"The Release of Atomic Energy Constitutes a new force, too revolutionary to consider in the framework of old ideas"

- HARVY. S. TRUMAN

CHAPTER EIGHT

A MODEL FOR THE COMMUNICATION AND INFORMATION SEEKING BEHAVIOUR

EXPERT SYSTEM FOR INFORMATION RETRIEVAL.
TOWARDS SENSITIZING FRAMEWORK FOR COMMUNICATION AND INFORMATION SEEKING BEHAVIOUR.
COMPARISON OF THIS STUDY WITH OTHER'S RESEARCH.
FUTURE AVENUES FOR RESEARCH.
CHAPTER EIGHT

MODEL FOR THE COMMUNICATION AND INFORMATION SEEKING BEHAVIOUR

A detailed analysis of the data of information seeking behaviour and communication pattern is presented in the previous chapters. Different aspects of the use of information and communication of information by engineering faculty are linked together into a comprehensive description of their information seeking behaviour. It is noted that the engineering faculty is involved mainly in multipronged activities based on 'Grounded Theory' i.e.

1. Teacher - as they are teaching the students.
2. Scientists - as they are involved in Research.
3. Engineers - as they are basically engineers and involved in consultancy to industries and other organizations.

In addition to these commitments they are also involved in administration, expertise in the technology, editing, writing and publication activities.

An indepth study of assessing the communication pattern and information seeking behaviour of engineering faculty has been the topic of interest to researchers these days and gaining momentum. Investigations have focussed on a wide variety of information seeking habits ranging from laboratory studies of highly artificial intelligence nature to user studies in the real
world of libraries. Much of this research has been oriented towards describing human abilities and limitations in information seeking as they are affected by various task parameters. A similar goal is pursued in this study in terms of models of information seeking and information communication.

The work reported in this study utilizes an experimental environment called 'engineering faculty communication' and 'information seeking behaviour'. The overall framework, the model as shown Fig. 23 includes three entities—'the Information generation', 'Information Seeking pattern' and 'Information Communication'. Information generation among engineering faculty is a continuous process. Information is the intellectual product of engineering faculty, which is produced and consumed by their own society for its progress. While research commences, results of such research are communicated by interpersonal communication or through formal communication. Thus resulted information leads to search for it by the seekers.

Information seeking is the recognition of some need perceived by the engineering faculty. That engineering faculty information seeking behaviour has taken several forms such as 'Starting', 'Chaining', 'Browsing', 'Differentiating', 'Monitoring' and 'Extracting'. The importance of engineering faculty information seeking behaviour aspects and their activities to inform the resulted research is more widely applicable and play a more prominent role in the design of information communication pattern.
MODEL OF INFORMATION SEEKING AND COMMUNICATION

INFORMATION GENERATION

INTER PERSONAL COMMUNICATION

- REPORT
- PATENT
- CONFERENCE
- PROCEEDINGS
- RESEARCH

CURRENT AWARENESS JOURNAL
INDEXING JOURNAL
ABSTRACTING JOURNAL
BIBLIOGRAPHY

- REVIEW, MONOGRAPH
- HANDBOOK, MANUAL
- ENCYCLOPEDIA
- TEXT BOOK
- STANDARD
- TREATISE

INFORMATION SEEKING

STARTING

CHAINING

BROWSING

DIFFERENTIATING

MONITORING

EXTRACTING

- JOURNAL ARTICLES
- BOOKS
- RESEARCH REPORTS
- PATENTS
- STANDARDS
- A. V. PRESENTATIONS
- OTHERS

COMMUNICATOR / ENGINEERING FACULTY

ENGINEERS

CHANNEL

CONVERSATION

INFORMAL DISCUSSION

CORRESPONDENCE

OTHERS

TECHNICAL PAPER

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The information in the form of message is generated by a communicator and with the help of language and some media that information is communicated to receiver by informal way of communication channels or formal way of communication channels. The language and the medium serve as the links to convey the information from communicator to the receiver. This will again give way to Generation of Information, Information seeking and Information Communication. This is an unending cycle which produces tremendous increase in generation and communication of information by every stage.

The information generation and communication are part of the communication pattern, while information seeking behaviour is assured result and forms the related resulting part of the study. This tremendous increase in the number of researches on engineering are accelerating the proliferation in the universe of information at a fabulous rate. This has to be so because social pressure demands that the interval between any major invention or discovery and its exploitation for human purpose should be reduced to a vanishing point. The following table reveals how the time-lag in application of new discoveries to beneficial social use has progressively reduced the time considerably.
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>YEAR OF DISCOVERY OF PRINCIPLES</th>
<th>YEARS OF PRACTICAL DEVELOPMENT OF DEVICE</th>
<th>NO OF YEAR OF LAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photography</td>
<td>1727</td>
<td>1839</td>
<td>112</td>
</tr>
<tr>
<td>Telephone</td>
<td>1823</td>
<td>1876</td>
<td>53</td>
</tr>
<tr>
<td>Atomic Power release</td>
<td>1932</td>
<td>1945</td>
<td>13</td>
</tr>
<tr>
<td>Transistor</td>
<td>1940</td>
<td>1948</td>
<td>6</td>
</tr>
<tr>
<td>Laser</td>
<td>1958</td>
<td>1960</td>
<td>2</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>1984 January</td>
<td>1984 April</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Further research organised by engineering faculty on a National and International basis with facilities for prompt communication of thought is leading to a spiral movement of short period in development of new engineering information. The spiral moves along the following stages:

1) Fundamental Research
2) Applied Research
3) Pilot Project
4) Design and Production of new Machinery
5) New Material
6) New Product
7) Using the New Product
8) New Problems created by the new Product sooner or later
9) Fundamental Research again to solve the new problems and the continuation of the spiral unending cyclic movement of the spiral.

The Spiral has been represented schematically in Fig. 4.
SPIRAL OF DEVELOPMENT OF ENGINEERING INFORMATION.

FIG. 2.4
In the past, the period of one cycle in the spiral was long extending over centuries. But Social urge caused by population pressure is now progressively shortening its period. Presently, the spiral movement has become so short that the development of new subjects are very rapid and have made the subjects in Engineering and Technology dynamic phenomenon.

The Universe of engineering subjects are not only dynamic but turbulently dynamic. It means that, when innumerable ideas are being created every minute and embodied in documents, there appear some seminal contributions which make a powerful, deep and extensive impact and even turn the course of development and structure of several subjects. The history of Science, Engineering and Social Sciences is full of instances of such seminal contributions like laws of gravitation theory of evolution and theory of relativity etc. which made such a disturbance that the course of development of various subjects started to change. In this context Price (1969)¹ has suggested that a theory similar to statistical thermodynamics may be helpful in considering the ratio of the total number of papers to the number of qualitative papers and the total number of Engineers to qualitative Engineers.

This spiral of development of subjects has got a direct bearing on the Information Seeking Behaviour as well as Communication Pattern processes. As said elsewhere, this Engineering faculty acts as a 'consumer' as well as 'producer of Information' by way of 'Teaching', 'Learning', 'Designing',

³²¹

In this study, each stage explains the behavioural activities represented by the principle generic features of the patterns with six basic categories of information seeking, they are: ‘Starting’, ‘Chaining’, ‘Browsing’, ‘Differentiating’, ‘Monitoring’ and ‘Extracting’. In addition, each channel of communication was derived again through these basic categories of information seeking behaviour. Instead of quantitative by measured values the qualitative value was added. The value measured utilized was discussed in more detail in the study. The derivation of data is analyzed and generation algorithm and structured interaction with this model are discussed.

In general, the results indicated that the communication and Information Seeking Behaviour in the present model has much more subtle effect than the simple theoretical presentation specifically, information seeking behavioural model with computerized information retrieval system had significant effect on "process" model but did affect on "product" model also. Type of information search behaviour had a significant effect on both process and product measures. 'Process model' refers to the matrix which characterize information seeking strategy of the engineering subject. 'Product measures' refer to the end results of the generation of information and communication of the information.
8.1 EXPERT SYSTEM FOR ENGINEERING INFORMATION RETRIEVAL:

Little has been written about information seeking and expert system. An understanding of the capabilities and limitations of the technology are critical to any information retrieval systems and expert systems to any informed evaluation of the library and information systems available. It is to provide these systems that this idea has been put forth in this chapter. The problem of selecting information seeking behaviour on appropriate application and assessing its feasibility are discussed in short, to give a flavour of the scope of expert systems, a discription of a range of potential expert system application is included.

The field of Artificial Intelligence is concerned with design of computer information retrieval system that perform tasks which would otherwise be thought to require human skills such as intelligence, perception and learning behavioural aspects on information seeking. An expert system includes ideas about knowledge and about reasoning technique used in knowledge-based system. This knowledge based systems grew due to need to be able to represent and use such knowledge in computer information retrieval systems, a need which itself arises because human experts are scarce, expensive, busy, fallible, inconsistent and mortal.

An expert system of information seeking behaviour consisting the basic components has been indicated in the Figure 25.
EXPERT SYSTEM OF ENGINEERING INFORMATION RETRIEVAL

Fig. 25
8.1.1 KNOWLEDGE BASE:

The knowledge base contains the expert systems knowledge about the information seeking domain. It not only includes the facts and relationships which make up the information seeking domain but also the judgmental knowledge and rules of thumb which an expert typically uses.

Frequently, the information required to evaluate the condition part of the rule will not be known with complete certainty. Techniques other than conventional logic must then be used to determine the degree to which the situation part is true.

8.1.2 INFORMATION INTERPRETER:

It is the mechanism of expert system which is able to apply its knowledge to a particular problem of information seeking. It must possess some mechanisms for inferring conclusions from particular condition. Two major categories of approach are used to find solutions:

1. Finding ways to information search among possible solutions in a search space most efficiently.

2. Finding ways to narrow the information search to smaller, more exhaustive, expeditious and pinpointed areas in the search space.

8.1.3 WORK SPACE:

All the data on which the expert system operates are stored in the work space. These data are of two types:

1. the problem description, consisting of data about the problem currently being taken up.

2. the problem status, consisting of the deductions, partial solutions and conclusions so far produced by the system.
The work space will merely consist of a list of simple hypothesis, each having associated with its truth or falsity. In more complex systems, elaborate hypothesis structures are created which not only indicate the degree of truth or falsity of the individual hypothesis but also the casual, structural and temporary relations between the hypothesis.

8.1.4 USER INTERFACE:

This interface to an expert system is the input and output of data directly relevant in solving the specific information service problem on hand. The input data may come from engineering faculty from databases, and from the library databases. The output data may be sent to the users i.e. engineering faculty. Such data are input and output from the systems work space.

8.1.5 INFORMATION INTERFACE:

These interfaces allow the user to interrogate the expert system as to its knowledge, problem solving strategies and conclusions and which provide a window on to the systems reasoning processes. Such requests are handled by the information interpreter and allow the user to ask of any point, any information during his dialogue with the expert system.

8.1.6 INFORMATION RETRIEVAL:

There is a fundamental problem with information retrieval and that is the engineering faculty often finds it difficult to know what information he needs or where to find it or even...
whether it exists. The increasing diversity of sources and systems published and informal information are adding the difficulty.

An Expert System designed to assist the engineering faculty in defining their needs in terms of the information seeking behaviour to be available. Expert System assists for selecting the sources where engineering faculty is likely to find that information. It formulates the search in the best possible way for the different systems he needs to have an access to those sources. In addition it provides semantic analysis of natural language input, involving both word recognition and parsing.

An Expert System for machine translation would involve Knowledge Based rules both for the semantic analysis of a natural language and for the building of semantic equivalents in a second natural language.

From the data analysis it is understood these information retrieval systems such as computerized information systems, electronic communication sources like CD-ROM databases, Online databases and utilization of expert system are perceived to be very reliable but are infrequently used in our country. The role of intermediary in future communications networking to sources outside the formal communication channel should be adopted to Regional Engineering Colleges as a possible option and information retrieval facility be made in available in plenty.
8.2 TOWARDS SENSITIZING FRAMEWORK FOR COMMUNICATION AND INFORMATION SEEKING BEHAVIOUR:

One of the widely accepted conceptual frameworks for user-research is that the one suggested by Paisley (1968)\(^2\). He places the information user at the centre of ten systems namely cultural system, political system, membership group, reference group "invisible college", formal organisation, work team, one's head/mind, legal and economic system and formal information system each forming concentric circles around the user. Except one's own head/mind, all other systems are external to the individual and they form his environment. However, one should not forget the complex interactions involving one's own head/mind in terms of personal attitudes and accumulated experience with one's present role, function, task and all other environmental systems. It is these complex interactions which lead to individual information behaviour. This conceptual framework however is in congruence with the functionalist theory or view of scientific growth propounded by Merton (1957)\(^3\) especially the fact that science exists as a subsystem within a larger social system. Yet, some hold the view that scientists live in two worlds, scientific world and a separate 'outside' world (Garvey, 1979)\(^4\). From this it appears that each one of the systems proposed by Paisley are not only task-dependent and situational, but also exert influence on the user to a varying degree.

Four basic concepts comprised the conceptual framework for this study. These concepts were evident in the review of the literature and supported in the results of this study. The first
concept was that individual faculty needs information and must be able to acquire the information needed to perform their respective tasks. The engineering teachers in this study did indicate a need for variety of information and stated that this information was used in the classroom and laboratories in reference to both teacher and student activities.

The second concept was that information needs vary and may be categorized by purpose or function. The engineering faculty in this study indicated a need for current, everyday, and indepth information to perform their tasks. The information needs of industrial problems of day to day work were to be considered as the main task while providing consultancy services.

The third concept stated that the information needs of on-going research in the laboratories play a significant role. The faculty in this study indicated that their personal contact or informal communication system were utilized extensively to obtain information.

Finally, the fourth concept indicated that the results of research studies on information needs and users serve valuable purposes. Based on the results of this study, the application of the recommendations from this research can be beneficial in providing improved information resources and services to the engineering faculty. Additionally, the data provides more insight regarding the use of information sources by 17 Regional Engineering College faculty members which adds to the body of professional knowledge on information needs and uses.
8.3 COMPARISON OF THIS STUDY WITH OTHER'S RESEARCH:

Crawford estimates that well over 1,000 user behaviour and information system use studies have appeared in print. These have been conducted in developed countries examining various aspects of information use. There is a paucity of such studies for developing countries like India, especially studies on Engineers and Scientists. Empirical data on the information use of scientists and engineers are needed for both theoretical and practical purposes, to contribute to basic knowledge about information use and to serve as a basis for the design of information systems and services.

### TABLE 8.2
SOME CENTRAL TENDENCIES OF COMMUNICATION PATTERN AND INFORMATION SEEKING BEHAVIOUR

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Scientists</th>
<th>Social Scientists</th>
<th>Humanists</th>
<th>Engineers &amp; Engineering Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>1. STARTING:</td>
<td>Initial familiarisation necessary</td>
<td>Initial familiarisation necessary</td>
<td>Initial familiarisation found</td>
<td>Initial familiarisation necessary</td>
</tr>
<tr>
<td>I Reading Habit</td>
<td>3-5 hours weekly</td>
<td>5-7 hours weekly</td>
<td>very important</td>
<td>8.15 hrs. weekly</td>
</tr>
<tr>
<td>II Personal contact</td>
<td>Found</td>
<td>Found</td>
<td>Found</td>
<td>Found</td>
</tr>
<tr>
<td>III Industry Institute Interaction</td>
<td>not necessary</td>
<td>not necessary</td>
<td>not necessary</td>
<td>necessary</td>
</tr>
<tr>
<td>IV Alternative key starting point</td>
<td>not necessary</td>
<td>not necessary</td>
<td>not necessary</td>
<td>necessary</td>
</tr>
<tr>
<td>2. CHAINING:</td>
<td>Analysing &amp; Synthesising is found</td>
<td>--do--</td>
<td>Analysing &amp; Synthesising is found</td>
<td>Analysing &amp; Synthesising is found</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Backward Chaining</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>II</td>
<td>Forward Chaining</td>
<td>necessary</td>
<td>yes</td>
<td>not necessary</td>
<td>yes</td>
</tr>
<tr>
<td>III</td>
<td>Closure</td>
<td>not necessary</td>
<td>yes</td>
<td>not necessary</td>
<td>yes</td>
</tr>
</tbody>
</table>

3. BROWSING:
- Arranging Information is not found
- Arranging Information is found
- Arranging Information is found

I Structured Searching
- yes
- yes
- No
- yes

4. DIFFERENTIATING:
- Filtering is found
- Filtering is found
- Filtering is found
- Filtering is found

I By Topic
- yes
- yes
- yes

II By Approach
- No
- yes
- yes
- yes

III By Author
- yes
- yes
- yes

IV By Quality
- yes
- No
- yes
- yes

5. MONITORING:
- Maintaining Awareness is found
- Maintaining Awareness is found
- Maintaining Awareness is not found
- Maintaining Awareness is found

I Informal Contact
- yes
- yes
- yes
- Main

II Journals
- yes
- yes
- yes

III Books
- No
- yes
- Not much

IV Conferences
- Not so much
- yes
- Not so much
- yes

V Teaching
- No
- It depends
- No
- yes

VI Industries
- Trade Reports
- No
- No
- No
- yes

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### 6. EXTRACTING: Focussing

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Formal Tools</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>II Search</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deligation</td>
<td>30%</td>
<td>40%</td>
<td>40%</td>
<td>38%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7. COMMUNICATION PATTERN

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information Generation</td>
<td>95%</td>
<td>85%</td>
<td>65%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>2. Informal Communication</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>I Technological Gatekeepers</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>II Invisible Colleges</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>No</td>
<td>yes</td>
</tr>
<tr>
<td>3. Formal Communication</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>I Through Journals</td>
<td>90%</td>
<td>60%</td>
<td>40%</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>II Through conferences</td>
<td>80%</td>
<td>90%</td>
<td>60%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>III Through Books, Reports, Standards</td>
<td>30%</td>
<td>52%</td>
<td>60%</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>IV Other Media</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

Studies taken as bases for comparison:
- Based on the study of Andrews, Frank, M. (1965)
- Based on the study of Ellis, D. (1987)
- Based on the study of Lawler, R. Allen, T. J. and Vondvan, R. F. (1977, 1974)
- Based on our own study and 1965)}
To be able to compare some central tendencies of others' research, Table 8.2 presents a summary of other's research results of central information seeking and communication patterns among scientists, social scientists, humanists and engineers and engineering faculties. The central tendencies among other's research results are primarily hypotheses owing to the few studies done on qualitative methods. This is, as indicated in the title of the table, only illustrative of some central tendencies of information seeking behaviour and communication pattern as interpreted other's research results. The aim of the table is not related to any explanatory power, but to give an overview of how most of the user studies have described the communication and information seeking among scientists, social scientists, humanists and engineering faculty.

8.4 FUTURE AVENUES FOR RESEARCH:

This study has provided data concerning the communication pattern and information seeking behaviour of engineering faculty in Regional Engineering colleges in India. It provides enlightenment in reference to the sources utilized for information and their perception of different types of libraries and the problems they encounter in obtaining information. The data adds to the body of knowledge on how the population seek to satisfy their information needs. Additionally, the results may be used by R.E.C. Libraries/media specialists to provide more efficient and effective information services to the teaching faculty.
As the growth of Knowledge is dynamic, multidimensional and multidirectional, so is the case of user who normally approach/seek information with varying degrees and dimensions. Hence there is a constant need for research in this aspect. Following are the suggested thrust areas in which there is an immediate need for research.

1. Studies of this magnitude should also be extended to other academic institutions like Indian Institutes of Technology and Indian Institute of Science and other technological universities in India.

2. Innovative efforts using a qualitative methodology such as the interview which could reveal more objective formulations.

3. Investigation should be directed to correlate the information seeking behaviour in the context of increasing computer based information retrieval system.

4. Application of expert system on information seeking and communication should be tested in all its perspective.

5. Further, research findings obtained from different investigation ought to be tested in related, but different, narrow settings. It will be a particular interest to follow up this research in areas of faculty member’s communication pattern compared to their project work in progress.

6. Motivational factors for communication and information seeking behaviour among scientists, scholars and engineering faculty should be scientifically identified and integrated in the light of the designed model of communication and information seeking behaviour.

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Factors affecting the manifestation of creative ability of scientists.

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