well informed and deeply motivated citizens, who can think critically, analyze problems of society, look for solutions to the problems of society, apply them and accept social responsibilities.

Kerins, Madden, and Fulton\textsuperscript{65} (2004) this paper reports the results of two empirical studies which explored the information seeking behaviour of engineering and law students in Ireland. Although the studies explored information seeking patterns in different ways, the findings of both studies revealed similar patterns in the information seeking behaviour. Students learned their information seeking strategies, including effective and less effective approaches, from educators. Mis-perceptions of the role and value of libraries and information professional in their studies were common, and as a result, students often adopted information seeking strategies that excluded libraries and libraries staff. The studies suggest that engineering and law students in Ireland could benefit from greater information literacy training and awareness, enabling them to acquire the information skills they need to function effectively and efficiently in their future professional work lives.

O'Brien and Bucley\textsuperscript{66} (2005) reviews, merges, and adapts existing information seeking models for different domains to propose a non-linear information seeking model for programmers involved in software maintenance. This paper examined the information requirements of programmers and proposed a non-linear model of the general information behaviour of programmers as they carry out software maintenance activities. This model is based primarily on the theories of information seeking proposed in the literature for different domains. The future work will attempt to further validate and refine this model by carrying
out more empirical studies of software maintenance engineers as they debug, expand, and evolve programs.

**Tiwari and Ashok** (2006) the present paper discusses the effect of proper communication on human performance and work culture. Effective communication is essential for high performance and it is our most important tool of all organizational operations and organizational development.

**Khan** (2007) emphasizes the need and role of language in technical education. The knowledge stored in books or that communicated through lecture is incorporated in language. He reveal the true need and role of language in technical education by elaborating how lack of language becomes a flaw and how perfection in it brings the desired and better results.

**Sharma** (2007) explains the technical professional should know how communicate effectively with his colleagues, friends and relations in the global scenario by over coming the different communication barriers and also suggest innovative techniques to improve communication skills and develop students into worthy professionals to face the challenges of present global environment.

Communication is an exciting and truly challenging field of human interaction the effective communication is indispensable for effective human relations.

### 2.3 User Studies Related to the Research Topic

**Herner** (1954) studied the information gathering behaviour of 606 teachers at the John Hopkins University, gathering the data by personal interviews based on questionnaires. He found that formal education did not influence information-gathering habits except in the case of physicians. However, he did
find evidence that the type of institution has an effect on the degree of literature usage and the sources used.

The information gathering behaviour of pure and applied scientists are compared. Pure scientists obtained 30% of their information from foreign sources as opposed to applied scientist obtaining only 10% of their information from these sources. Both pure and applied scientists considered advanced textbooks and monographs, research journal, handbooks and mathematical tables as among the five most useful direct sources. Pure scientists added review publications and applied scientists added security classified research reports.

For both pure and applied scientist the five most important indirect sources were personal recommendations, cited references from books or papers, regular scanning of the literature, indexes and abstracts and bibliographies. Pure scientists made greater use of the library than applied scientists, pure scientists tended to rely on informal contact rather than formal presentations. However, applied scientists tended to rely more on the formal presentations.

Quinn71 (1985) conducted a study of the information seeking behaviours of industrial engineers and scientists drawn from five professional bodies. It is revealed in this study that online database was found to be an important information sources for industrial chemists. The older scientists use online searching less than the young scientist. The informal communication with colleagues was the most important source of information.

Aggarwal and Raina72 (1996) reviews the development of the technical education in India, various schemes of government of India for promotion of technical education, national policy on education and the objectives, attainment and future perspective of the world bank assisted technical education project.
Mukhopadhyay\textsuperscript{73} (1999) in his paper narrates the future of technical education in India and it states the role of faculty in the future of technical education of our country. In his conclusion he states that, without proper man, machine doesn’t have any value; without proper faculty, infrastructure doesn’t have any quality education.

Ravichandaran\textsuperscript{74} (1999) explains that technical education plays a vital role in nation’s development. It imparts technical knowledge, research and technology transfer. In recent times the technical education system is being enriched by the application of information technology. While computer application is much appreciated, the utility of telecommunication is much more welcomed. Brief attempt has been made to describe the Internet and its use for technical education system.

Babu and Subramaniyan\textsuperscript{75} (1999) conducted survey of self-financing engineering colleges genesis and development in Tamil Nadu. The survey reveals the status of the library, physical facilities, manpower, and services offered, collection development and organization. Few suggestions have been given based on the results of the survey.

Jain et al.,\textsuperscript{76} (2000) have attempted to discuss the present technical education system. The suggestions such as need-based expansion of facilities, institute-industry interaction, emphasis on skill development, academic audit, comprehensive manpower information system, sharing of information through networking of information centers/ libraries etc.

Sharma\textsuperscript{77} (2001) conducted a survey in 2001 on status of engineering college libraries in Haryana and made an attempt to examine the status in terms of manpower, services offered, physical facilities, collection development, and collection organization. Based on the survey and major findings, few suggestions have been given to improve the status of libraries.
Jyothi\(^7\) (2001) explain the role of digital libraries in the era of information technology and engineering college libraries should effectively utilize application of information technology in library management for providing value added information services to the users.

Natarajan\(^7\) (2002) highlighted the engineering achievements that had the greatest impact on the quality of life in the 20\(^{th}\) century. It is followed by: strength and weakness of technical (SWOT) education analysis of a traditional engineer; desirable characteristic of 21\(^{st}\) century engineers; the distinct phases in an engineer’s professional development; the anatomy of research university; stake holder relationships in the education system; a SWOT analysis of the national technology education system; and asymmetries in our technical educational system and comparison of experimental and theoretical research. The mega trends affecting engineering education are then explored. The importance of professional ethics and human values is also stressed.

Natarajan\(^8\) (2002) explains the global view of the goals of engineering education. Some desirable characteristics of the international engineer are then described. The origin, evaluation and content of the relevant national policies are also discussed. A SWOT analysis of the national technical education system is provided. The use of the principles of TQM in engineering education is explored, covering a vast range of issues in technical education and the strategies for tackling them. Finally describes the implications of some futuristic initiatives in engineering education.

Mathai and Soni\(^8\) (2002) discussed the mission to march into the 21\(^{st}\) century by transforming the existing learning resource center and creating a digital library and archives for the technical teachers training institution (TTTI) Bhopal. It also discussed the basic infrastructure facilities in terms of software and
manpower requirements. The factors involved in the development of system architecture and implementation of the digital library and archives.

Sirohi and Sinha\textsuperscript{82} (2003) reveal that technical education is a good indicator for the development and socioeconomic condition of a nation. Hence there is a greater need for high quality technical education to produce trained manpower in the country. Therefore, the quality assurance process in technical education should address specific academic issues such as strengthening of research programmes, curriculum development, etc.

Ocheibi and Buba\textsuperscript{83} (2003) conducted survey on the information needs and information gathering behaviour of medical doctors in Maiduguri, Nigeria. Based on the result of the study, suggest that the respondent medical doctors use informal and semi informal sources to a lesser extent. The study also made an observation that the behaviour of medical doctors in seeing and gathering information where they spend a longer period of time at each visit to library because of the non-availability of electronic media such as databases, both online and CD-Rom, Internet facility, etc.

Singh\textsuperscript{84} (2003) explain the role of library in digital environment. How internet will help for library and information science professionals for providing various types of information services to the users by utilizing the resources available on the internet and it play a vital role in library related activities.

Mahajan\textsuperscript{85} (2004) aims at presenting salient requirements of effective classroom lecture planning with the appropriate modern teaching tools, mind setup of the teachers and students. He proposed a model that ensures the quality of technical education with optimum utilization of time of classroom period. In this paper he suggested object oriented teaching scheme shall be beneficial to the students which would make them competitive in their future practical life.
Saravanan et al. (2005) explain the role of teachers in technical education pertaining to characteristics of a teacher, methods of technical teaching, curriculum development and co-curricular activities. They conclude that the teacher’s play a major role in the protection of intellectual and potential engineers and the technical teaching is therefore has to provide a special attention not only in teaching but also in communication skill, leadership qualities, practical knowledge and engineering ethics, the teacher should possess multi function approach in improving the quality of technical education.

Grewal (2005) in this paper attempt as been made to investigate the problems in higher technical education in India. This paper surveys the actual out turn of P.Gs and Ph.Ds in India, the out turn required and the gap between the requirement and actual out turn number and quantity wise. There after it studies the reasons of the gap, adequacy of the existing system and policy framework and recommends measures to improve upon the system and policy framework so that India achieves its target by 2020.

Lohar and Roopashree (2006) evaluate the use of electronic resources by faculty members of Bapuji Institute of Engineering and Technology (BIET) in Davangere (Karnataka). A survey of 60 faculty members was conducted through questionnaire. 26.67% of the faculty members use electronic resources ‘once in a week’, followed by 25.00% using ‘daily’. 35.09% of the faculty members are using electronic resources for finding relevant information in their specialization, followed by 20.47% of members using for their ‘research purpose’. Majority 42.64% of the faculties use electronic resources through browsing Internet. Concluding that, the faculty members use electronic resources for their academic activity.

Marsonia (2007) focuses on how to improve the quality of teachers in new millennium. He discuss the various paths like quality improvement
programmes, self improvement, the role of institutions in inspiring the teachers to improve their quality by participating in national or international seminars or conferences. He concludes that the existing technical teachers have great responsibilities of giving their best to the learner, and upgrade their own knowledge as well as qualifications.

Choudhary\(^9\) (2007) discusses the quality of technical education may help the nation in emerging as a knowledge super power if we opt for quality up gradation of education system.

Govindan\(^9\) (2007) discussed the teachers concerned have a number of responsibilities apart from their main task of teaching. Teacher effectiveness plays a vital role in moulding and shaping the students. This paper reveals the teachers accountability of effective teaching, teaching skills, students expectations, academic audit, professional development, etc.,

Kaushik et al.,\(^9\) (2007) this paper presents the different aspects of digital library, and how the physical media that records knowledge is changing from time to time with technological advancements and innovations. It explains the information storage, retrieval and disseminations in the digital form in a new prospective in the field of education.

2.4 User Studies Conducted in India

Singh\(^9\) (1981) has carried out an experiment on Information needs of engineering scientists in India in three technical institutes. Questionnaire survey was conducted to 55 research engineers and engineering faculty at three technologies institutes and tried to assess the information needs of engineering scientists in India. The study reveals about the needs of information services. The faculty and research scholars expressed their needs, as well as their association with the channels of communication. The study shows the importance of the
publications and other communication patterns. The study also depicts factors influencing the needs and the implication.

Maheswarappa$^{94}$ (1983) conducted citation study, out of the 5533 citations, 4363 (78.85%) are for periodicals. This strengthens the universal belief concerning literature use habits of scientists i.e. the mostly frequently used of all sources of information are periodicals the other major source of information for phytomorphologists are monographs accounting for 17.53% of total citations. In other words periodicals and books together meet 96.38% of their total information needs. The remaining 3.62% information's are meet by theses conference proceedings, preprints and technical reports.

Gopinath$^{95}$ (1984) gave a bird’s eye view of latest trends in information sources, information transfer and communication as well as a review of significant studies of information seeking behaviour. He has also analysed the nature of work of product design engineers and the process of product design to identify the decision making situations leading to a need for a particular type of information services in industry.

Raju and Kavitha$^{96}$ (1986) conducted a study in the field of organic chemistry have reported that the articles published in journals (85%) constitute the most important medium for scholarly communication among the Indian organic chemists. Journals articles were found to be the largest single category of documents cited. This was clear indication of the importance of primary journals as sources of information next in the order come book (10.35%), patents (2.82%), Theses/dissertation (0.91%), conference paper (0.2%) and reports (0.07%) etc.

Sridhar$^{97}$ (1987) conducted a study on information seeking behaviour of Indian Space Technologists by using multiple and complimentary investigation methods i.e., questionnaire, interview, observation, and other indirect methods. Various aspects of information seeking behaviour examined includes motives and
purposes of seeking information, nature and type of information sought, sources of bibliographic information used, time spent on information gathering activities, informal and formal communication behaviors, use and user interactions with the library. Compares and contrasts with results of other similar studies, and finally concludes by highlighting the implications of the results and by projecting the areas for further research.

Satish\(^{98}\) (1990) conducted a study about the attitude behaviour in relations in information use by social scientists and revealed that scientists greatly depend on communication with fellow specialist. Research worker almost always rely on the work of others working within the same field. Scientists not actively involved in research also frequently search for information to up-date professional information in order to perform best. They should also be in a position to acquaint themselves with innovations in their field.

Guha and Rikhy\(^ {99}\) (1993) was conducted Information seeking and communication behaviour of Indian Scientist in the institute of social analysis and communication. The study reveals how exactly the libraries were used by faculty of the five science and technology institutions. The study has covered the other behavioral aspects of technologists and scientists, on keeping abreast and current developments, relative importance of types of documents, tools, used for obtaining information, use of online services, frequency of scientists choosing periodicals for publishing. How they gather information through invisible colleges and time allocation for information gathering, communication activities.

Koganurmath\(^ {100}\) (1994) studied the communication pattern, information seeking behaviour among the teaching faculty of 17 regional engineering colleges in India, using personal interview, questionnaire methods by selecting 800 samples, 126 are covered under interview method, where as 574 teachers have responded to the questionnaire.
Journals (32%) were the most important and favoured information source followed by Books/ Monographs, encyclopedias (21%). Faculty (89%) members have informal information communication with colleges in their institute. (77%) of respondents are having informal contacts with Librarian and Library staff for the information exchange of their interested subjects. In comparison to publishing article in Journals (72.7%), engineering faculty prefer conferences and seminar proceedings (78%) to publish their research results.

Comapres and contrasts the results with results of other similar research results of information seeking and communication patterns among scientists, social scientists, humanists and engineers and engineering faculties. Suggest the thrust areas for further research.

Reddy and Karisiddappa\textsuperscript{101} (1997) conducted a survey on information seeking behavior of 160 medical scientists on the use of formal sources of information which showed that journals are preferred for formal source of information for preparing course/teaching materials. Books are used more for providing consultation and offering therapeutic/diagnostic services. The time spent in borrowing/reading literature for various purposes has also been studied.

Prasad and Tripathi\textsuperscript{102} (1998) conducted a study with physical and social scientists working in Banaras Hindu University to find out their information seeing behaviour. They also enumerated the various sources of information and information channels used by scientists. The journals were the most frequently used by both groups of scientists.

The study reveals that there are significant differences in information seeking behaviour of physical scientists. There are differences in their approach, information seeking process, difference of information needs and sources used for satisfying their information requirements.
Ayesha\textsuperscript{103} (1998) conducted a study of information seeking, generating and communication behaviour of P.G. Teachers of Kuvepu University, using questionnaire method, where as 80 teachers have responded to questionnaire out of 110 samples.

Teachers (92.85\%) were depends on University library resources and services. Nearly (61.42\%) of teachers have preferred the books and research reports as the first and major sources of information followed by periodicals (42.85\%). (35.71\%) respondents have attended national level seminars, where as 30\% have attended International seminars. (64.42\%) of teachers visit University library to prepare classroom lecture. She conclude by suggesting that the University teacher should play three important roles namely teaching, research and extension, for that University should take care to provide effective and efficient services to its users.

Tripathi and Prasad\textsuperscript{104} (2001) conducted a study with physical and social scientists belonging to both physical and social science disciplines working in Banaras Hindu University, to examine the information seeking activities and their information needs. 60\% responses were received and analyzed using M-STAT package by applying Z-test.

It was found that, physical scientists and social scientists differed in use of formal and informal sources and used different types of information in order to meet their requirements. The study reveals that the two groups of scientists physical and social have distinct characteristics with regard to the use of media and sources.

Vijayalaxmi and Maheswarappa\textsuperscript{105} (2001) has conducted a survey among the postgraduate lady students of Gulbarga University, to study the types of information required, methods and sources used for gathering information. 73 final year students were selected through questionnaires, 95.89\% were responded.
97.1% uses information sources to keep up to date, 86.6% uses information sources for background reading. It also found that the majority of the respondents 88.6% were reading latest books, followed by discussions with classmates 78.6%. The correlation between the awareness and use of information sources among post graduate lady students. The textbooks 94.3%, encyclopedia 78.6% and dictionaries 57.1% were useful of information sources.

Kumar and Kaur106 (2006) conducted a study to analyze the use of Internet and related issues among the teachers and the students of engineering colleges in India’s three states viz, Punjab, Haryana and Himachal Pradesh. Questionnaires were distributed among 1980 teachers and students, 80.9% were responded. The study demonstrates and elaborates the various aspects of Internet use. 31.3% of them had been using the internet for 2-4 years, 28.0% used it for 1-2 years; 24.3% respondents indicated having used it for more than 4 years. 74.2% respondents used the Internet for an educational purpose, 50.8% respondents for the research purpose, 49.5% for the communication purpose. 89.5% respondents are of the opinion that internet is time saving as compared to conventional documents, 84.2% respondents feel that the internet is more informative as compared to conventional documents. The result of the survey also provides information about the benefits of the Internet over conventional documents.

Several important considerations emerged from the review of the literature. The studies dealing with scholarly scientist populations and information needs, seeking behaviour and information generation activities varied from discipline to discipline, person to person and stage of research to stage of research. The experience affected search behaviour as well as the type of information communication pattern selected by the researcher.
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