CHAPTER 4

Information Seeking Behaviour:
A Conceptual Framework

4.1 Introduction

In this information age there is so much of information being generated that we are confronted with growth of information which leads to information explosion, exponential information pollution. Due to this information explosion or information pollution the people are confused about the information need, information access and information sources. Again information access varies from person to person according to their needs. Thus, information seeking is a kind of communication behaviour, which may be influenced by many factors. It also involves personal reasons for seeking information, the kind of information which sought, and the ways and sources with which needed information is sought.

According to UNESCO (1979), information is defined as "Information is made up of symbolic elements, communicating scientific and technical knowledge, irrespective of their nature (numerical, textual, graphic, etc.), material carriers (paper-print, microform or machine readable form), form of presentation, etc. It refers both to the substance or contents of documents and to the physical existence; the term is also used to designate both the message (substance and form) and its communication (act)" (UNESCO, 1979)

Information emanates from all human activities and achievements; both individuals and corporate bodies are involved in the creation of information for some purpose or the other. Research and Development activities, for instance, generate new

information which, in turn, is used as a basis for bringing forth more information. Some organisations are entrusted with the task of collecting and organising statistical information through census and surveys. A state with its organs of executive, legislature; judiciary, business and industry generates vast amount of information and contributes substantially to its growth.

The Random House Dictionary has also listed two sets of words that are used synonymously with the term "information". These are;

a) Data, Facts, Intelligence, Advice.

b) Information, Knowledge, Wisdom.

4.2 Data, Information and Knowledge

The term "data" (plural form of datum) refers to "an individual fact, statistic, or a piece of information or a group or a body of facts, statistics or the like" (Random House Dictionary of the English language, College Edition, 1975). Thus, data may be described as discrete and unorganized pieces of information. Data become "information" when these pieces are processed, interpreted and presented in an organized or logical form to facilitate a better comprehension of the concerned topic or issue. In other words, data become information when processed and presented to form an intelligible context. Data are sets of facts or observations and they are turned into useful information after sorting, compressing and organizing them into a meaningful guide to form a basis for further study and research.

Patterns of such information are then built into a coherent body of knowledge. Knowledge, hence, consists of an organized body of information. The Random House Dictionary defined knowledge as "…….organized body of information or the comprehension and understanding, consequent on having acquired an organized body of facts" (Random House Dictionary of English Language, 1983).

A book of knowledge is the title of a book which contains data and information about selected topics which would be useful to students appearing for competitive examinations. Therefore, in common parlance, we use information and knowledge more or less synonymously, without making any distinction between them. Thus the three concepts data, information and knowledge are interrelated. Their relationship can be understood from the following examples which are often given by many scholars as shown below.

Data   →   Raw Material
↓   ↓
Information   →   Intermediary
↓   ↓
Knowledge   →   Finished Products
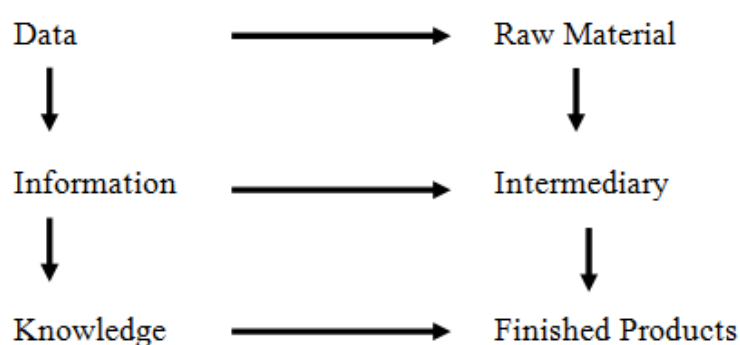
Thus, the defining information is a complex issue; however for the purposes of this research information is regarded as something containing value to the scientific communities which must contain something that informs them.

4.3 Various Types of Scientific Information

The CODATA Task Group on Accessibility and Dissemination of Data (CODATA/ADD) recognised in 1975 the need for categorising data while working on its report on the problems of accessibility of data. The Task Group evolved a scheme according to which the following categories of scientific data are formed:

i) Data with reference to time factor: Based on time factor, data can be classified into the following two types:

a) *Time-independent data:* The term refers to the data, which can be measured repeatedly.

b) *Time-dependent data:* These can be measured only once.

ii) Data with reference to location factors: Data with reference to location factor can be categorised as follows:

 a) *Location-independent data*: These are independent of the location of objects measured.

 b) *Location-dependent data:* These are dependent on the location of objects measured (Manfred, 1967)

iii) Data with reference to mode of generation: There are three types of data under this category. These are:

 a) *Primary data:* Data are primary when obtained by experiment or observation designed for the measurement.

 b) *Derived (reformatted) data:* These data are derived by combining several primary data with the aid of a theoretical model.

 c) *Theoretical (predicted) data*: These are derived by theoretical calculations.

iv) Data with reference to nature of quantitative values: These are categorised into the following two classes:

 a) *Determinable data:*Data on a quantity, which can be assumed to take a definite value under a given condition, are known as determinable data.

 b) *Stochastic data:* Data relating to a quantity, which take fluctuating values from one sample to another, from one measurement to another, under a given condition are referred to as stochastic (Smith & McCombs, 1971).

v) Data with reference to terms of expression: The categorisation in this case yields three classes of data:

a) *Quantitative data*: These are measures of quantities expressed in terms of well-defined units, changing the magnitude of a quality to a numerical value.

b) *Semi-quantitative data*: These data consist of affirmative or negative answers to posed questions concerning different characteristics of the objects involved.

c) *Qualitative data:* The data expressed in terms of definitive statements concerning scientific objects are qualitative in nature.

vi) Data with reference to mode of presentation: These are categorised as numerical, graphic and symbolic data.

a) *Numerical data:* These data are presented in numerical values, e.g., most quantitative data fall in this category.

b) *Graphic data:* Here data are presented in graphic form or as models. In some cases, graphs are constructed for the sake of helping users grasp a mass of data by visual perception. Charts and maps also belong to this category.

c) *Symbolic data:* These are presented in symbolic form, e.g., symbolic presentation of weather data.

These are, six basic types of scientific data based on the nature of data. Within these six types, there exist fifteen different classes of data (Carpenter, 1978).

4.4 Information Needs

Shannon and Weaver's (1949) classic communication model is often cited as the basic representation of the transmission of information between a source and its destination. In this model (Figure 4.1) the message from the information source goes through a transmitter and communication channel to a receiver and ultimately the destination (Shannon and Weaver, 1949, p. 98).
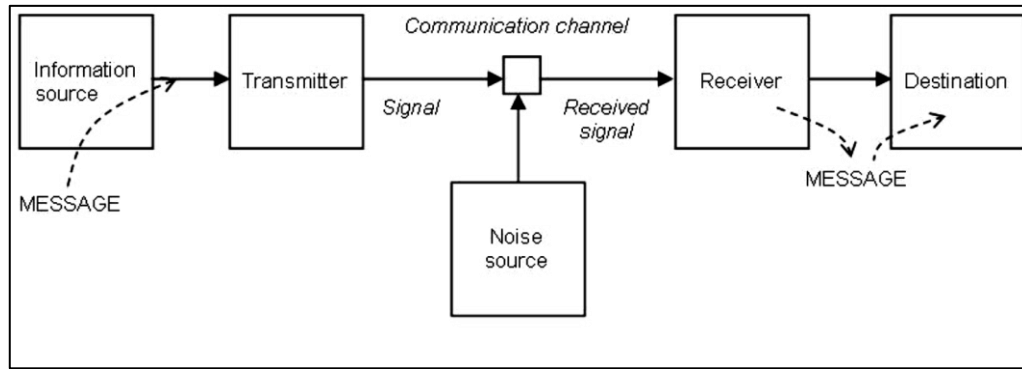
Figure 4.1: communication model from Shannon and Weaver

Line defined that information need is what an individual ought to have for his work, his research, his edification, his creation etc (Line, 1974). Hernon and Chen defined that information need occurs when ever people find themselves in situations that required some form of knowledge for resolution (Hernon and Chen, 1982). Ford and Krikelas defined "information need as an awareness or recognition of not knowing or existence of uncertainty" (Ford, 1980; Krikelas, 1983).

According to Girja kumar, the information need may be expressed as input-process-output model. The basic components of the system are: a) Problem, b) Problem solving process, and c) Solution. The problem is analyzed to determine information needs. It is indicative of the uncertainty in knowledge. Solution results in resolving of the situation by filling the gap in the knowledge (kumar, 1990). The model set-forth by him can be illustrated as Figure: 4.2.

Information needs can be divided into the following categories:

a) *Social Information needs*: Information required to cope with day to day life.

b) *Recreation Information needs*: Information satisfying the recreational and cultural interest of an individual.

c) Professional Information needs: Information required to operate competently within a business or professional environment.

d) Educational Information needs: Information required to satisfying academic requirement at an institution.
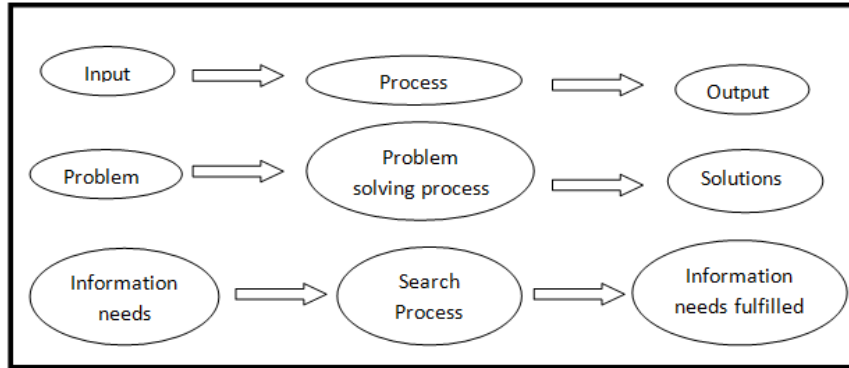

Figure: 4.2: Model for Identification of Information Needs

The structure given by Bernshtein in 1967 for information needs which is related to problem solving is shown in Figure: 4.3.
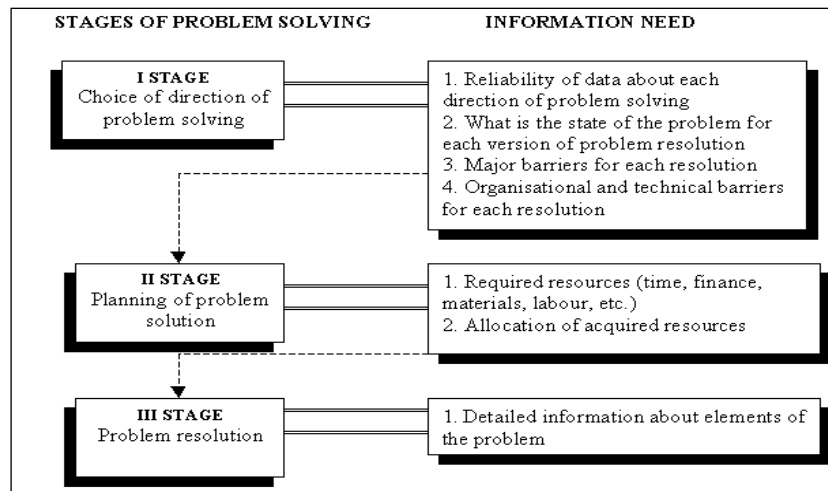

Figure: 4.3 Stages of information needs

Thus, according to Bernshtein information needs involves three different stages, which are given below:

Stage I: Choice of direction of problem solving;

Stage II: Planning of problem solving; and

Stage III: Problem resolution.

But there is a confusion regarding the user's needs, as a user may not be always aware of his needs. Information access can start without a demand being expressed or even without a want being felt (Bernshtein 1967).

4.4.1 User Groups and Their Specific Information Needs

The process of socio- economic and industrial development has been a major thrust in almost every country in the latter half of 20th century. Specialised groups of people have been working in these institutions with different functions and responsibilities. This, in turn, has given rise to the need for information and knowledge on various aspects of the work in which each group has been involved. These developments naturally have brought pressure on the libraries to innovate new types of intensive reference services to meet the growing demand for information .each group has a distinct purpose for information support. The table below gives a board summary of the different groups of persons , their needs for and purpose of information and the type of services offered by libraries in meeting them.

Table: 4.1 User Groups and Their Specific Information Needs

Category	Types of Information needs
Students	Study, examination, extra-curricular activities, etc.
Teachers	Teaching, guiding students; writing, etc.
Researcher	Research related
Engineers	Construction, production and other technical activities , etc.
Medical Practitioners	Biological, medical activities , etc.
Lawyers and Judges	Constitutional , Legal activities , etc.
Businessmen and industrialists	Market potential, product demand, product development, economy, etc.

4.5 Information seeking behaviour

Information behaviour means the way users seek information, the way they go about finding it and the way they use it. Again, users' information behaviour has two aspects: verbal and actual. Users' verbal behaviour is what they express, they like and they do. While assessing needs, users' information behaviour is analysed. One set of methods is used for analysing their verbal behaviour and another for analysing their actual behaviour.

Information seeking behaviour is the "recognition that your knowledge is inadequate to satisfy a goal that you have" (Case, 2007, p. 5). The definition of information seeking behaviour has a degree of agreement within the information science field. In 1983 Krikelas states that information seeking behaviour is "… activity of an individual that is undertaken to identify a message that satisfies a perceived need" (Krikelas, 1983 p6).

This is in line with Case's view of information seeking behaviour as the "conscious effort to acquire information in response to a need or gap in your knowledge" (Case, 2007, p. 5); whilst Wilson emphasized the aim of information seeking behaviour as "… the purposive seeking for information as a need to satisfy some goal" (Wilson, 2000, p. 49) including the interaction with manual information systems (newspaper, library) or computer-based systems (Internet).

More broadly speaking information seeking behaviour can be seen as the 'active' or 'conscious' element of information behaviour (Spink and Cole, 2004, p. 657). Information seeking behaviour is what takes place when an individual (or group) identifies an information gap and purposefully tries to fill it (Stokes, 2013).

4.6 Models of Information Behaviour / Information Seeking Behaviour

A model may be described as a framework for thinking about a problem and may evolve into a statement of the relationships among theoretical propositions. Most models in the general field of information behaviour are of the former variety: they are statements, often in the form of diagrams, which attempt to describe information seeking activity, the causes and consequences of that activity, or the relationships among stages in information seeking behaviour. Information seeking behaviour model refers to the way people search for and utilize information. At present there are various Information seeking behaviour models exists, which are Wilson's model of information seeking behaviour; Dervin's sense-making theory; Ellis's behavioural model of information seeking strategies; Kuhlthau's model of the stages of information seeking behaviour; Wilson's re-model etc. which expands various type of general ideas of information seeking in fields of information science.

4.6.1 Model of Information Behaviour

4.6.1.1 Wilson's Model of Information Behaviour

A model may be described as a framework for thinking about a problem and may evolve into a statement of the relationships among theoretical propositions. Most models in the general field of information behaviour are of the former variety: they are statements, often in the form of diagrams that attempt to describe information seeking activity, the causes and consequences of that activity, or the relationships among stages in information seeking behaviour. Rarely do such models advance to the stage of specifying relationships among theoretical propositions: rather, they are at a pre-theoretical stage, but may suggest relationships that might be fruitful to explore or test.

Models of information behaviour, however, appear to be fewer than those devoted to information seeking behaviour or information searching. Figure 4.4 is a

variation on Wilson's model of 1981. The aim of this model was to outline the various areas covered by what the writer proposed as 'information seeking behaviour', as an alternative to the then common 'information needs', but it is clear that the scope of the diagram is much greater and that it attempts to cover most of what is included here as 'information behaviour'. The model suggests that information seeking behaviour arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services, which result in success or failure to find relevant information. If successful, the individual then makes use of the information found and may either fully or partially satisfy the perceived need or indeed, fail to satisfy the need and have to reiterate the search process.
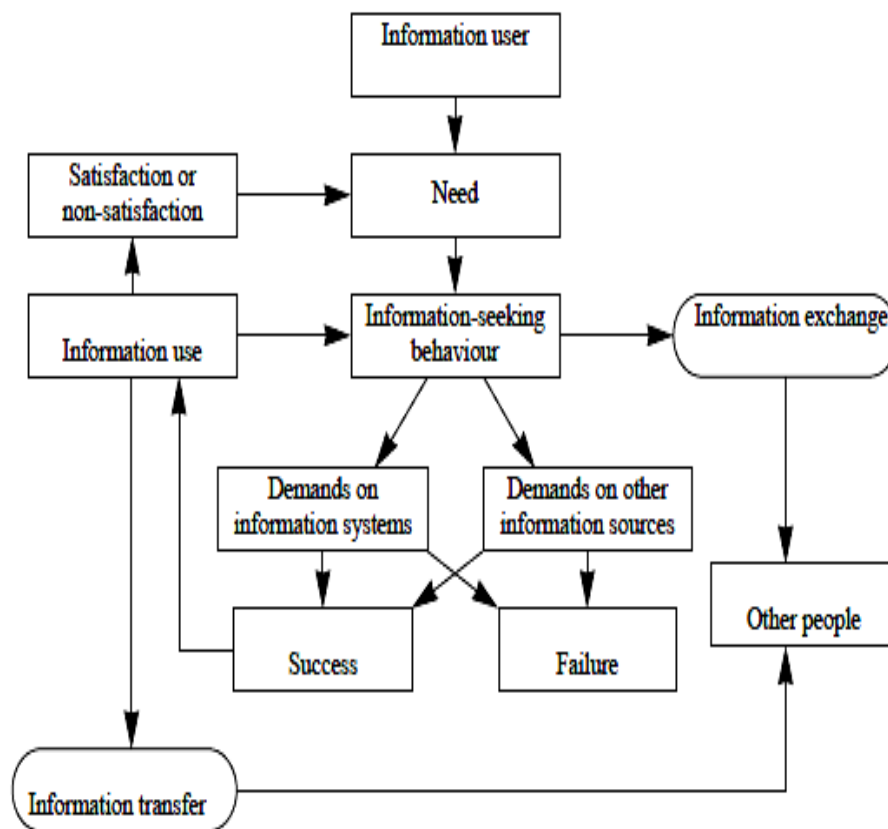

Figure: 4.4 *Wilson's model of information behaviour*

The model also shows that part of the information seeking behaviour may involve other people through information exchange and that information perceived as useful may

be passed to other people, as well as being used (or instead of being used) by the person himself or herself. One of the results of the analysis that led to the diagram was the recognition that information use had received little attention and, within information science, that statement is still relatively true today. Nor has much attention been devoted to the phenomenon of the informal transfer of information between individuals since Allen's pioneering work on transferring to the research laboratory the 'two-step' flow of communication model of the 'gatekeeper'. The identification of these areas is relatively lacking in research attention which demonstrates one of the functions of these models.

4.6.1.2 Godbold model

Godbold (2006) devised a model focussing on the "information behaviour wheel" (figure 4.5). This model was formulated by looking critically at models by various authors (Wilson, Dervin, Kuhlthau, and Ellis in particular) in order to create a model that incorporated ideas from these but extended the overall concept to include aspects of multi-directionality (akin to Foster's non-linearity). Godbold's idea here is that an individual encounters an information gap after experiencing one of three potential activating mechanisms: chance discovery, information monitoring, or information seeking.

The individual then tries to either close the gap, build a bridge, or doesn't bother closing the gap (or a combination of the three) and following this their knowledge structure changes. Godbold also suggests that the gap may appear larger or smaller, or that other gaps may appear within the information wheel whilst the individual is closing a different gap – resulting in looping and feedback mechanisms (Godbold, 2006).

This model takes its main concepts from Dervin and Wilson's various models to provide a generalised model. It includes elements of feedback and non-linearity, and chance discovery. It does not however explicitly include the concept of passive

information acquisition which by its very nature requires no effort on the part of the individual to undertake strategies to navigate a conceived 'gap' as no 'gap' necessarily exists. It could be envisaged that passive information acquisition bypasses the wheel still resulting in a changed knowledge state, but with no conscious attempt by the individual to close a gap.
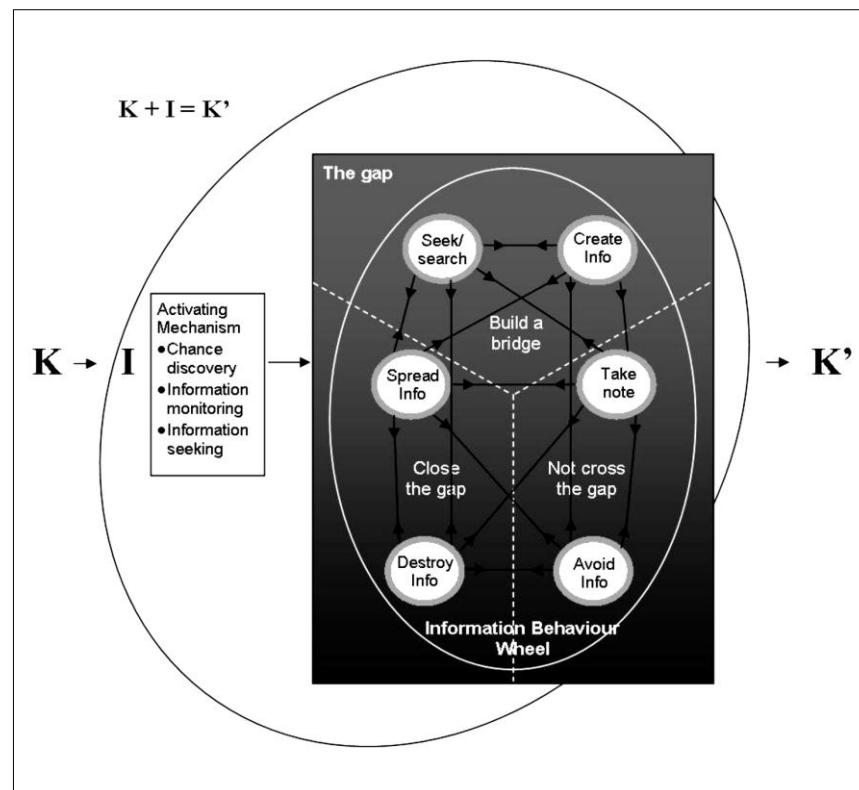

Figure 4.5: Godbold's (2006) model of IB

4.6.2 Model of Information Seeking Behaviour

4.6.2.1 Wilson's Model of 1981

Wilson's second model of 1981 (Figure: 4.6) is based upon two main propositions: first, that information need is not a primary need, but a secondary need that arises out of needs of a more basic kind; and second, that in the effort to discover information to satisfy a need, the enquirer is likely to meet with barriers of different kinds.

Wilson proposes that the basic needs can be defined as physiological, cognitive or affective. He goes on to note that the context of any one of these needs may be the person him or herself, or the role demands of the person's work or life, or the environments (political, economic, technological, etc.) within which that life or work takes place. He then suggests that the barriers that impede the search for information will arise out of the same set of contexts.

This model is shown in a simplified version which also shows the search behaviours defined by Ellis. Wilson's model is clearly what may be described as a macro-model or a model of the gross information seeking behaviour and it suggests how information needs arise and what may prevent (and, by implication, aid) the actual search for information. It also embodies, implicitly, a set of hypotheses about information behaviour that are testable. For example, the proposition that information needs in different work roles will be different, or that personal traits may inhibit or assist information seeking. Thus, the model can be regarded as a source of hypotheses, which is a general function of models of this kind.

The weakness of the model is that all of the hypotheses are only implicit and are not made explicit. Nor is there any indication of the processes whereby context has its effect upon the person, nor of the factors that result in the perception of barriers, nor of whether the various assumed barriers have similar or different effects upon the motivation of individuals to seek information. However, the very fact that the model is lacking in certain elements stimulates thinking about the kinds of elements that a more complete model ought to include.
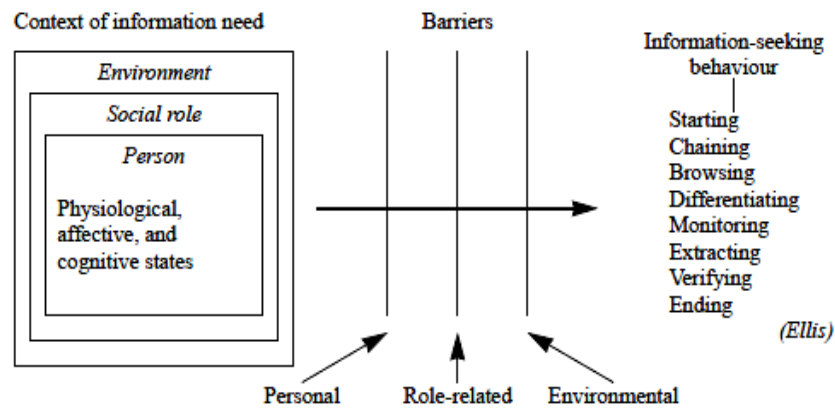
Figure: 4.6 Wilson's model of information seeking behaviour

It is a useful model in terms of the expansion of external and affecting factors, but again the idea of a conscious need impinges on its value as a general model of information behaviour.

4.6.2.2 Krikelas Model

One of very well-known information seeking behaviour model is that of Krikelas (1983), which is similar to Wilson postulated information seeking behaviour in the some context of external factors. According to Krikelas's model there are two types of "information acquisition"; information gathering, and information giving. For Krikelas information gathering concerns activities that result in information being acquired and stored for future use resulting from a "deferred need". Information giving, however, is the "act of disseminating messages" (Krikelas, 1983, p. 13). Krikelas also stated that "……. activities associated with satisfying immediate needs are information-seeking behaviour" (Krikelas, 1983, p. 8). Thus the model shows two aspects of information behaviour in terms of needs requirement: deferred and immediate. Krikelas also suggested that satisfying deferred needs could be both structured (keeping up to date with literature), and casual; but in either case it is still purposeful – a need must exist. Krikelas's model does not account for a poor search outcome and there is no feedback or

looping in the process. The model also does not include any influencing element of environmental or personal factors that Wilson raised in his second model (Wilson, 1981). Although the intervening three decades has seen an increase in the ease of access to electronic resources, Krikelas's view that individuals find information from the most convenient place first (e.g.: people) still applies today (Julien & Michels, 2000; Lathey & Hodge, 2001; Stokes & Lewin, 2004; Haines et al., 2010; Stokes, 2013).

4.6.2.3 Dervin's Sense-Making Theory

Dervin's Sense-Making theory has developed over a number of years, and cannot be seen simply as a *model* of information seeking behaviour. It is, rather, as she says, "… a set of assumptions, a theoretic perspective, a methodological approach, a set of research methods, and a practice". Dervin's Sense-Making theory designed as a triangular form to cope with information perceived as, "… a human tool designed for making sense of a reality assumed to be both chaotic and orderly" which is shown in Figure 4.7. However, Sense-Making is implemented in terms of four constituent elements: a *situation* in time and space, which defines the context in which information problems arise; a *gap*, which identifies the difference between the contextual situation and the desired situation (e.g. uncertainty); an *outcome*, that is, the consequences of the Sense-Making process, and a *bridge*, that is, some means of closing the gap between situation and outcome. Dervin presents these elements in terms of a triangle: situation, gap/bridge, and outcome, which can be represented as in Figure 4.7. However, it may be preferable to use the bridge metaphor more directly and present the model as Figure 4.8.
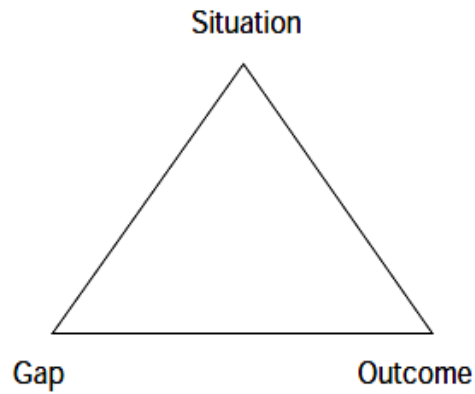
Situation

Gap   Outcome

Figure: 4.7 *Dervin's Sense-Making framework*

Bridge

time/space

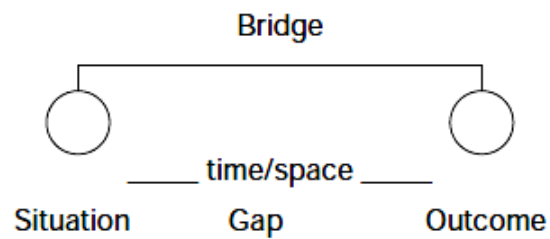Situation   Gap   Outcome

Figure: 4.8 Dervin's *Sense-Making framework modified*

The strength of Dervin's model lies partly in its methodological consequences, since, in relation to information behaviour, it can lead to a way of questioning that can reveal the nature of a problematic situation, the extent to which information serves to bridge the gap of uncertainty, confusion, or whatever, and the nature of the outcomes from the use of information. Applied consistently in 'micro-moment, time-line interviews' such questioning leads to genuine insights that can influence information service design and delivery.

Sense-Making theory does not claim to be an information behaviour model and to deride its lacking in aspects such as serendipity and passive information acquisition, and its over emphasis on the 'individual', would be a disservice (Stokes, 2013).

4.6.2.4 Ellis, 1989 and Ellis, Cox and Hall, 1993 Model

Ellis's elaboration of the different behaviours involved in information seeking is not set out as a diagrammatic model and Ellis makes no claims to the effect that the different behaviours constitute a single set of stages; indeed, he uses the term 'features' rather than 'stages'. These features are named and defined below:

a) **Starting:** the means employed by the user to begin seeking information, for example, asking some knowledgeable colleague;

b) **Chaining:** following footnotes and citations in known material or 'forward' chaining from known items through citation indexes;

c) **Browsing:** 'semi-directed or semi-structured searching;

d) **Differentiating:** using known differences in information sources as a way of filtering the amount of information obtained;

e) **Monitoring:** keeping up-to-date or current awareness searching;

f) **Extracting:** selectively identifying relevant material in an information source;

g) **Verifying:** checking the accuracy of information and

h) **Ending:** this may be defined as 'tying up loose ends' through a final search.

The strength of Ellis's model, as with Kuhlthau's is that it is based on empirical research and has been tested in subsequent studies, most recently in the context of an engineering company. Of the features, Ellis notes that, "the detailed interrelation or interaction of the features in any individual information seeking pattern will depend on the unique circumstances of the information seeking activities of the person concerned at that particular point in time".

However, it is clear that 'starting' must initiate a process and that 'ending' must end it. It also seems reasonable to suggest that 'verifying' is a penultimate stage in a

process and that 'extracting' must follow on from a specific search behaviour such as 'browsing'. Indeed, drawing attention to this fact leads to the conclusion that 'extracting' is not an information behaviour of the same kind as 'browsing', or 'chaining' or 'monitoring', and further suggests that 'differentiating' is also a different kind of behaviour: browsing, chaining and monitoring are search procedures, whereas differentiating is a filtering process and extracting may be seen as an action performed on the information sources.

Browsing

Starting —— Chaining —— Differentiating —— Extracting —— Verifying ➤ Ending

Monitoring
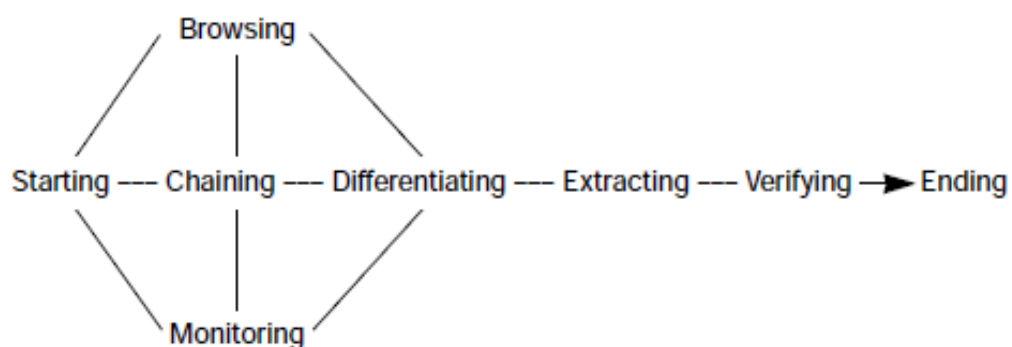
Figure: 4.9 A stage process version of Ellis's behavioural framework

The remaining behaviours do not necessarily take place in a specific sequence and may be initiated in different sequences at different times in the overall search process. Ellis's account, therefore, in terms of the different kinds of features it embodies, appears to sit between the micro-analysis of search behaviour (starting, chaining, extracting, verifying, ending) and a more macro-analysis of information behaviour generally (browsing, monitoring, differentiating).

If these points are accepted, it is then possible to suggest a diagrammatic presentation of the model, as in Figure 4.9. Thus, the models of Wilson and of Ellis are intended to function at different levels of the overall process of information seeking and this fact is demonstrated by the ability to nest one within the other.

4.6.2.5 Kuhlthau, 1991 Model

Kuhlthau's work complements that of Ellis by attaching to stages of the 'information search process' the associated feelings, thoughts and actions, and the appropriate information tasks. This association of feelings, thoughts and actions clearly identifies Kuhlthau's perspective as phenomenological, rather than cognitive. The stages of Kuhlthau's model are: Initiation, Selection, Exploration, Formulation, Collection and Presentation. As an example, the Initiation phase of the process is said to be characterized by feelings of uncertainty, vague and general thoughts about the problem area, and is associated with seeking background information: the 'appropriate task' at this point is simply to 'recognise' a need for information.
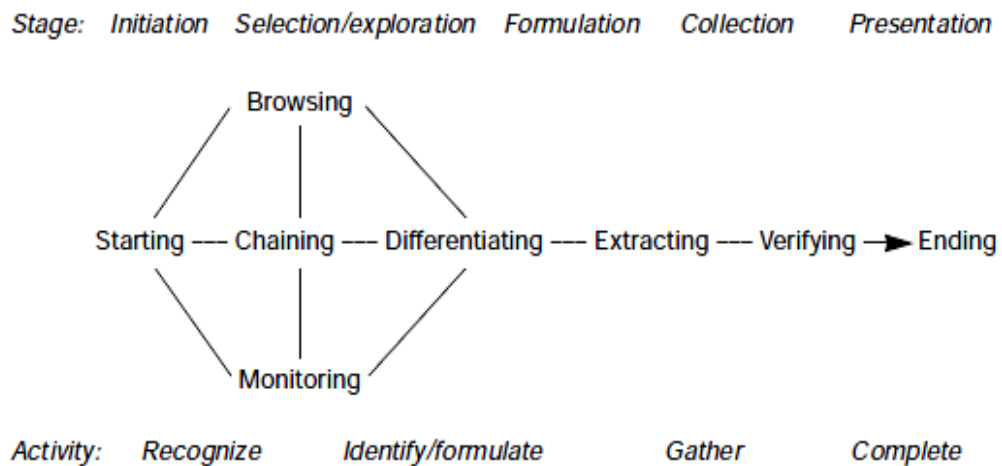

Figure: 4.10: A comparison of previous Figure 4.7
with Kuhlthau's stage process model

The remaining appropriate tasks are: Identify, that is, fix the general topic of the search. Investigate, or search for information on that general topic; Formulate, focus on a more specific area with in the topic; Collection, that is, gather relevant information on the focus; and Complete, end the information search. Kuhlthau's model is thus more general than that of Ellis in drawing attention to the feelings associated with the various stages and activities. In this regard, Kuhlthau acknowledges her debt to Kelly's 'personal

construct theory' which describes the affective experience of individuals involved in the process of constructing meaning from the information they encounter. The fundamental proposition is that the feelings of uncertainty associated with the need to search for information give rise to feelings of doubt, confusion and frustration and that, as the search process proceeds and is increasingly successful, those feelings change: as relevant material is collected confidence increases and is associated with feelings of relief, satisfaction and a sense of direction.

In effect, what Kuhlthau postulates here (and confirms by empirical research) is a process of the gradual refinement of the problem area, with information searching of one kind or another going on while that refinement takes place. Thus, a successive search process is implicit in Kuhlthau's analysis of the search activity. Although Kuhlthau's early work was a series of longitudinal studies of high school students, more recently she has shown the applicability of the model to the work of a securities analyst, It is interesting to explore whether the Ellis and Kuhlthau models may be brought together, and this is attempted in Figure 4.10, where my representation of Ellis's categories is accompanied by the stages of Kuhlthau (the latter in italic).

Through this merger of the two models, we can see strong similarities and the major difference appears to be that Ellis specifies the modes of exploration or investigation. The point must be reiterated, however, that Ellis does not present his characteristics as stages but as elements of behaviour that may occur in different sequences with different persons or with the same person at different times. Thus, the two models are fundamentally opposed in the minds of the authors: Kuhlthau posits stages on the basis of her analysis of behaviour, while Ellis suggests that the sequences of behavioural characteristics may vary.

4.6.2.6 Wilson, 1996 Model

Wilson's 1996 model (Figure 4.11) is a major revision of that of 1981, drawing upon research from a variety of fields other than information science, including decision making, psychology, innovation, health communication and consumer research.
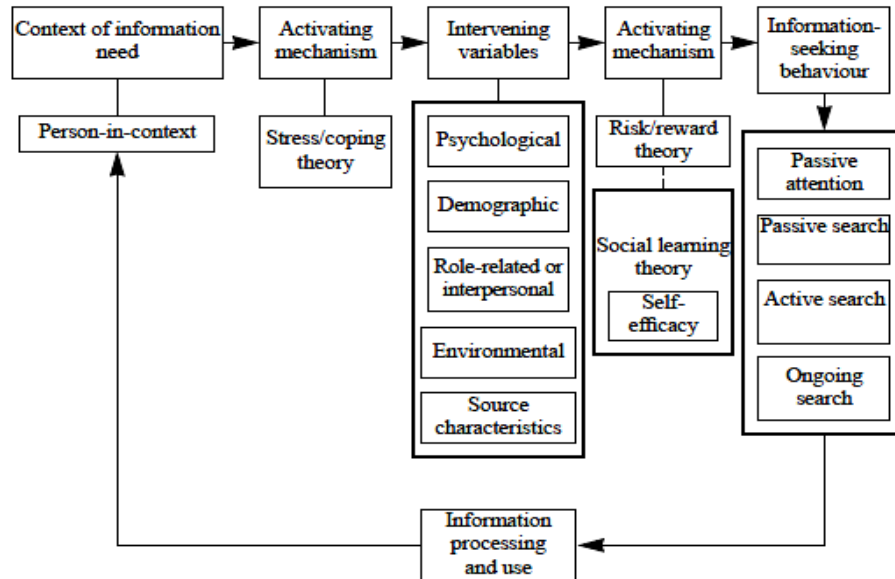

Figure: 4.11: Wilson's 1996 model of information behaviour

The basic framework of the 1981 model persists, in that the person in context remains the focus of information needs, the barriers are represented by 'intervening variables' and 'information seeking behaviour' is identified. However, there are also changes: the use of the term 'intervening variables' serves to suggest that their impact may be supportive of information use as well as preventive; information seeking behaviour is shown to consist of more types than previously, where the 'active search' was the focus of attention; 'information processing and use' is shown to be a necessary part of the feedback loop, if information needs are theory, which offers possibilities for explaining why some needs do not invoke information seeking behaviour; risk/reward theory, which may help to explain which sources of information may be used more than others by a given individual; and social learning theory, which embodies the concept of

'self-efficacy', the idea of 'the conviction that one can successfully execute the behaviour required to produce the [desired] outcomes'.

Thus, the model remains one of macro-behaviour, but its expansion and the inclusion of other theoretical models of behaviour make it a richer source of hypotheses and further research than Wilson's earlier model. It is fairly obvious that the models of both Ellis and Kuhlthau relate to the *active search* mode of information seeking behaviour and provide, in effect, an expansion of that box in the diagram above. Dervin's model is completely different in character, since its aim is to provide a framework for exploring the totality of information behaviour from the exploration of the context in which information needs arise to the means whereby that need is satisfied, whether through active searching or otherwise. In effect, it is a model of a methodology, rather than a model of a set of activities or a situation.

4.6.2.7 Task based models

The success of information seeking behaviour process depends on the complexity of the tasks involved in locating the desired information and that more sources are consulted when the information required is more complex (Bystrom, 2002; Bystrom & Hansen, 2005; Bystrom & Jarvelin,1995). Bystrom and Jarvelin's model (figure 4.12) was developed following research on civil servants and has since been empirically tested and validated (Bystrom, 2002, Bell and Ruthven, 2004). This shift in focus from 'problems' to 'tasks' and the perceived difficulty of the tasks for the individual seeking the information impacts on the success of the search process (Case, 2007). The model is again directional in that it is a step-by-step process that relies on each step being completed before moving onto the next, but it encompasses feedback within its structure. This feedback mechanism is reliant on the evaluation of the search (whether;

"completed", "it's impossible", or "need more") and the individual's personal seeking style (Case, 2007). One individual might feel they haven't enough information and carry on searching, whereas someone else with the same (or less) information may feel they have completed the task.
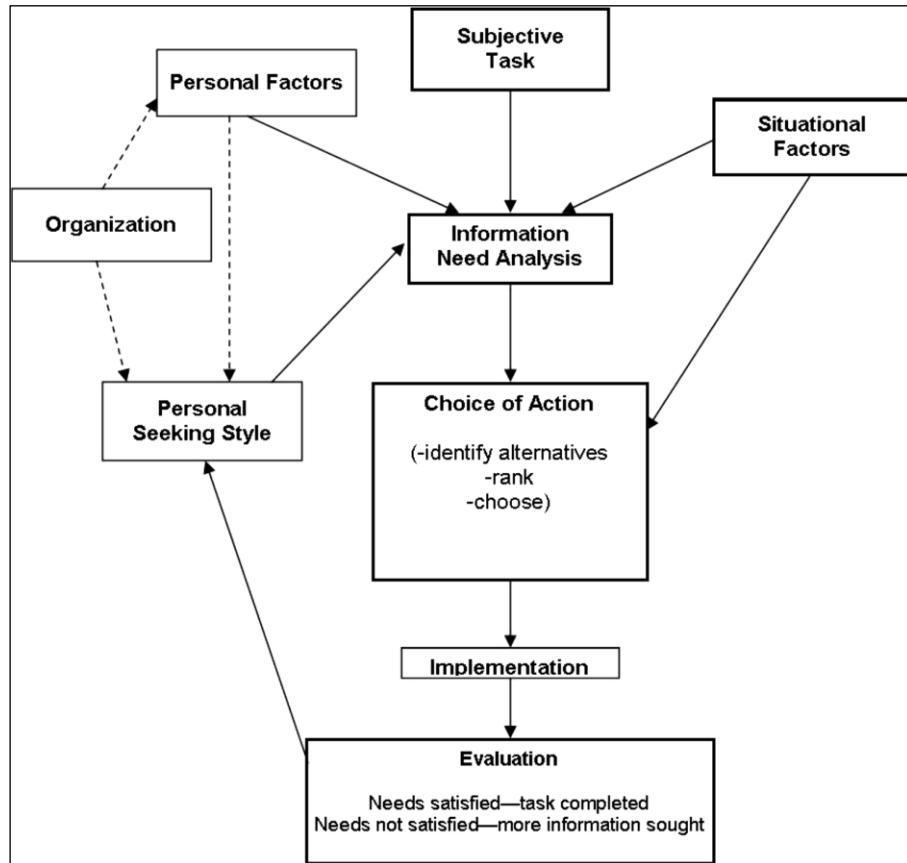

Figure: 4.12: Bystrom and Jarvelin's (1995) task-based ISkB model

A second task-based model derived from an existing research base is that of Leckie, Pettigrew and Sylvain (1996). Three distinct professional groups (engineers, health care professionals, and lawyers) were used to develop the model; however the model is intended to be generalisable across all professions. This model focuses on six distinct aspects: work roles, tasks, information needs, awareness, sources, and outcomes. In this model work roles influence tasks which in conjunction with information needs, then determine the way information is sought. Once again this is a directional model with a definitive starting point. Feedback is incorporated into the model depending on the

outcomes of the search process and this is dependent on both the sources of information and the awareness of the individual that information exists.

4.6.2.8 Foster model 2004

The emergent concepts were grouped into three core categories: Opening, Orientation, and Consolidation, around which detail relating to their definition, function and context continued to be developed through further analysis. The new model of interdisciplinary information seeking is represented in terms of three core processes and three levels of contextual interaction in Figure 4.13. The following sections provide an overview beginning the core processes of opening, Orientation, and Consolidation at the center of the Figure 4.10, and moving on to discuss their interface with the three outer contextual interactions of the model.
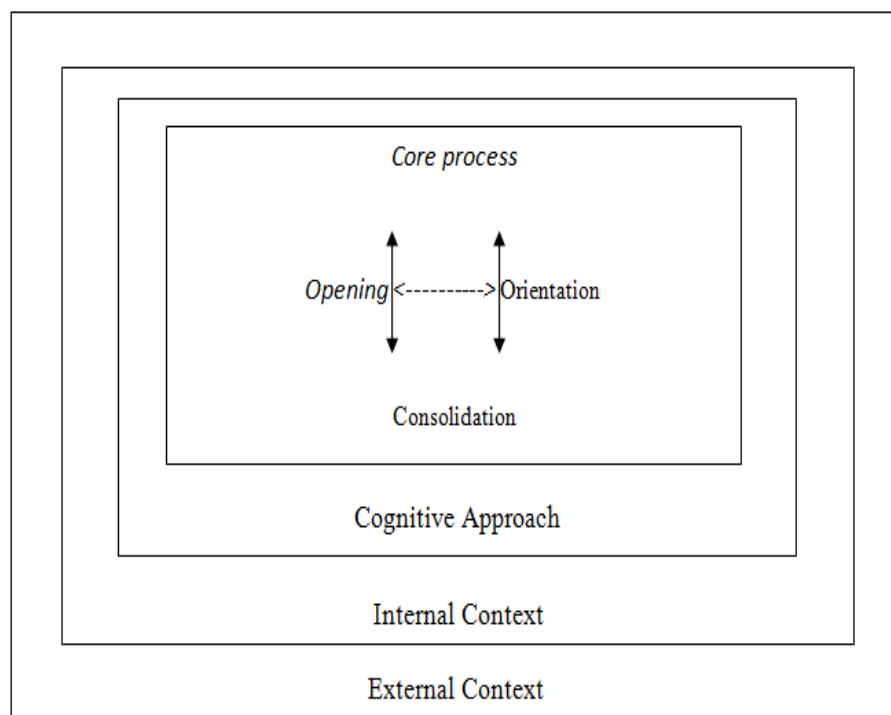

Figure: 4.13: Non-linear model of information seeking behaviour

Opening was not as might logically be thought a starting point (Ellis 1989; Kuhlthau, 1993). Opening was identified as corresponding to the process of moving from

a state of orientation to actually seeking, exploring and revealing information. Interviewees suggested during the member checking process that the term *opening* best described how they opened lip their topics through information seeking activities. Opening is a non-linear component representing a collection of activities. Each of the activities interacted and informed both further opening activities and the other core processes. Two activities, Breadth Exploration and Eclecticism, were identified as complex in that they involved combinations of other activities to form a larger process, though these worked alongside other activities. The key element was the combination and recombination of possibilities to achieve information. Breadth Exploration was identified as a conscious expansion of searching to allow exploration of every possibility. This included deliberate expansion of information horizons to bring within range different information types, sources, concepts, and disciplines.

Interviewees described it as a 'kind of splitter gun approach' which was associated particularly with starting wider so that narrowing could produce results implications of this activity of the orientation process were identified as choice of keywords, selection of sources, and the initiation of combinations of other core processes. Eclecticism encompassed accepting, gathering and storing information from a diverse range of both passive and active sources. Eclecticism influenced information seeking as a determination to obtain information from as many channels as possible and to absorb as many pieces of information as possible to reveal new concepts and ideas. Eclecticism provides a conceptual approach to finding information which combines active passive and serendipitous information acquisition.

Serendipity, identified as a method for achieving breadth and identifying unknown results, was found to be closely associated with Browsing, Eclecticism, and Networking. Serendipity and activities that encouraged the occurrence of serendipitous

results were frequently mentioned as a valued part of information seeking, as illustrated in more depth in Foster and Ford.

4.7 Human Information Behaviour (HIB) Model

4.7.1 Sonnenwald and Iivonen's Model

Sonnenwald and Iivonen's (1999) model was perhaps the first clear attempt to produce a comprehensive Human Information Behaviour (HIB) model (figure 4.14).
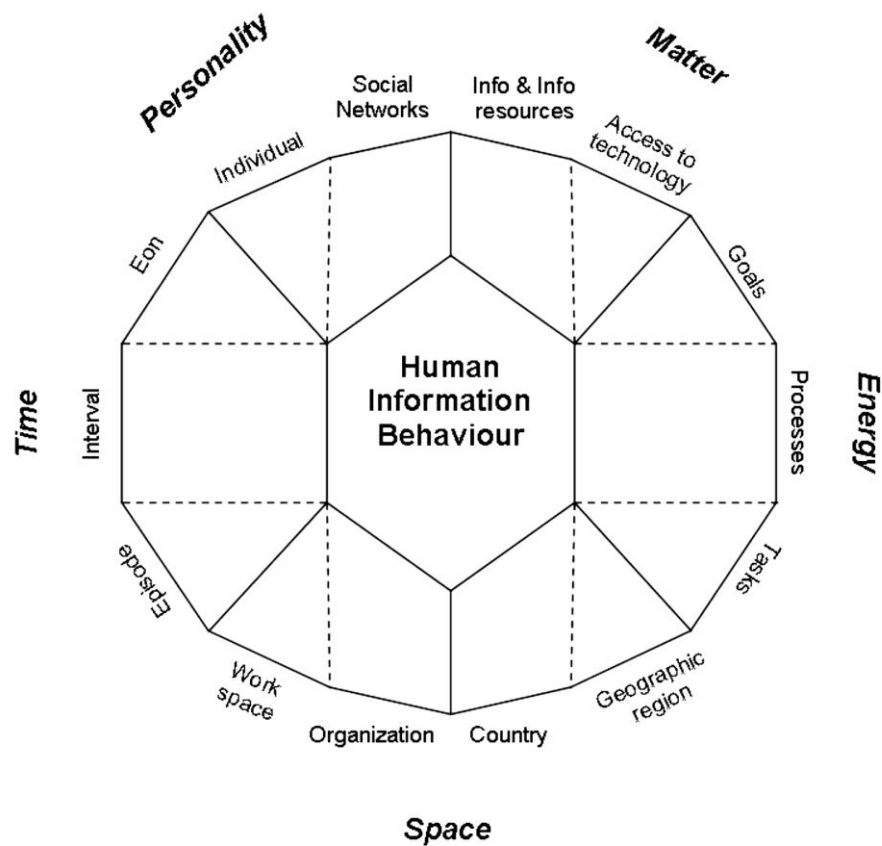

Figure: 4.14: Sonnenwald and Iivonen's (1999) model

This model was derived from a meta-analysis of previous studies of information behaviour and includes five general facets in line with Ranganathan (1957, cited in Sonnenwald and Iivonen 1999 pp. 434-436): personality (who is doing the searching), matter (sources, technology), energy (the action taken), space (tasks, organisational), and

time (constraint for the search). It contains fourteen separate categories within these five facets including: different lengths of time, goals, and social networks.

This model benefits from the inclusion of external factors, but conversely to the other models does not include elements of the search process. It is also limited by the vagueness of any interactions between elements and that it cannot be assumed that the same features would be repeated always and everywhere (Sonnenwald & Iivonen, 1999 p. 451). It is not clear whether any elements are sequential although clearly there is not a step-by-step process within the model.

4.7. 2 Niedzwiedzka's model

Niedzwiedzka's model still incorporates the cyclical nature of information seeking behaviour and includes activating mechanisms at various stages within the cycle. These mechanisms, however, now affect more stages and particularly those relating to information acquisition. The intervening variables now affect the whole process not just individual aspects of the cycle and thus they can influence the process at all stages.

There are now two strategies open to the individual seeking information: personally, or using intermediaries. Information seeking behaviour can include only one of these strategies (fully independent), both strategies (partially dependent), or only intermediaries (fully dependent).

This model (acknowledged by Niedzwiedzka) is still incomplete in that information seeking behaviour does not necessarily follow a cycle (non-linearity), and that certain aspects of information behaviour are not included (incidental information acquisition and information encountering). In view of this the model necessarily is limited to information seeking behaviour rather than information behaviour in general.
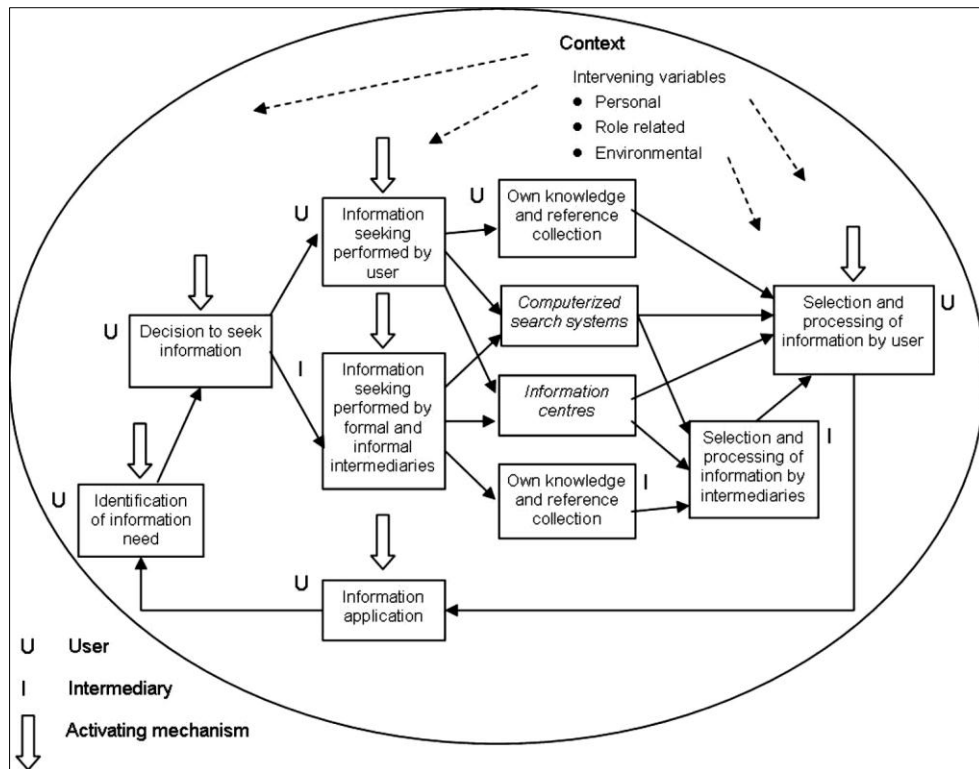
Figure: 4.15: Niedzwiedzka's (2003) model

4.7.3 Spink and Cole's Model

Spink and Cole's (2006a) unified human information behaviour theory is a comprehensive model that unifies four information seeking approaches: problem solving, sense-making, everyday life information seeking (ELIS) leading to a 'mastery of life', and information foraging (Pirolli and Card, 1999), integrating these approaches and principles of evolutionary psychology into a perspective on the 'total human information condition' (Spink and Cole, 2004a) (figure 4.16).

This model has been shown and discussed in various guises (Spink and Cole, 2004a, Spink and Cole, 2006a, Spink et al., 2006, Spink and Cole, 2006b, Spink and Currier, 2006) and is still evolving. The depiction here is a remodelled representation of these entities.
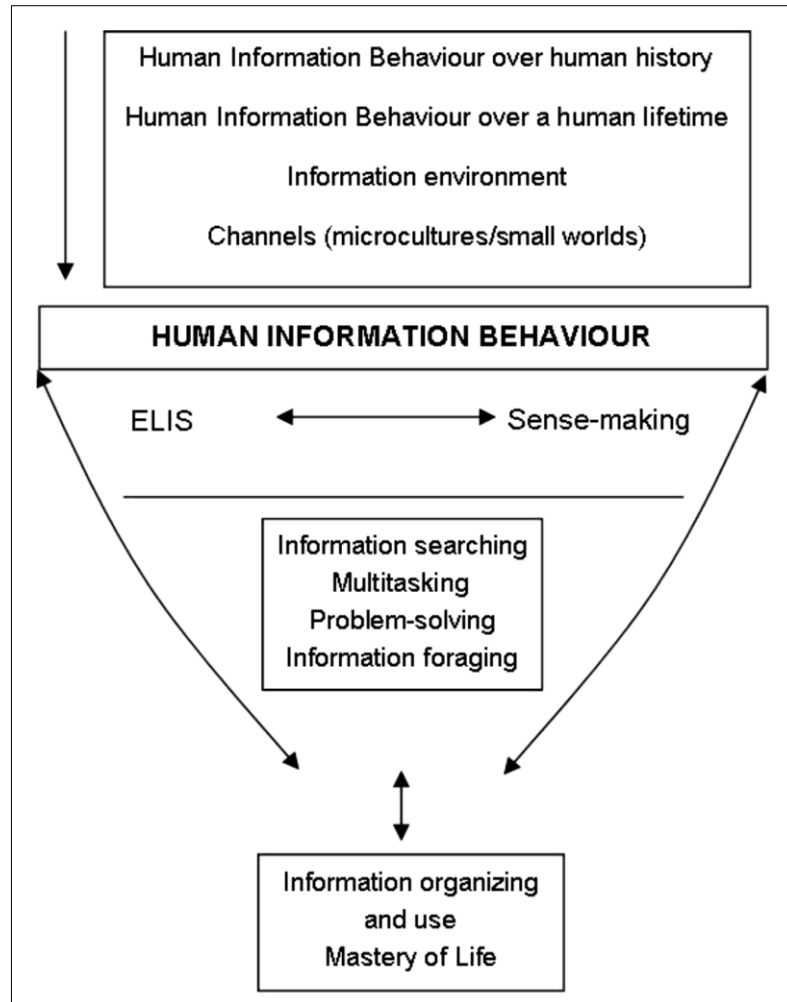
Figure: 4.16: Spink and Cole's integrated HIB model.

The inclusion of ELIS and sense-making theories within the model increases the level of completeness within the context of human information behaviour as these concepts include aspects of non-purposive information seeking (serendipity, browsing). Once again, however, a lack of provision for passive information acquisition is a limitation, the inclusion of which even non-overtly would enhance the model. A variation on this model (Spink and Heinstrom, 2011) depicts six levels and a range of dimensions within each.

4.7.4 Model of human multiple information task behavior

Park (2013) study on human multiple information task behavior; shows that how people interact with multiple information tasks. The model in Figure 4.17 shows the processes individuals engage in to manage multiple information tasks in terms of how multiple information tasks are carried out in dynamic and complex information situations under time pressure. It indicates that, at an internal level, self-regulating individuals engage in information task perceptions and then, emotional, mental, and temporal reactions, which are followed by emotion control, effort application, and time management by individuals' central executive mechanisms. Once the initial processes are operated at the internal level, a signal is sent out to the external level to prioritize and coordinate multiple information tasks. The model further suggests that individuals monitor and coordinate their internal (i.e. emotion, effort, and time) and external (i.e. performance) activities through continuous self-feedback. Coordinating activities entail task switching, tabbed browsing, strategic search planning, and information evaluation, which are all closely related to time management.

Based on the empirical evidence of this study, it may be reasonable to claim that effort, time, or perception may all be necessary factors in producing good performance in dynamic and complex information environments. But how we control our emotions and feelings ultimately yields successful performance or learning. High mental effort, even when accompanied by productive time management, is not sufficient to produce high performance unless we effectively deal with our emotions and feelings in such situations. Models of human multiple information task interaction can be employed for designing adaptive user interfaces, which monitor and analyze user behavior in order to anticipate user needs (Budzik & Hammond, 2000; Maglio et al., 2000).
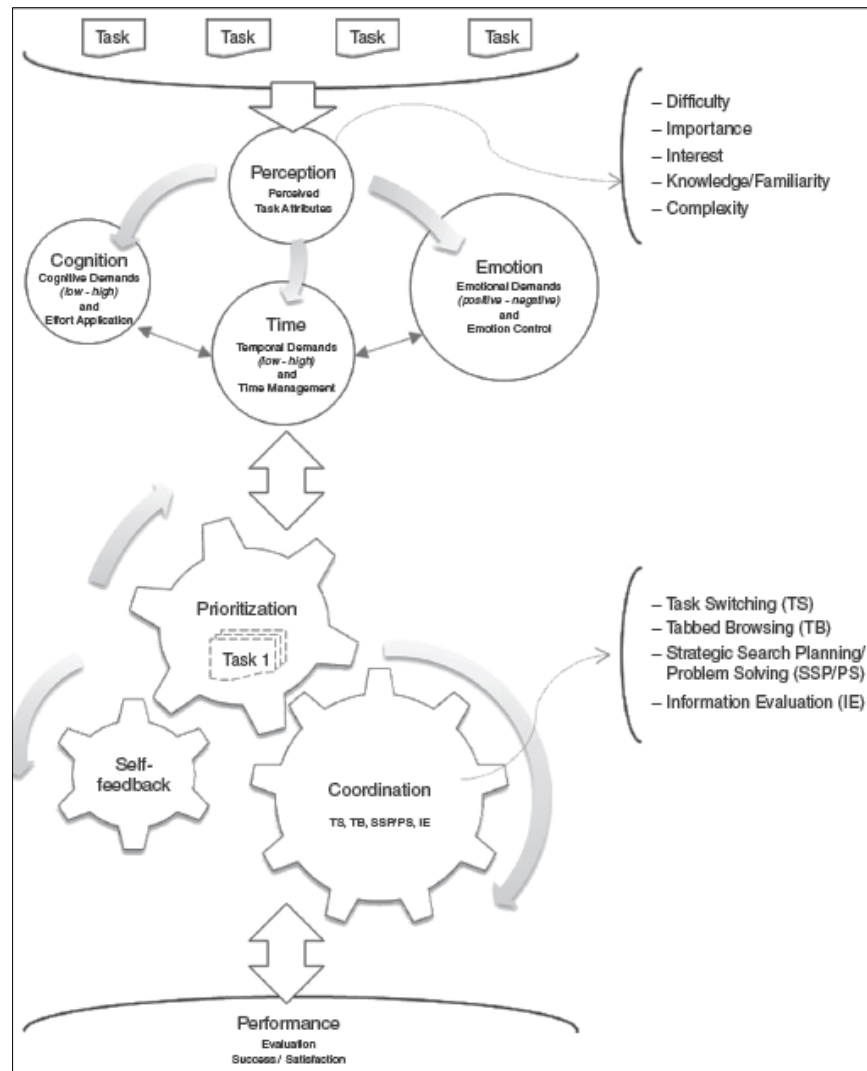
Figure: 4.17: Model of human multiple information task behavior

4.8. Information Searching Models

4.8.1 Ingwersen's Model

Ingwersen's model is shown in Figure 4.18. When we examine this model, we can see its close family resemblance to other models of information seeking behaviour. In particular, the elements 'user's cognitive space' and 'social/organisational environment' resemble the 'person in context' and 'environmental factors' specified in Wilson's models and the general orientation towards queries posed to an IR system point

to a concern with the 'active search', which is the concern of most information seeking models.
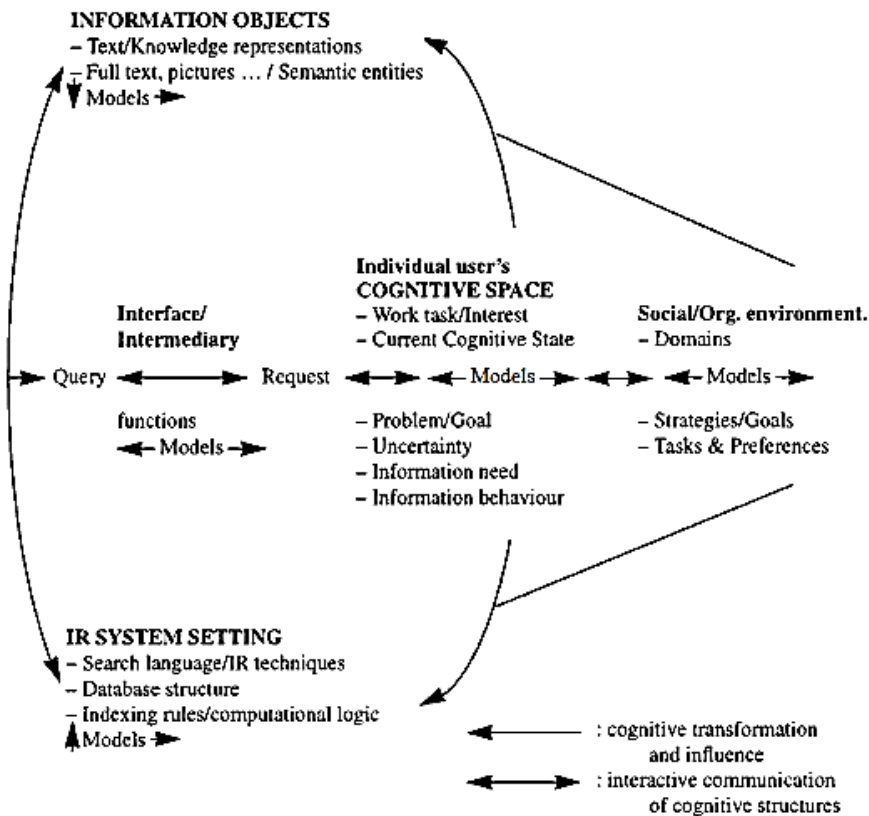

Figure: 4.18: Ingwersen's model of the IR process

Ingwersen, however, makes explicit a number of other elements: first, he demonstrates that within each area of his model the functions of the information user, the document author, the intermediary, the interface and the IR system are the result of explicit or implicit cognitive models of the domain of interest at that particular point. Thus, users have models of their work-tasks or their information needs, or their problems or goals, which are usually implicit, but often capable of explication.

Again, the IR system is an explication of the system designer's cognitive model of what the system should do and how it should function. Secondly, Ingwersen brings the IR system into the picture, suggesting that a comprehensive model of information seeking behaviour must include the system that points to the information objects that

may be of interest to the enquirer. Thirdly, he shows that various cognitive transformations take place in moving from the life-world in which the user experiences a problem or identifies a goal to a situation in which a store of pointers to information objects can be satisfactorily searched and useful objects identified. Finally he points to the need for these models or cognitive structures and their transformations to be effectively communicated throughout the 'system', which will include the user, the author and the IR system designer.

Thus, Ingwersen's model, to a degree, integrates ideas relating to information behaviour and information needs with issues of IR system design, and this, together with the focus on cognitive structures and the idea of polyrepresentation, is an important strength of the model. Saracevic suggests that: "The weakness is in that it does not provide for testability … and even less for application to evaluation of IR systems".

4.8.2 Saracevic's Model

Saracevic's own model (Figure 4.19) is described as a 'stratified interaction model' and posits a three level structure: surface, cognitive, and situational. Again, this model shows a strong resemblance to that of Ingwersen. At the surface level, a user interacts with a system through an interface by issuing commands or queries that represent, in some way, a problem statement. At the same level, the system responds either with meta-information, or texts (including images, etc.) or with queries of its own designed to elicit from the user further information on the nature of the problem.

At the cognitive level, the user interacts with the output of the system, or with texts obtained subsequent to system interaction, in ways that enable the user to assess the utility of the text in relation to the initial problem. At the situational level, "…users interact with the given situation or problem-at-hand which produced the information

need and resulting question. The results of the search may be applied to the resolution or partial resolution of the problem".
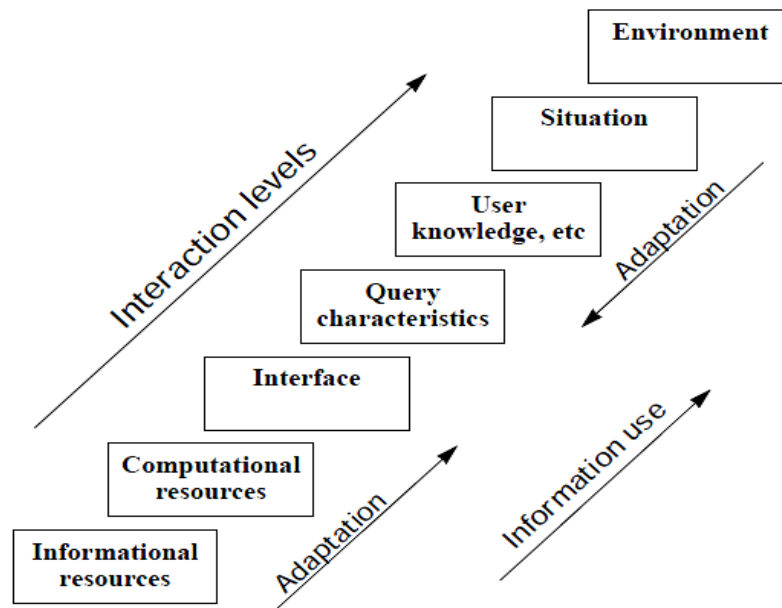

Figure: 4.19: Saracevic's model of the IR process

4.8.3 Spink's Model

Spink proposes a model of the search process, derived from empirical research, which identifies user judgments, search tactics or moves, interactive feedback loops, and cycles as constituting the search process of a person in interaction with an IR system. Spink describes the model as follows: "Each search strategy may consist of one or more cycles [one or more search commands ending in the display of retrieved items …. Each cycle may consist of one or more interactive feedback occurrences (user input, IR system output, user interpretation and judgment, user input). An input may also represent a move within the search strategy … and may be regarded as a search tactic to further the search …. Each move consists of a user input or query requesting a system's output". The model is shown, in simplified form, in Figure 4.20.
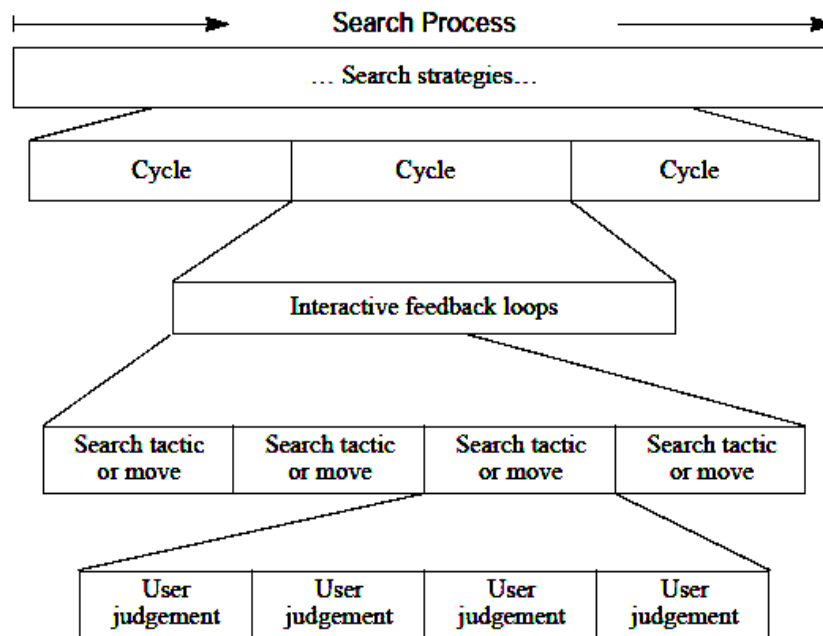
Figure: 4.20: Spink's model of the IR interaction process

The value of this view of IR interaction is that it is based directly on empirical research and that the appearance of user judgments, search tactics and interactive feedback loops links IR interaction directly with information seeking behaviour in general.

4.8.4 A Nested Model

Information seeking is one such behaviour and implies an active search for information and other information behaviours include, for example, the passive reception of information as when a person watches television advertisements. Information searching is defined as that mode of information seeking that involves interaction with computer based information retrieval systems. Thus, a *nested model,* (Figure 4.21) which connects of three concepts: Information behaviour, Information seeking behaviour and Information searching behaviour.
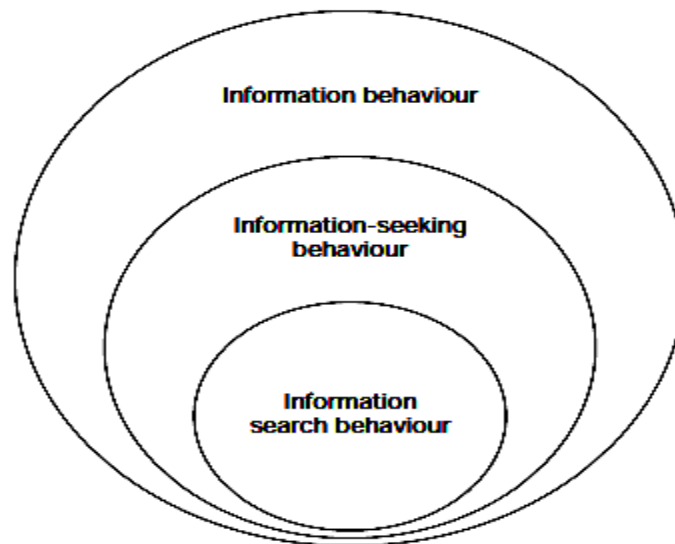
Figure: 4.21 A nested model of the information seeking and searching research areas

It might also extend the nested model further by showing that information behaviour is a part of human communication behaviour which gives the amount of information related research in various aspects of communication studies, such as that on consumer behaviour, it may be particularly useful to remember this in certain contexts. Information seeking behaviour has been studied from a variety of perspectives but most often in relation to different groups of people, either differentiated by discipline or by work role of the life problems of the ordinary citizen.

4.8.5 The Problem-Solving Model as a Theoretical Perspective

The theoretical perspective adopted is that of information seeking and searching as related to problem solving. A stage process is postulated, in which the individual proceeds from the identification of the problem for investigation through the definition of the problem, to its resolution and the representation of the solution. At each stage it is suggested that some uncertainty which originally drove the search for information, is resolved. The failure to find a useful definition of the problem may result in a return to the problem identification stage, for further consideration of the problematic situation if

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the uncertainty-resolution loop fails. However, the search for information may not fully resolved uncertainty and, therefore, successive searches within the same stage may be necessary, or the search may increase uncertainty and the individual may have to return to an earlier stage to resolve that uncertainty.
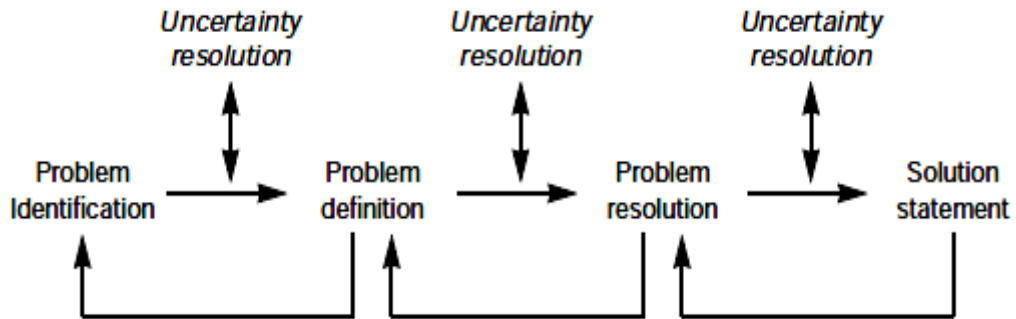

Figure: 4.22 A problem solving model of the information seeking and searching process

4.8.6 Linking Information Seeking and Communication

The focus of studies in information behaviour is on the information seeker of known or unknown communications, while, although the communication recipient is considered in research in communication studies, there is also a strong focus upon the communicator and the channels of communication. So, while attention is drawn to the connection here, a general relationship between communication and information seeking behaviour is shown in Figure 4.23.

It also suggests that the areas in Figure 4.23 interact with the field of human-computer interaction, as indeed they must and, because human-computer interaction is concerned with all aspects of human and computer interaction, including computer based information retrieval, we can perceive it as a related field that intersects with communication behaviour and its sub-fields.
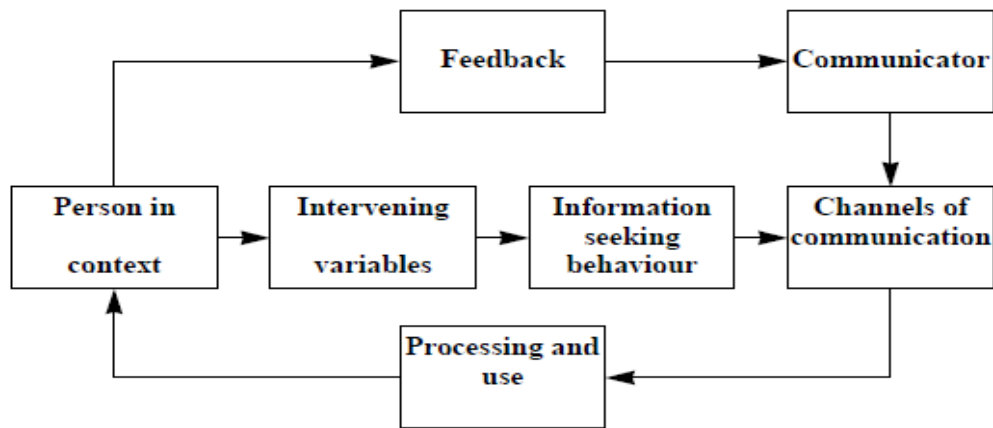
Figure: 4.23: Linking information seeking and communication

4.9 Conclusion

Human information behaviour is now a well-defined area of research within information science, and research is beginning to show the benefits of accumulated knowledge. New topics emerged day by day, such as collaborative information seeking, the role of information seeking behaviour in teams, and information seeking and the World Wide Web. The range of contexts within which information behaviour is now studied shows that the field has expanded well beyond a concern for the literature and information service needs of scientists. The various models of information behaviour, information seeking behaviour and information searching represent different aspects of the overall problem, but almost all they are complementary, rather than competing. But the findings of this model of information search behaviour suggested above may provide a sound basis for the development of research ideas.