Investigating the Evaluation and Selection of Knowledge Management Tools

A Thesis Submitted for the Degree of Doctor of Philosophy

Nayna Patel

Department of Information Systems and Computing

Brunel University

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Abstract

Knowledge management is becoming increasingly fashionable because organisations perceive they are no longer working in a predictable and incremental environment. The number of knowledge management tools available on the software market is numerous, making the selection of a suitable tool not as simple as may originally be perceived. This dissertation investigates possible ways of assisting the evaluation and selection process of a commercial knowledge management tool so that an organisation may purchase a tool that is suitably close to their business requirements. In order to achieve this, various levels of empirical investigation is carried out on 44 knowledge management tools by the researcher. Furthermore, four case studies are undertaken to support and enhance the findings from empirical investigation. The case studies consist of a research group, a computer centre based within a university, a content management consultancy, and an IT consulting and software services company. The outcome of the research is a framework to facilitate the evaluation of commercial knowledge management tools. In addition, a frame of reference that describes the issues and factors that can be taken into consideration during the selection of a commercial knowledge management tool is proposed. A taxonomy for the classification of knowledge management tools is presented along with proposals for further development of knowledge management tools.

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Declaration

The following papers have been published, accepted for publication or submitted, as a direct or indirect result of the research discussed in this dissertation:

Journal Papers:

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Patel, N and V. Hlupic (2001) Dynamic Business Process Modelling (BPM) for Business Process Change. *International Journal of Simulation: Systems, Science and Technology*. Vol. 2, No. 2, pp. 51-64.

Conference Papers:

Hlupic, V., N. Patel, and J. Choudrie (1999) The REBUS Approach to Business Process Re-engineering. *Proceedings of Information Technology Interfaces*, ITI '99, June 1999, Pula, Croatia (Ed. by Kalpic D. and Dobric V.), pp. 475-481, University Computing Centre, 1999.

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Chapter 1.

Introduction

1.1 Introduction

It is claimed that the interest in knowledge management from both industry and academia is increasing at a rapid rate (Alvesson and Kärreman, 2001). Furthermore, this interest appears to stem from two different stances. Some view knowledge management as a new revolutionary management approach that must be embraced in order for an organisation to maintain a competitive advantage whilst others are of the opinion that knowledge management is simply a fad that will pass without having a lasting impact. Advocates of knowledge management invest their efforts dissecting, analysing, and developing the area. On the other hand, people who oppose knowledge management attempt to prove that it is simply an existing management approach that has been newly re-labelled with the latest buzzword. Regardless of the stance that is adopted it is claimed that further research is required, and intended, for the future (Wiig, 1999).

1.2 Research Background

Although a great deal of research has been carried out in the area of knowledge management, the subject remains in its infancy. Furthermore, the results for the research undertaken in knowledge management thus far have not succeeded in reaching a common definition or concept. In fact, the opposite is true and knowledge management is surrounded by a great deal of vagueness and ambiguity. There are numerous schools of thought with regards to the difficulties experienced defining the term 'knowledge management' (Davenport, 1997; Nonaka, 1998; Prusak, 1998; Ruthkowski and Stasko, 2000; Sveiby, 2001). Firstly, there are numerous labels for the term knowledge management (Prusak, 1998; Ruthkowski and Stasko, 2000). For example, Prusak (1998) includes Knowledge Capital, Knowledge Assets, Intangible Assets, Intellectual Capital, and Organisational Knowledge. Rutkowski and Stasko (2000) extend this list to include Knowledge Strategies and Corporate Knowledge.

Secondly, knowledge means different things to people depending on their geographical location (Malhotra, 1997; Nonaka, 1998). For instance, according to Malhotra (1997) organisations in Eastern countries such as India understand knowledge to be intellectual property whereas Western companies refer to knowledge as something that exists in peoples' heads. Another viewpoint is that managers in the West tend to perceive an organisation as 'information processing machines' and therefore their interpretation of knowledge is something that is explicit and quantifiable. Whereas certain Japanese managers view knowledge as being tacit and the organisation being a living organism (Nonaka, 1998). Therefore, the differing views between the East and the West with regards to knowledge adds a further dimension to the problems associated with defining knowledge management.

In addition, the interchangeable use of the terms data, information, and knowledge also contributes to the confusion and ambiguity of knowledge management (Davenport, 1997). For instance, Rutkowski and Stasko (2000) provide dictionary definitions for data, information, and knowledge and go on to emphasise that although each term has been individually defined there is no clear differentiation. Furthermore, they stress that the definition of data contains the term information three times and the definition of information uses the term knowledge twice. Davenport (1997) defines data as simple observations of states of the world, information as data endowed with relevance and purpose, and knowledge as valuable information from the human mind that includes reflection, synthesis, and context. Setzer (1999) defines data as being syntactic, information as semantic, and knowledge as pragmatic.

Finally, a person's educational background is also considered to have an influence on their interpretation of knowledge. Sveiby (2001) claims that the individuals involved in knowledge management can be divided into two tracks. The first one is where people come from a background that is computer and/or information science oriented who perceive knowledge to be an object and knowledge management refers to the 'management of information'. The second category consists of individuals from a philosophy, psychology, sociology, or business/management background who consider knowledge to be related to processes and knowledge management to be the 'management of people'. Furthermore, there are two levels of activities. The 'organisation level' concentrates on the organisation whereas the 'individual level' refers to where focus in research and practice is placed on the individual. The two tracks and levels are illustrated in Table 1.1.

Track / Level	IT – Track Knowledge = Object	People - Track Knowledge = Process
Organisation Level	Re-engineers	Organisation Theorists
Individual Level	AI-specialists E-specialists	Psychologists

Table 1.1: The Two Tracks and Levels of Knowledge Management Interpretation

(Source: Sveiby, 2001)

According to Sveiby (2001) the varying educational backgrounds of the practitioners of knowledge management results in the use of two completely different languages and dialogues when they are attempting to describe knowledge and knowledge management. Furthermore, when either track of practitioner describes knowledge management they are referring to entirely different things. This is due to IT practitioners obtaining their understanding of knowledge from information theory and concepts whereas practitioners from the people track base their understanding of knowledge on concepts drawn from philosophy, psychology, and, sociology.

Despite the difficulties experienced in defining knowledge management and the inability to achieve a mutual understanding it appears that organisations have not been deterred from undertaking a knowledge management deployment. Furthermore, software vendors have exploited the uncertainty surrounding knowledge management by inundating the software market with numerous knowledge management tools (Angus *et al.*, 1998; Davenport and Prusak, 1998; Silver, 2000). This is not immediately perceived as being problematic since the greater the choice the more competitive and dynamic the

market. However, the wide range of alternatives can make it difficult for organisations to select a suitable knowledge management tool that adequately meets their requirements. This is further complicated by the fact that, whilst some of these tools have been designed specifically as knowledge management tools, others have been re-packaged, re-labelled, and re-marketed as knowledge management tools (Angus *et al.*, 1998). Other disciplines such as health care, education and the military have tackled similar problems by providing guidelines to aid the evaluation and selection of an appropriate software tool (Parnas *et al.*, 1990; Berryman *et al.*, 1994; McDonald, 1996; Buckleitner, 1999; Dupuy and Leveson, 2000). Furthermore, even application areas within the discipline of Information Systems such as simulation and CASE (Computer Aided Software Engineering) have made such provisions (Forte, 1992; Mosley, 1992; Hlupic, 1997; Nikoukaran *et al.*, 1998). However, no such facility appears to exist for commercial knowledge management tools.

1.3 Research Objectives

In light of this, the aim of this research is to provide a set of guidelines to aid the evaluation and selection of knowledge management tools. To accomplish this it is necessary to achieve the following objectives:

1. Conduct a critical literature review;
2. Identify the need and focus for the research;
3. Collect and analyse data; and
4. Research findings and novel contributions.

The purpose of the first objective is to gain a theoretical understanding of the issues surrounding the research area in question. Therefore, three areas of literature will be investigated including knowledge management, knowledge management tools, and existing guidelines for tool evaluation and selection. Knowledge management literature will be examined to determine the context of knowledge management tools within the broader area of knowledge management. Furthermore, the literature will highlight the areas of knowledge management that are important and need to be incorporated into the guidelines. Investigating the knowledge management tool literature will enable a more in-depth understanding of the research area of knowledge management tool evaluation and selection. This will also enable the researcher to establish the research that has already been undertaken in the particular area of knowledge management tool evaluation and selection, its shortcomings and how it can be developed further. Investigation of this particular literature would also determine whether any form of guidelines for knowledge management tools already exist thus, justifying this research. Literature detailing the evaluation and selection of software tools will also be included as a part of the literature review since this will enable the researcher to establish the similar work that has been carried out within other areas and disciplines.

The purpose of the second objective is to establish whether there is a need for such research and if so the focus of the research needs to be specified. This will be achieved in the first instance by examining the literature to determine if a requirement for such research has been explicitly specified, or if any research has been initiated in the area. The need for the research will also be established by actually asking organisations and institutes whether they would make use of and find such guidelines useful. Once a need for the research is identified then the second part of this objective entails that the

research area in question achieves a certain level of focus. This will involve identifying the specific areas that need to be investigated. For instance, with regards to this research it will be necessary to identify the type of data that needs to be obtained and where to gather it from, thus supporting the development of guidelines.

Having identified that there is a need for this research, it will be possible to undertake the fifth objective that involves collecting and analysing data. This involves identifying from where and how the required data will be collated. For instance, if the researcher was intending to speak to an organisation that has previously been involved in the evaluation and selection of a knowledge management tool, then a number of techniques could be used to generate the data including: a survey, interviews, observation and participation. Once the relevant data have been gathered it will be necessary to analyse it in order to glean some insight and translate it into meaningful information.

The final objective entails presenting the findings from this research and illustrating the novel contributions that have been made as a result. The research findings will be presented in the form of conclusions and the novel contributions will be the guidelines. The following section describes the novel contributions that may arise as a result of this research if further detail.

1.4 Potential Research Contributions

Knowledge management is a multi-faceted research area in which a great deal of research has already been undertaken. However, this is predominantly focused on the organisational and human aspects (Tolen, 1999). Consequently, the technology component of knowledge management appears to be somewhat neglected. Therefore,

the motivation for this research stems mainly from the lack of work undertaken within the technology branch of knowledge management. Encompassed in this area are software tools that have been developed in order to support a knowledge management deployment. As previously mentioned, one of the repercussions of the increasing interest in knowledge management is a sudden proliferation of knowledge management tools making it difficult for organisations to purchase a suitable tool.

Therefore, this research would be valuable to both, the academic community and industry, for a number of reasons. Firstly, the theoretical aspect of knowledge management remains broad and ambiguous. Furthermore, the majority of literature that does exist appears to focus on the 'softer' aspects of knowledge management. Therefore, this research will help to further define and add to the technology component of knowledge management. Secondly, the numerous knowledge management tools, and tools claiming to be knowledge management tools, available on the software market can make it difficult for an organisation to evaluate and select an appropriate tool. Therefore, a set of evaluation and selection guidelines is valuable to any organisation experiencing difficulty with the knowledge management software market.

As a result of this research it is envisioned that there will be four main contributions to the field of knowledge management. Firstly a framework will be designed that can be used to evaluate knowledge management tools. Secondly, a frame of reference for the selection of a knowledge management tool will be developed. Thirdly, a taxonomy will be created in order to provide a classification system for knowledge management tools. Finally, requirements for further development of knowledge management tools will be obtained.

1.5 Research Methodology

Knowledge management can be classified under the area of Information Systems (Onge, 2001) and therefore requires an appropriate research method. According to Galliers (1992) there are a wide range of research methods that are particularly applicable for research that is to be conducted in the field of Information Systems. The way to identify the most appropriate research method to adopt depends on the nature of the research to be undertaken (Galliers, 1990). In light of this, the nature of this particular research involves establishing how an organisation should go about evaluating and selecting a commercial knowledge management tool.

Therefore, two research strategies could be adopted in order to capture the relevant data including a survey or a case study. The former would be particularly useful for collating information about features existing in knowledge management tools. However, it would be difficult to obtain details about an institution's perspective of the selection process. For instance, one respondent could describe the selection process that was successfully used within their institution. However, if none of the other respondents come from the same institution it is impossible to get a true institution-wide perspective. It is important to obtain an overall picture of the issues surrounding the evaluation, selection and use of a knowledge management tool in order to ascertain the outcome. Although the actual outcome in itself is unimportant it is crucial to know the experiences, successful or unsuccessful, so that they can be utilised within the guidelines in the correct manner. Therefore, since an institution-wide perspective is required the most appropriate research strategy to adopt is the case study.

A case study may consist of anything from a study including one person to a study including a whole institution (Yin, 1994). However, since the aim of this research is to investigate how institutions go about evaluating and selecting a knowledge management tool a case study will consist of an institution. Furthermore, since the experiences of one institution is unlikely to be sufficient to create a general set of guidelines for knowledge management tools several institutions will need to be investigated. Therefore, the research will consist of several case studies. The research strategy along with the case studies is discussed in further detail in Chapter 4.

1.6 Dissertation Outline

This section provides an outline of each of the seven chapters contained within this dissertation. This chapter, Chapter 1, provides an introduction to the research being undertaken including background research and a problem definition. In order to address the problem a set of research objectives were specified and a methodology for undertaking this research was also identified. This is followed by an outline of the chapters contained within this dissertation. The chapter concludes with a summary providing an overview of the chapter.

Chapter 2 provides a detailed discussion of the literature with the aim of providing context for the research in question. However, prior to this a brief description of the emergence of the knowledge age is provided. Following this is a discussion of knowledge management and how and where this research fits into the broader context. The chapter then goes on to describe research that has already been undertaken within this particular area. The chapter then moves on to analyse the variety of guidelines that already exist for the purpose of tool evaluation and selection.

Chapter 3 describes the empirical investigation of four knowledge management tools. The purpose of this is to demonstrate the various types of knowledge management tools that exist. Furthermore, features of each of the knowledge management tools are identified for criteria for the evaluation framework. In addition, weaknesses of the tools are identified along with recommendations for improving the tool.

Chapter 4 provides a brief introduction to the research strategy being adopted for this research along with data collection and data analysis techniques. This is followed by a description of the experiences of four institutions that have been through the process of either evaluating and selecting, or developing a knowledge management tool. An outline of how the knowledge management tool was acquired or developed and its use is provided. However, the main focus is the selection method adopted and the features identified. Furthermore, details about the positive and negative aspects of each feature are described where applicable.

Chapter 5 demonstrates and describes the evaluation framework and a frame of reference designed for the selection of knowledge management tools as a result of the research carried out. A description of how the evaluation framework was designed along with details of the categories and criteria contained within it is provided. The chapter then focuses on how the framework may be applied for the evaluation of knowledge management tools. The chapter then goes on to discuss the design of the frame of reference along with a demonstration of the actual frame of reference itself. The chapter concludes by discussing the various ways the frame of reference can be applied.

Chapter 6 describes a taxonomy and requirements for future knowledge management tool development. A description of how the taxonomy was designed is provided along with details of how the tools included in the study can be classified applying this. The second part of this chapter discusses requirements that were identified for future development of knowledge management tools. In turn, these are related back to the categories contained within the taxonomy for knowledge management tools.

The final chapter, Chapter 7, provides a summary of this dissertation. Furthermore, a description of the conclusions drawn from this research and the contributions from this research are specified. Following this, the limitations of the research are discussed along with areas of further work.

1.7 Summary

In summary, the increasing popularity of knowledge management has led to a rise in the number of knowledge management tools available on the software market, therefore making it difficult for organisations to select one that suitably meets their requirements. In order to address this, the aim of this research is to provide a set of guidelines to aid in the evaluation and selection of knowledge management tools. This will be achieved predominantly by conducting case studies in institutions whereby they have previously been through the process of evaluating and selecting a knowledge management tool. The following chapter provides a detailed account of the literature related to this research.

Chapter 2.

Research Background

2.1 Introduction

The purpose of this chapter is to demonstrate the context of the research being undertaken along with a description of similar research that has previously been conducted. This chapter begins by introducing the knowledge age and its emergence. Following on from this is a section on knowledge management illustrating how the research area of knowledge management tools fits into the broader context. This is succeeded by an account of the research that has previously been undertaken with regards to knowledge management tools. The chapter then shifts focus from knowledge management to literature that is related to tool evaluation and selection. Both, generic and discipline specific guidelines are investigated in order to establish how existing techniques function. Furthermore, the areas that can be incorporated into the knowledge management tool evaluation and selection guidelines are also identified.

2.2 The Evolution of the Knowledge Age

Over the years the business environment has evolved from the industrial age, through the information age, and is currently on the threshold of the knowledge age (Toffler, 1980; Miles *et al.*, 1997, Sterling, 1997; Trauth, 1999). Although there were many phases within the industrial age the final outcome of this era was the mass production, enabled by machinery, of goods such as steel, oil, and automobiles, at low costs (Toffler, 1980; Miles *et al.*, 1997). During the information age the focus shifted, as the term suggests, to information. The aim was to facilitate the free flow of information via products and services e.g. financial services and logistics (Miles *et al.*, 1997; Wang, 1999). During this era the potential value of information was identified and further on in time the value of adding intelligence to that information resulted in the emergence of the knowledge age (Trauth, 1999). Therefore, having progressed from a capital-intensive industry to an information-intensive industry the focus of the current industry is knowledge (Miles *et al.*, 1997).

There are many schools of thought with regards to the meaning of the term knowledge (Leonard-Barton, 1995; Kogut and Zander, 1997; Davenport and Prusak, 1998; Applehans *et al.*, 1999). Davenport and Prusak (1998) define knowledge as a collection of experiences, values, contextual information, and expert insight that enables the ability to evaluate and incorporate new ideas and information. Furthermore, knowledge is something that is obtained progressively over time and is constantly being altered and replenished (Leonard-Barton, 1995). The importance of knowledge within an organisation has been recognised by Drucker (1993), Toffler (1990), and Teece (1998). However, the ability to create and maintain knowledge is thought to be the key to gaining and maintaining a competitive advantage (Miles *et al.*, 1997; Nonaka, 1998;

Trauth, 1999). This is further substantiated by Nonaka and Takeuchi (1995) who attribute the success of Japanese companies, as opposed to their Western counterparts, to their ability to create and manage organisational knowledge. In addition, Davenport and Prusak (1998) and Milton *et al.*, (1999) claim that knowledge is critical to the success of a business and may have an impact on its survival. However, in order to exploit knowledge to its maximum potential, it is essential that it is managed appropriately (Svensen, 1998). This is further substantiated by Leonard-Barton (1995) who likens the importance of managing knowledge to the importance of managing finances.

2.3 Knowledge Management

Despite the potential value of knowledge being well recognised it remains a broad and ambiguous subject with no common definition or concept. Surprisingly, this has not deterred numerous organisations from embracing knowledge management. However, amongst all of the confusion there does appear to be some consistency with regards to the components and the activities, often referred to as processes, which constitute knowledge management. Figure 2.1 shows that knowledge management consists of two areas; knowledge management activities and knowledge management components. The former, knowledge management activities, is divided into the three areas of knowledge generation, knowledge organisation, and knowledge sharing. These represent the primary activities that can take place, either in isolation or in various combinations, during a knowledge management deployment. The latter, components of knowledge management, consist of culture, business processes, and *technology*. These reflect the aspects of an organisation that must be taken into consideration for a knowledge management effort to be successful. Unlike the activities, the components must not exist

in isolation as part of a knowledge management exercise. In fact, all three components should receive equal, and combined, attention (Borghoff and Pareschi, 1997; Davenport, 1997; Davenport and Prusak, 1998; Milton *et al.*, 1999; Trauth, 1999; Vaas, 1999, Duffy, 2001, Stewart, 2002). The remainder of this section describes the two areas in further detail.

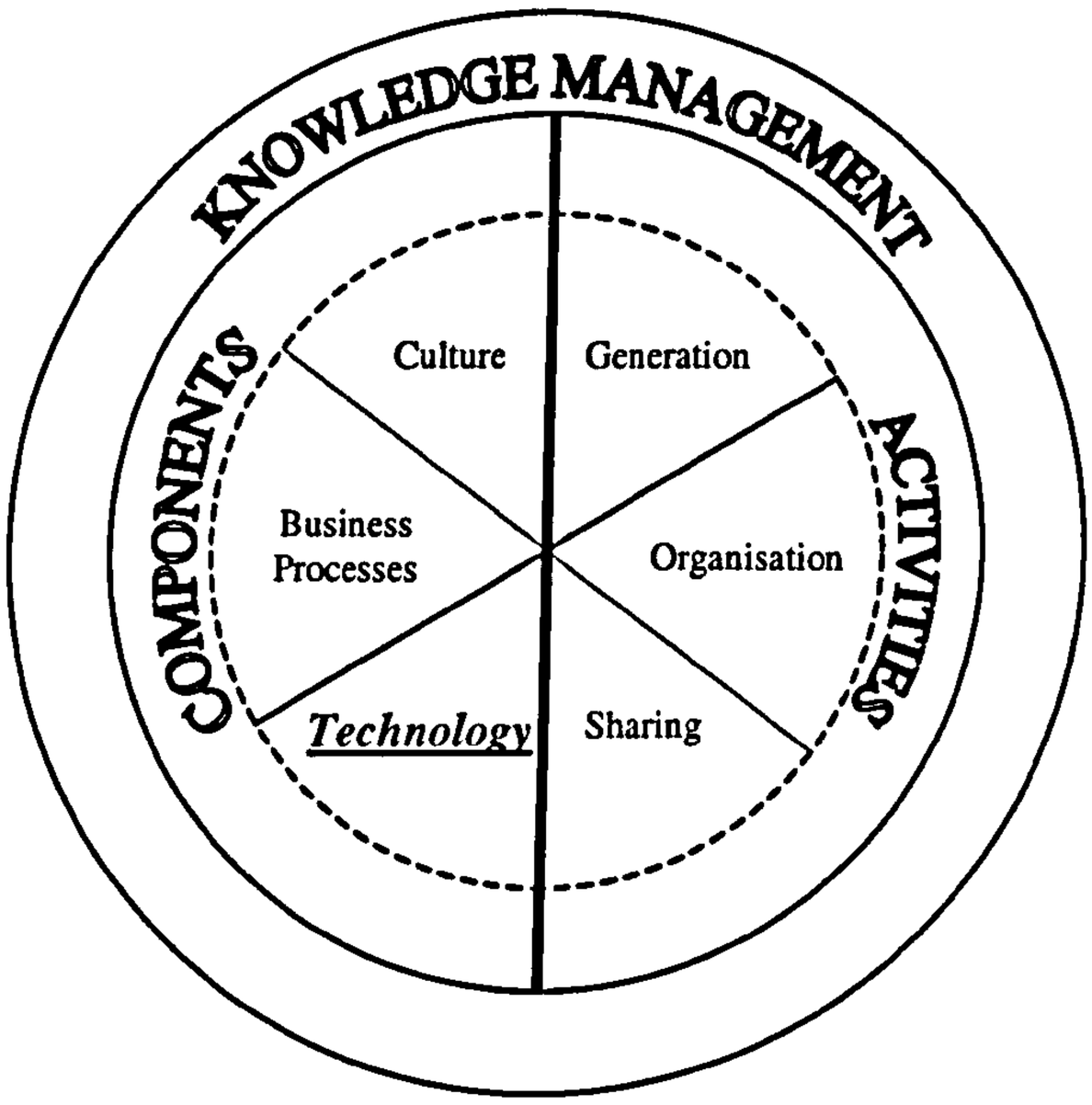


Figure 2.1: Knowledge Management Activities and Components

2.3.1 Knowledge Management Activities

As previously mentioned knowledge management activities refer to the phases that take place in order to achieve knowledge management. Table 2.1 describes the knowledge management activities specified by various practitioners. In general, knowledge management activities range from between three and five categories. Although the terms used are very similar, there appears to be some variance in the meanings. For instance, Angus and Patel (1998) claim that knowledge gathering refers to the bringing in of information and data. However, according to Kramer (1998) knowledge gathering

entails the process of collecting knowledge. The subtle difference here is reference to what is being gathered. Angus and Patel (1998) are collating information and data whereas Kramer (1998) is gathering knowledge. Subsequent to Table 2.1 descriptions are provided of the interpretations by a selection of the practitioners.

PRACTITIONERS	KNOWLEDGE MANAGEMENT ACTIVITIES				
Ruggles (1997)	Generation	Codification	Transfer		
Angus and Patel (1998)	Gathering	Organising	Refining	Disseminating	
Kramer (1998)	Gathering	Organising	Distributing	Collaboration	
Ferran-Urdaneta (1999)	Creation	Legitimisation	Sharing		
Jackson (1999)	Gathering	Synthesis	Storage	Communication	Dissemination
Macintosh (1999)	Developing	Preserving	Using	Sharing	
Zolingen *et al.*, (2001)	Acquiring	Codifying	Disseminating	Developing	Applying

Table 2.1: Knowledge Management Activities According to Various Practitioners

Ruggles (1997) claims that knowledge generation refers to the creation of new ideas, the recognition of new patterns, the synthesis of separate disciplines, and the development of new processes. The codification of knowledge involves the representation of knowledge such that it can be accessed and is ready to be transferred. Knowledge transfer refers to the process of ensuring that the knowledge is shared. According to Angus and Patel (1998) knowledge gathering refers to the bringing in of information and data. Organising relates to ensuring that the knowledge is easily accessible by giving it context by linking items to subjects; adding value to knowledge using various means including identifying relationships, abstracting, and synthesis. Finally, sharing is considered as refining knowledge and knowledge dissemination is associated with ensuring that the right people have access to this knowledge.

Kramer (1998) describes gathering knowledge as the process of collecting knowledge. Organising involves classifying knowledge with the aim of giving it meaning so that it can be located with ease by those searching for it. Distribution refers to dispersing the knowledge and collaboration refers to sharing and using the knowledge that has been obtained. Ferran-Urdaneta (1999) uses three categories to define the knowledge management activities. Knowledge creation is associated with the process by which an individual gains new insight. Legitimisation refers to the actions of checking the validity of the knowledge and sharing relates to the distribution of knowledge.

Essentially, it appears that the knowledge management activities involve obtaining the knowledge in the first place, organising it so that it can be easily accessed at a later date, and ensuring that the knowledge collated is exploited by sharing it with the people who require it. A number of practitioners have sub-divided each of the knowledge management activities further by associating various functions that refer to the way the activity is achieved. For example, Angus and Patel (1998) claim that knowledge can be gathered through pulling, searching, Optical Character Recognition (OCR), or, voice input. These are described in further detail in Sections 2.4.1, 2.4.2, and 2.4.3 of this chapter.

2.3.2 Components of Knowledge Management

The other aspect of knowledge management that appears to contain some consistency is related to the areas that must be addressed during a knowledge management deployment. These include; culture, business processes, and technology (Borghoff and Pareschi, 1997; Davenport, 1997; Davenport and Prusak, 1998; Milton *et al.* 1999; Trauth, 1999; Vaas, 1999, Duffy, 2001). The cultural aspect of knowledge management

is often considered as one of the most difficult obstacles to overcome (Bicknell, 1999; McDermott and O'Dell, 2001). This is attributed to traditional business practices of hoarding knowledge (Hibbard and Carillo, 1998). Previously, knowledge was perceived as an individual's power and secured their position, and in some cases led to a promotion within an organisation. However, the repercussions of the knowledge age mean that in order to create a knowledge sharing environment, it is necessary for employees to change their way of thinking. Nevertheless, theory is very different from practice. Many suggestions have been made in order to improve the cultural environment, ranging from story telling (Reilly *et al.*, 1999) to ensuring that employees feel confident that they will still be a valuable asset to the organisation if they share their knowledge (Angus *et al.*, 1998; Hibbard and Carillo, 1998). Unfortunately, the cultural branch remains a major hindrance to the success of many knowledge management deployments (McDermott and O'Dell, 2001).

A number of practitioners believe that the key to creating a knowledge sharing environment is to re-design business processes (Angus and Patel, 1998; Hibbard and Carillo, 1998; Klamma and Schlaphof, 2000). This involves the radical re-design of business processes that exist within an organisation without allowing current practices to influence the resulting design (Davenport, 1993; Hammer and Champy, 1993; Robson and Ullah, 1996). Consequently, business processes are re-designed in order to accommodate a knowledge sharing environment. Furthermore, the resulting business processes should also consider, and support, the chosen knowledge management strategy. For instance, an organisation's strategy may consist of capturing information from consultants while they are working at a client site on a project. However, in order to achieve this it is necessary for the consultants to keep a record of certain activities.

This should be taken into consideration and time to do this should be allocated within the re-designed business processes. Knowledge management strategies are a separate research area altogether and are out of the scope of this research and therefore are not covered in further detail within this dissertation.

According to Ruggles (1997), technology and culture are connected by the condition that technology is compromised if the appropriate knowledge sharing culture is not adopted. Technology, in the form of knowledge management tools, is used to facilitate the knowledge management activities. As described in Section 2.3.1 these consist of knowledge generation, organisation, and sharing (Ruggles, 1997; Angus and Patel, 1998; Davenport and Prusak, 1998; Kramer, 1998; Ferran-Urdaneta, 1999; Jackson, 1999; Macintosh, 1999). One example of a knowledge generation tool is software that creates user profiles according to the parts of a website a user has navigated. The knowledge collated is exploited during the user's subsequent visits. For instance, if during the initial visit the user shows an interest in the sports sections of the website, they would be presented with various links connected to sport on their next visit. If during this particular visit they only read the football articles then the site would prioritise football articles. Each time the user visits the site, more knowledge is collected about them and, it is believed, the better their requirements are understood. Knowledge generation tools appear to vary quite considerably in where knowledge is obtained from and how it is generated. Some tools generate new knowledge by combining old knowledge that already exists within an organisation. Others search the Internet to obtain the relevant knowledge.

Knowledge organisation tools are used to store and organise knowledge so that it is quick and easy to access by the people who need it. Although not immediately obvious, there are various ways that knowledge can be stored and organised. For instance, the method of cataloguing knowledge may be achieved automatically by the tool using a predefined set of criteria. Alternatively, it may be necessary for somebody, often referred to as a knowledge librarian, to organise the knowledge manually. Commonly, knowledge organisation tools also contain a monitoring facility that track the various items entering the knowledge repository. In some cases users are notified of a particular occurrence within the knowledge repository.

Davenport and Prusak (1998) claim that knowledge sharing tools are the most valuable of the three. The main aim of knowledge sharing tools is to disseminate knowledge to the relevant people efficiently and effectively. This may be achieved by using utilities such as conferencing, bulletin boards, messaging, and file transfer. A conferencing facility would enable a group of people to work together although they may be located in a dispersed fashion. Tools of this calibre enable the use of features such as chat, whiteboard, and application sharing so that all group members are able to see and understand what is being demonstrated. Furthermore, an item can be worked on collaboratively with everyone present being able to view the same information.

2.4 Knowledge Management Tools

Whilst a number of objects can be classified as knowledge management tools (Ruggles, 1997; Davenport and Prusak, 1998) e.g. the telephone, paper, pen, etc this research focuses specifically on software tools for knowledge management. Ruggles (1997) defines knowledge management tools as technologies that enhance and enable

knowledge generation, codification, and transfer. Knowledge management tools are different from data management and information management tools in that knowledge management tools capture the complexity of content and the richness of knowledge (Ruggles, 1997; Duffy, 2001). In comparison to the volume of literature related to knowledge management and, in particular, its organisational and human aspects, the level of literature with respect to the more technical aspects appears to be limited. Furthermore, the majority of the literature that does exist focuses on individual cases where organisations have developed a knowledge management tool for internal use (Stewart, 2000). Alternatively, reviews of commercial knowledge management tools also appear to be quite common in the knowledge management literature. The former is useful for drawing on previous experience for any organisation wishing to develop their own knowledge management tool. The latter can be utilised should an organisation be interested in the knowledge management tool contained within the review. However, it is difficult to ascertain if any bias exists from the reviewer's perspective.

A limited amount of research has been undertaken in the general area of knowledge management tools. However, none of these are focused on providing evaluation and selection guidelines. For instance, the first of the studies that is to be discussed aims to determine how knowledge management tools can be used to facilitate the knowledge management activities. The purpose of the second study is to investigate the technical aspects of knowledge management tools and more specifically the architecture. The third study was conducted in order to establish the extent that knowledge management tools met the vendors' claims. The remainder of this section describes the three studies in detail with the aim of establishing the work that has previously been undertaken and to identify any areas that are relevant to this research.

2.4.1 Knowledge Management Tools Study I

The main objective of Ruggles's (1997) study was to investigate how knowledge management tools could be used to support the automation and augmentation of organisational knowledge management. As a result of the exploration of 12 knowledge management tools Ruggles (1997) arrived at the conclusion that knowledge management tools can be divided into three general categories: generation, codification, and transfer. According to Ruggles (1997) these categories represent the primary knowledge management activities of most organisations. In addition, these categories can be sub-divided further as illustrated in Figure 2.2.

According to Ruggles (1997) the first knowledge management activity, knowledge generation, involves the creation of new ideas, the recognition of new patterns, the synthesis of separate disciplines, and the development of new processes. In order to achieve this, tools that enable the acquisition, synthesis and creation of knowledge are required. Knowledge acquisition refers to the obtaining of new knowledge. This can simply mean accessing existing knowledge within an organisation for the first time. Knowledge synthesis concerns the creation of new ideas by combining old ideas and concepts. Knowledge creation is the rarest form of knowledge generation and relates to encouraging people to think differently.

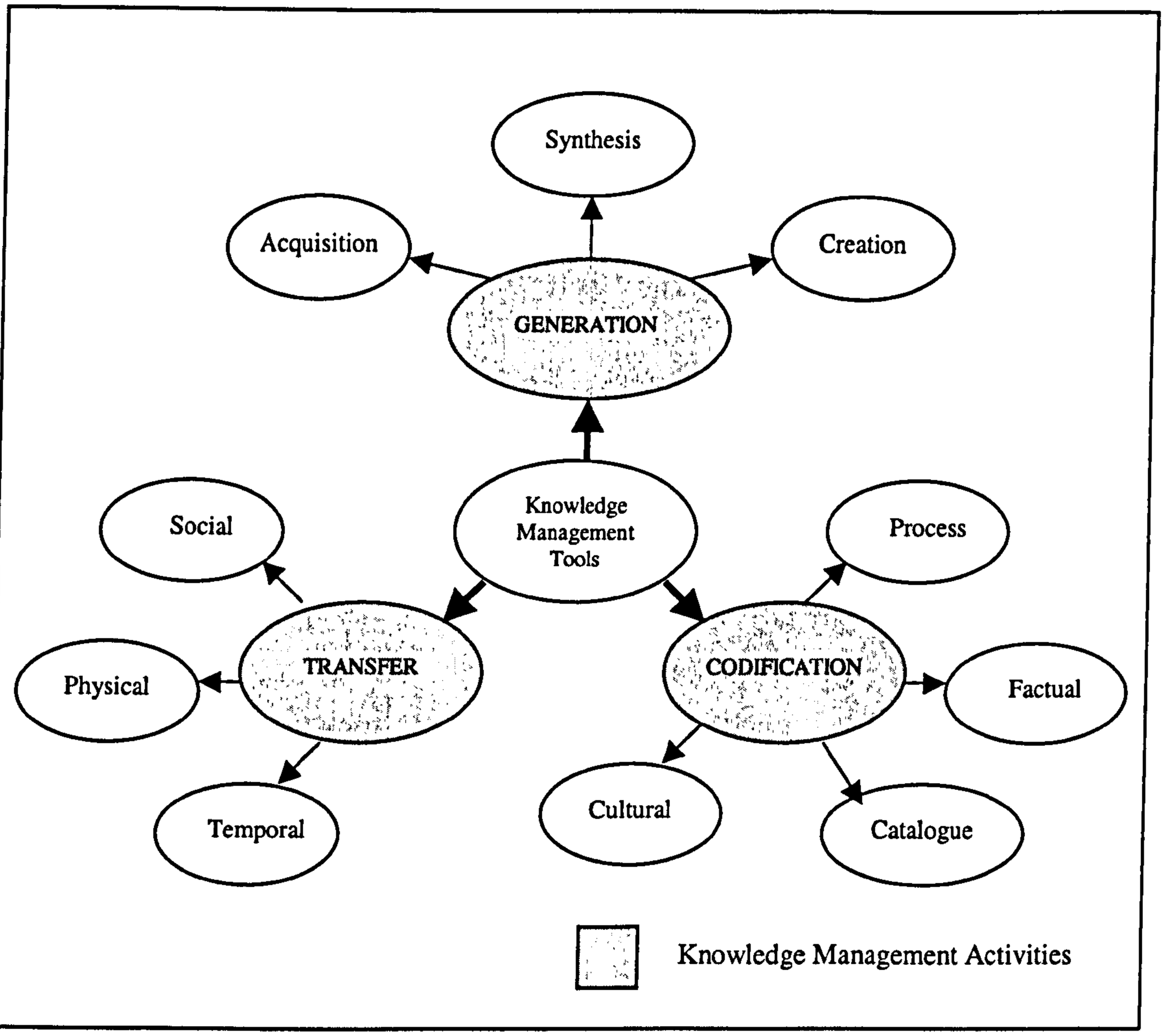


Figure 2.2: Knowledge Management Activities (Source: Ruggles, 1997)

Knowledge codification refers to organising and classifying the knowledge obtained through knowledge generation. Ruggles (1997) believes that it is difficult to categorise knowledge because it cannot be referred to in discrete units and therefore suggests that it may be useful to begin with a broad classification. The classification technique consists of dividing the knowledge according to the type of knowledge it represents. Table 2.2 demonstrates the categories suggested by Ruggles (1997) along with a brief description.

Type of knowledge	Description
Process Knowledge	Can be thought of as recipes for doing things well.
Factual Knowledge	Basic information about people and things contained in peoples heads.
Catalogue Knowledge	Individuals who posses catalogue knowledge know where things are – directory of expertise.
Cultural Knowledge	Knowing how things get done in an organisation.

Table 2.2: Categories for Classifying Knowledge (Source: Ruggles, 1997)

Generating and codifying the knowledge is useless if it is not disseminated to the right people. This is the concern of the final category knowledge transfer. According to Ruggles (1997) the three main barriers to sharing knowledge are temporal distance, spatial distance, and social distance. Temporal distance barriers consist of historical and current time barriers. Historical time barriers refer to the capturing and sharing of knowledge. For instance, knowledge that has been transferred from one person to another via a conversation is likely to be very rich in nature. However, the knowledge acquired cannot be exploited by anyone else other than the two people involved in the conversation if it is not captured and shared with others.

Current time barriers relate to the difficulties in organising time between two or more people in order for knowledge transfer to take place. Ruggles (1997) claims that in today's business environment people spend more time conversing through voicemail and email as opposed to in person. The second barrier for knowledge transfer is the physical distance involved within organisations and between customers and suppliers. Regardless of the distance involved it is necessary for organisations to conduct business and interactions adequately. The third and final barrier for knowledge transfer is the social distance. Out of all three this is considered to be the most difficult barrier to

overcome and involves factors such as hierarchical, functional, and cultural issues. According to Ruggles (1997) these factors stem from deep mental models that people have built their sense of self around.

Activity	Tools	Description
Generation	GrapeVINE	Uses a knowledge chart, user interest profiles, and several other components to add value to information on an individual basis.
	IdeaFisher	Works through associative lists of words and phrases, can help people put together disparate pieces to generate new ideas.
	Inspiration	Allows users to develop flexible, graphical mind or concept maps.
	Idea Generator	Encourages people or groups of people to break away from their usual thought process.
	MindLink	Encourages people or groups of people to break away from their usual thought process.
Codification	KnowledgeX	Facilitates the creation of knowledge maps containing details such as contacts, documents, events, and other interactions with information, allowing users to continually comment, update, and explore the nodes or destinations on the map and create and alter the relationships.
	RetrievalWare	Facilitates the ability to locate pictures and text through supplied criteria and sophisticated pattern recognition.
	TeleSim	Based on simulation – enables telecommunication companies to try strategies and learn about some of the underlying dynamics of their industry.
Transfer	Lotus Notes	Commonly classified in the groupware range. It enables people to communicate with each other in a virtual space, over time, capturing the interactions, and permitting context and understanding to be enhanced.
	NetMeeting	Facilitates simultaneous conversations over distance. It combines video, voice, and document sharing capabilities at the individual desktop.
	EnCompass	Translates cross-validated interaction information (e.g. frequency and importance) into a powerful, three-dimensional, graphical representation. Once interactions and relationships have been mapped, more useful ones can be proposed and the gaps and disconnects displayed.

Table 2.3: Knowledge Management Tools (Source: Ruggles, 1997)

Having established how the knowledge management process works Ruggles (1997) evaluates 12 tools in order to identify how they facilitate the knowledge management process and in the case of knowledge transfer how they overcome the problems associated with this particular knowledge management activity. Table 2.3 illustrates the

tools used for the study, the knowledge management activities they are classified under, and a brief description of how each of the tools facilitates the associated knowledge management activity.

2.4.2 Knowledge Management Tools Study II

The purpose of Jackson's (1998) study was to identify general and specific technology issues related to the development of knowledge management tools. This was achieved by conducting a twelve-month qualitative investigation of 59 knowledge management tools. The tools that were selected for this study range from small component based technologies, such as search engines, to large commercial groupware systems. Furthermore, the selection of tools contained within this study consisted predominantly of products developed by American companies. Jackson (1998) claims that the tools were classified according to the five knowledge management activities illustrated in Figure 2.3. However, unfortunately Jackson (1998) does not specify which knowledge management activity each of the knowledge management tools is classified under.

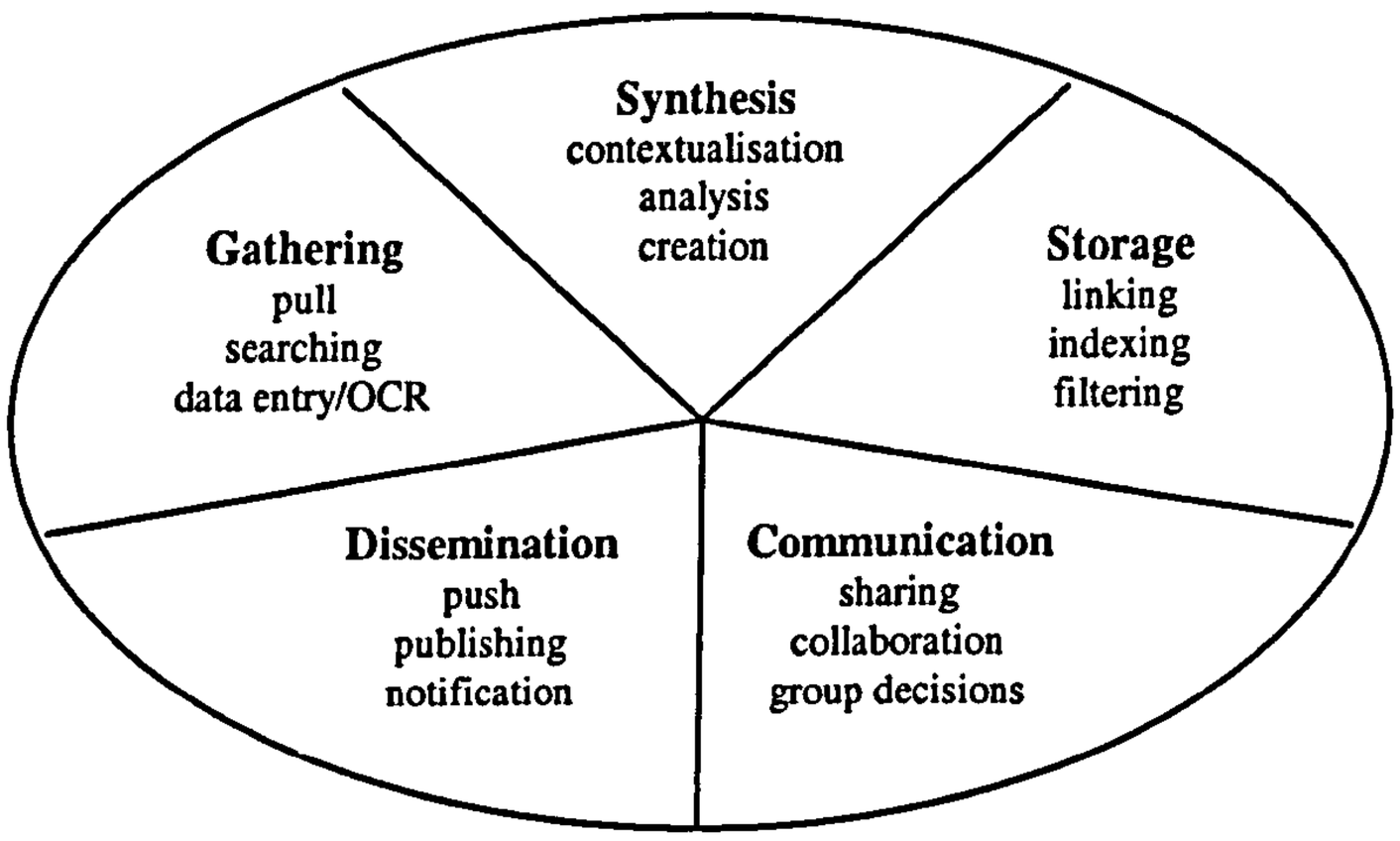


Figure 2.3: Knowledge Management Activities (Source: Jackson, 1998)

The tools are also classified according to five categories that are representative of the current knowledge management software market as demonstrated in Table 2.4. This time Jackson (1998) does specify which of the categories 14 out of the 59 knowledge management tools can be classified as. However, 45 of the knowledge management tools remain unclassified. Jackson (1998) also acknowledges the presence of a sixth category, Intellectual Assets, although systems for managing intellectual property are not strictly considered actual knowledge management tools and therefore have been omitted from Jackson's (1998) study.

KM Software Market	Document Management	Information Management	Searching and Indexing	Communications and Collaboration	Expert Systems
Knowledge Management Tools	Dataware Documentum Jetform	Baan Information SAP	Excalibur Fulcrum Verity	IBM/Lotus Notes Microsoft Qualcomm	Evolutionary Technologies Trajecta

Table 2.4: Knowledge Management Tools Classified According to the Current Software Market (Source: Jackson, 1998)

The study appears to proceed by evaluating each of the knowledge management tools paying particular attention to the architectural structure of the tool. As a result of the study Jackson (1998) identifies three general architectures that are most predominant in current knowledge management tools. In addition, Jackson (1998) identifies technical features that are prevalent in current knowledge management software and specifies issues that need to be addressed during the future development of knowledge management tools.

2.4.3 Knowledge Management Tools Study III

In comparison to the two studies previously described, the third study by Angus *et al.*, (1998) is most closely related to the research being undertaken for this dissertation. The purpose of this study was to examine how well each of five knowledge management tools fulfils its claims. Furthermore, to establish the functions within each of the knowledge management activities that each tool facilitates. This is achieved by basing the evaluation of the tools around the knowledge management activities and associated functions identified in a previous study (Angus and Patel, 1998). A detailed description of each of the tools is provided along with its main features, areas where the tool is lacking and other general strengths and weaknesses. The results of the second part of the study where each of the tools was investigated in terms of the knowledge management activities and functions are demonstrated in Table 2.5.

KM Activities and Functions	Knowledge Management (KM) Tools				
	Wincite	Intraspect	ChannelManager	KnowledgeX	BackWeb
GATHERING					
Pull	No	Yes	Yes	No	Yes
Search	No	Yes	Yes	Yes	Yes
OCR	No	No	No	Yes	No
Voice input	No	No	No	No	No
Data Entry	Yes	No	No	No	No
ORGANISING					
Cataloguing	Yes	No	No	No	No
Filtering	Yes	No	No	Yes	No
Linking	Yes	Yes	Yes	Yes	Yes
Indexing	Yes	Yes	No	Yes	No
REFINING					
Contextualising	No	Yes	No	Yes	No
Mining	No	No	No	Yes	No
Projecting	No	No	No	No	No
Compacting	Yes	No	No	No	No
Collaborating	No	Yes	Yes	No	Yes
DISSEMINATING					
Flow	No	No	No	No	No
Push	No	Yes	Yes	Yes	Yes
Sharing	Yes	Yes	No	Yes	No
Alert	No	Yes	Yes	Yes	Yes

Table 2.5: Supported Knowledge Management Activities and Functions

2.5 Critique of the Knowledge Management Tool Literature

It is evident from the three studies described (Ruggles, 1997; Jackson, 1998; Angus *et al.*, 1998) that the work currently undertaken in the area of knowledge management tools is extremely limited. Furthermore, although it has been acknowledged that numerous knowledge management tools exist on the software market (Angus *et al.*, 1998) no direct attempt has been made to provide any form of evaluation and selection guidelines. However, whether consciously or unconsciously, one theme does appear to be consistent across the three studies. Each has produced a classification system for knowledge management that is based around the knowledge management activities. Therefore, this should be further investigated during the design of the taxonomy that is a part of this research. Furthermore, the studies have functions associated with each of the knowledge management activities that reflect various ways in which that particular knowledge management activity can be achieved. The remainder of this section analyses the three studies with the aim of identifying weaknesses and areas that have not been investigated.

Study I by Ruggles (1997) has been described in a working paper and, as of yet, has not been published. It appears as though Ruggles (1997) conducted a high-level investigation of 12 knowledge management tools in order to establish how and which of the knowledge management activities each facilitates. However, additional features both, knowledge management tool specific and general, are not taken into consideration. Furthermore, details about how the tools were evaluated are omitted and it would not be possible for a third party to repeat the process.

The second study by Jackson (1998) involves the investigation of 59 tools with the aim of establishing technology issues related to the development of knowledge management tools. One of the shortcomings of Jackson's (1998) study is that the choice of tools to be evaluated is biased towards American companies. Furthermore, as with Ruggles's (1997) study apart from the fact it was a qualitative study, no additional details have been provided. The result of Jackson's (1998) study is a number of architectures that are common across knowledge management tools.

Angus *et al's.*, (1998) study is directly related to this study in that it provides a set of criteria against which five knowledge management tools were evaluated. However, the criteria are limited to evaluating aspects of the tools that are related only to the knowledge management activities and their respective functions. Additional criteria specific to knowledge management tools and general criteria have been omitted from the framework. Furthermore, details of how to go about evaluating a knowledge management tool are also disregarded.

Considering the lack of any comprehensive guidelines for knowledge management tool evaluation and selection possible alternatives need to be investigated. Generic guidelines could be used to evaluate and select a knowledge management tool (Curry and Bonner, 1983; Martin and McClure, 1983; Lynch, 1985; Breslin, 1986; Klein and Beck, 1987; Anderson, 1990; Le Blanc and Jelassi, 1991; Sharland, 1991; Montazemi *et al.*, 1996). However, these are considered not to be specific enough to cater for the individual features of knowledge management tools. Therefore, it is necessary to create a set of guidelines specific to knowledge management tools.

In order to achieve this existing guidelines are investigated for three purposes. Firstly, to gain a general idea of the types of guidelines available. Secondly, to identify any parts of existing guidelines that can be incorporated into the knowledge management tool guidelines. Finally, to recognise any weaknesses with the existing guidelines so that these can be addressed during the design of the knowledge management tool guidelines. The following section describes the types of guidelines already available.

2.6 Existing Guidelines for Tool Evaluation and Selection

Guidelines for tool evaluation and selection appear to consist of two main themes, generic and discipline specific. The former refers to guidelines that can be applied to any software tool regardless of whether it is generic or has been designed for a specific discipline area. The latter refers to guidelines that have been designed for use within a particular area or discipline such as education, health, etc. In order to produce a set of guidelines for the evaluation and selection of knowledge management tools both types, generic and specific, of existing guidelines is investigated. The remainder of Section 2.6 describes the various guidelines for tool evaluation and selection. The first sub-section, Section 2.6.1, demonstrates generic guidelines and the second, Section 2.6.2, illustrates discipline specific guidelines.

2.6.1 Generic Tool Evaluation and Selection Guidelines

There are numerous guidelines designed for the purpose of the evaluation and selection of generic software tools (Curry and Bonner, 1983; Martin and McClure, 1983; Lynch, 1985; Breslin, 1986; Klein and Beck, 1987; Anderson, 1990; Le Blanc and Jelassi, 1991; Sharland, 1991; Montazemi *et al.*, 1996). Curry and Bonner (1983) propose an eight-step methodology, aimed specifically at small businesses, for purchasing a

software tool. Justification for targeting this particular niche is that although there is a lack of systematic approaches to selecting a software tool the literature that does exist is aimed at the larger organisation. Curry and Bonner (1983) highlight that small businesses do not necessarily have the time and resources to conduct detailed analysis of the tools. The methodology proposed by Curry and Bonner (1983) is illustrated in Figure 2.4.

The aim of the first phase is to identify the business functions that should be investigated. Following on from this, each function should be analysed thoroughly in order to identify the processes that, ideally, need to be addressed by the purchased tool. This procedure can be considered similar to a brainstorming exercise where a list of requirements is gathered without consideration for whether the requirements appear obtainable or not.

The purpose of the next step is to investigate the software tool market to get an idea of what is available in terms of tools and in terms of vendors. It is recommended that a number of vendors are visited as opposed to one so that general knowledge can be obtained. Furthermore, it is important to become familiar with the expressions and terms commonly used by the vendors. Equipped with general knowledge about the market it is possible to refine the list to reflect realistic and obtainable requirements. The third phase involves documenting what the tool should be able to achieve in order to meet the requirements. This is probably the most important phase of the whole process since the success of the selection depends on the clarity of the requirements. The documented requirements do not necessarily have to be a large detailed document, additional notes

on the requirements will suffice so long as it reflects an accurate description of the business requirements.

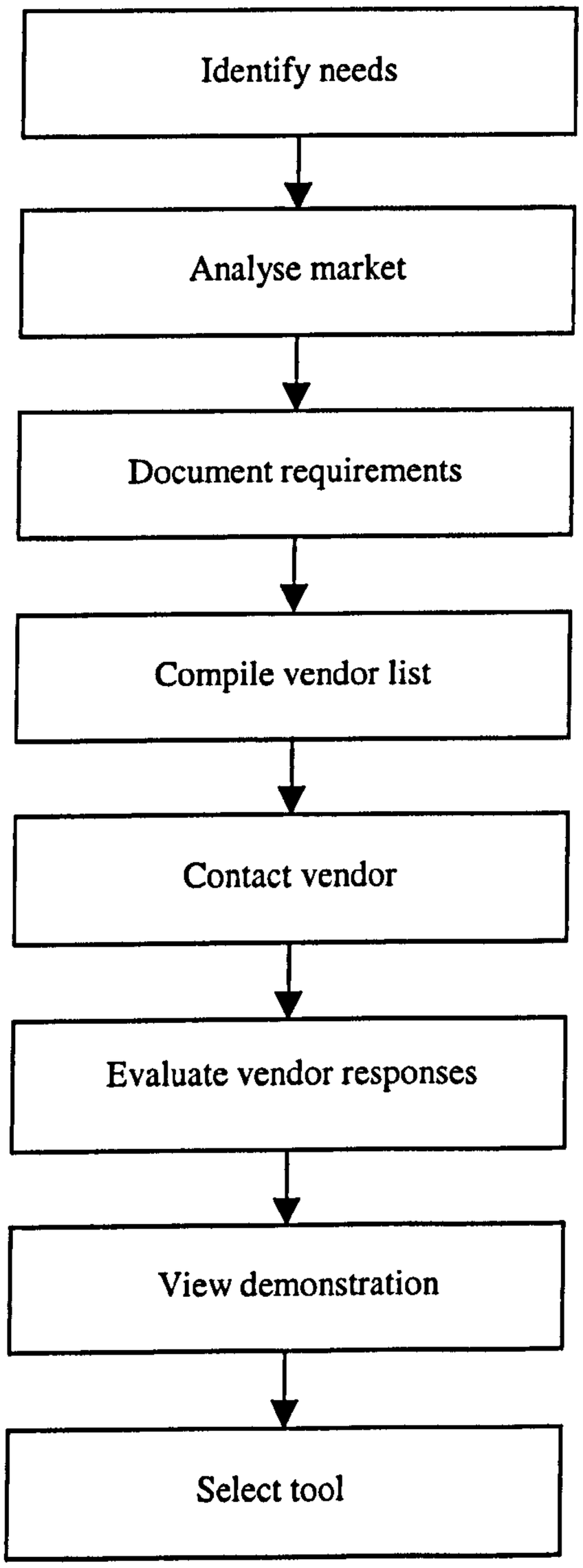


Figure 2.4: Tool Selection Steps for Small Businesses

(Adapted: Curry and Bonner, 1983)

The middle two phases of the methodology involves the compiling of a vendor list and the contacting of vendors. The importance of the former phase should not be underestimated. It is essential that good vendors are identified as they are more likely to respond with a proposal addressing the requirements from the document. Reputable vendors can be located from a variety of sources including articles and advertisements in magazines, and by physically visiting the vendor. It is also recommended that, at this point, demonstrations of tools can help to further refine the requirements document. The latter of the two middle phases consists of contacting each of the vendors on the list and enabling them to propose how their tool meets the specified requirements.

Curry and Bonner (1983) recommend that the vendor is provided with information such as, general information about the organisation requesting the proposal, any cost restrictions, a deadline for when the vendor's proposal should be received, and details about how the requesting organisation intends to evaluate and select the most appropriate tool. This last point involves establishing a set of evaluation criteria against which tools can be compared. Curry and Bonner (1983) include: meeting the requirements; high-quality documentation; availability of maintenance; total cost; and the availability of conversion assistance as examples of potential criteria. Having identified the criteria set each criterion must be assigned a weight according to their importance. The weights allocated to the entire criteria set must total 100.

The sixth step of the methodology consists of evaluating the responses from each of the vendors. It is suggested that each of the vendor responses is read through first without consideration for whether the proposed tool matches the requirements so that a general impression of the proposal can be gained. The next task within this step involves taking

each proposal and using the criteria and requirements to evaluate the tool. Once this is complete, the points for each of the proposed tools should be totalled and listed in order of points received starting with the highest. After considering the compatibly with hardware the top two or three tools should be selected for further investigation.

The penultimate phase involves viewing a full demonstration of each of the tools contained within the short-list. It is recommended that more than an hour is spent viewing and experimenting with the tool. The organisation requesting the tool must ensure that the vendor demonstrates how functions that the tool is intended to be used for are carried out. This also enables the opportunity for the vendor's competence to be monitored. During this phase it may be highlighted that some of the requirements are unobtainable in which case they must be discarded. On the other hand, the vendor may draw attention to features that were not originally considered but may prove useful and therefore can be added to the requirements document. The final phase involves making the decision of which tool to purchase. According to Curry and Bonner (1983), this should be relatively straightforward as one tool is likely to stand out more than the others.

The motivation for Martin and McClure's (1983) study stems from the inability to develop software tools in order to maintain the pace of the rapid evolution of computer hardware. It is believed that this problem can be overcome by purchasing commercial software tools as opposed to developing tools internally. However, Martin and McClure (1983) emphasise that this does not mean that a commercial tool is the most appropriate solution in all cases and the choice of whether to buy or develop must be investigated thoroughly. If a commercial tool is to be purchased then this task must be undertaken

systematically with a formal, logical procedure. Martin and McClure (1983) propose a methodology consisting of 11 phases for the purpose of tool evaluation and selection as demonstrated in Table 2.6.

Phase	Description
1	List present and future requirements
2	Survey all available tools
3	Examine documentation and user manuals
4	Establish whether tool is sufficiently parameterised
5	Check whether tool has adequate aids to maintenance
6	Short list suitable tools
7	Investigate each tool using organisational data if possible
8	Determine whether the tools can link into the organisational data base plans
9	Conducts benchmarks if performance is critical
10	Allow end users to implement the tool on a temporary basis if the interface is critical
11	Negotiate and construct an appropriate contract

Table 2.6: Phases for Purchasing a Software Tool

(Adapted: Martin and McClure, 1983)

Anderson's (1990) study involves the comparison of five methodologies designed for the purpose of tool evaluation and selection. Each model is used to identify the top two tools from three different types of applications including: wordprocessor; spreadsheet; and database. In order to conduct an evaluation of each model six categories are identified against which to compare each tool including: basic functions; documentation; advanced functions; vendor support; ease of use; and required training time. These categories are further sub-divided into a number of criteria. In some cases, such as documentation and training, the criteria are the same across the three different applications. However, categories such as basic functions and advanced functions

contain criteria specific to the application type. For instance, the advanced functions for the wordprocessing tools include testing for a spell checker and hyphenation. Whereas the criteria for the advanced features in the database tools include investigating relational capabilities and indexing. The following paragraphs describe how each of the five methodologies are implemented using this information.

The first is the Linear Weighted Attribute methodology that calculates the quality of each tool based on the weight assigned and the performance rating of each category. The evaluator defines the weighting of each category and the performance rating is based on a scale of 1-10 also specified by the evaluator. Once a value, representing the quality, has been achieved for each tool they can be put into order of highest to lowest quality.

The second, the Linear Assignment methodology, is based on ranking each tool for each category. The workings of this methodology are slightly more complex than the others and are therefore best described using an example. If four tools are to be evaluated based on six categories the first step would involve ranking each tool based on the first category. This process should be repeated until the tools have been ranked for all of the categories. The results should be represented in the form of a matrix as shown in Step 1 of Figure 2.5. The results demonstrate that for the first category Tool 4 has the highest ranking followed by Tool 1, then Tool 2, and finally Tool 3.

STEP 1

	CATEGORIES					
TOOL	**1**	**2**	**3**	**4**	**5**	**6**
1	2	3	2	2	1	4
2	3	1	3	3	2	3
3	4	2	1	1	3	2
4	1	4	4	4	4	1

STEP 2

	RANKING			
TOOL	**1**	**2**	**3**	**4**
1	1	3	1	1
2	1	1	4	0
3	2	2	1	1
4	2	0	0	4

Figure 2.5: Steps 1 and 2 of the Linear Assignment Methodology

Once each tool has been ranked according to each category it is possible to establish how many times each ranking was achieved by each tool as illustrated in Step 2 of Figure 2.5. The results show that Tool 2 was ranked in first place for one of the categories, in second place for another category, in third place for four of the categories, and was never ranked in last place for any of the categories. Step 3 involves identifying all of the possible combinations where each tool is uniquely assigned one rank and vice versa. This is demonstrated in Figure 2.6.

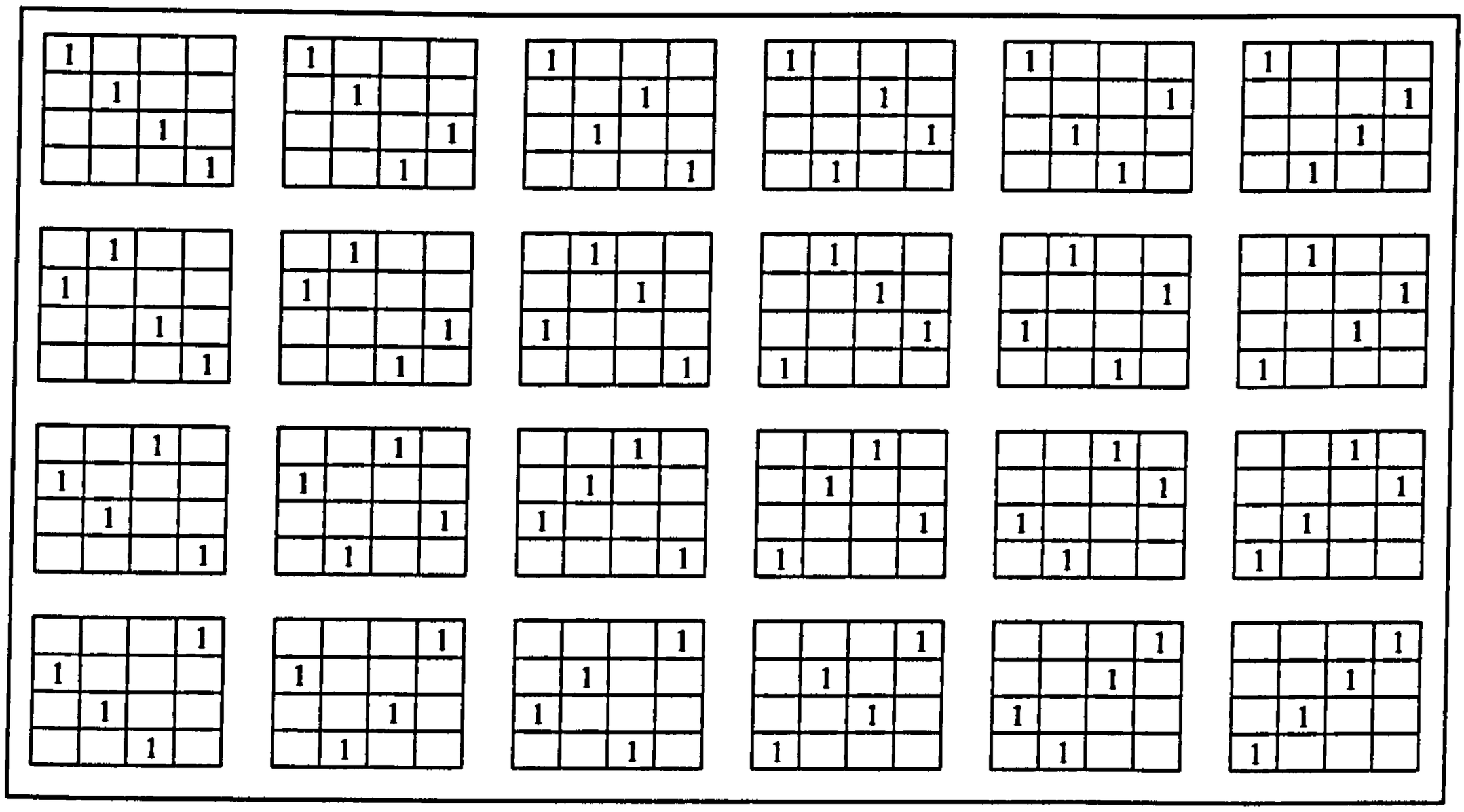


Figure 2.6: Step 3 - Permutations for the Four Tools

Using the matrix created during Step 2 in Figure 2.5 and each of the combinations identified in Figure 2.6 a score is calculated. For instance, using the first permutation from Figure 2.6 sum the scores in each of these positions from the matrix in Step 2 of Figure 2.5. The numbers in these positions are 1, 1, 1, 4 and therefore the total score is 7. Once the score has been calculated for each, the tool receiving the highest score indicates the ranking of the packages. Table 2.7 displays the various permutations along with the individual scores located in the respective positions and the total score. As is evident, the combination of line 9 receives the highest score. Therefore, the order of ranking for the four tools, starting with the best and ending with the worst is Tool 2, Tool 3, Tool 1, and Tool 4.

	PERMUTATIONS				INDIVIDUAL SCORES				TOTAL SCORE
1	1	2	3	4	1	1	1	4	7
2	1	2	4	3	1	1	1	0	3
3	1	3	2	4	1	4	2	4	11
4	1	3	4	2	1	4	1	0	6
5	1	4	2	3	1	0	2	0	3
6	1	4	3	2	1	0	1	0	2
7	2	1	3	4	3	1	1	4	9
8	2	1	4	3	3	1	1	0	5
9	2	3	1	4	3	4	2	4	13
10	2	3	4	1	3	4	1	2	10
11	2	4	1	3	3	0	2	0	5
12	2	4	3	1	2	0	1	2	5
13	3	1	2	4	1	1	2	4	8
14	3	1	4	2	1	1	1	0	3
15	3	2	1	4	1	1	2	4	8
16	3	2	4	1	1	1	1	2	5
17	3	4	1	2	1	0	2	0	3
18	3	4	2	1	1	0	2	2	5
19	4	1	2	3	1	1	2	0	4
20	4	1	3	2	1	1	1	0	3
21	4	2	1	3	1	1	2	0	4
22	4	2	3	1	1	1	1	2	5
23	4	3	1	2	1	4	2	0	7
24	4	3	2	1	1	4	2	2	9

Table 2.7: Permutations and Scores for the Four Tools

Maximax is the third methodology and is the simplest of the five approaches. It involves identifying the category, within each tool, that received the highest performance rating. The next phase entails listing the categories identified in order of highest to lowest and the tools placed at the top two positions of the list can be selected.

The fourth methodology, Elimination by Aspects (EBA), functions on the basis that a minimum performance rating is assigned to each category. The initial phase involves ordering the categories according to importance starting with the most important. The evaluator must then specify a minimum acceptable performance rating for each category. Using the category at the top of the list the tools must be divided into two

groups, the first containing tools that meet the minimum acceptable performance rating and the second, the tools that do not. If the first group only consists of one package then this is selected, otherwise the evaluator must move onto the next category in the list and repeat the process from where the set of tools are divided into two groups. The process is continued until one tool can be selected or there are no remaining categories on the list.

The final methodology, Lexicographic Ordering, is similar to the previous approach except that this method does not adopt the use of setting a minimum performance rating for each category. As with the Elimination by Aspects (EBA) methodology the first phase involves listing the categories according to the order of importance to the user. Using the category at the top of the list, the tool(s) with the highest performance rating are identified. This process is repeated moving down the list of categories until either, one tool can be selected or there are no more categories to use for comparison purposes.

According to Sharland (1991) tool evaluation consists of three phases; defining the business requirements, gathering information about each tool, and comparing the outcome of steps one and two. The purpose of the first phase is to ensure that the business requirements for the tool are clearly specified. If this is not achieved then it is likely that the entire evaluation process may conclude negatively (Berryman *et al.*, 1994). Establishing the business requirements for the tool may involve defining details such as, business objectives, general design requirements, business requirements, vendor related requirements, performance requirements, technical design requirements, and supplier requirements. Once the business requirements for the tool have been

ascertained, the next phase is to gather information about each candidate tool. Sharland (1991) suggests four different techniques for achieving this as illustrated in Table 2.8.

Methodology	Phases
Picture Comparison	• Identify requirements • Trawling and dissemination of information related to tools • Compare tools with tools and tools with requirements
Detailed Evaluation	• Identify requirements • Thorough investigation of each tool
Implemented Evaluation	• Identify requirements • Collect and analyse information about candidate tools • Purchase candidate tools • Evaluate tools using requirements • Select/reject tool
Package Led Evaluation	• Identify business requirements as clearly as possible • Identify tools which appear to cater for business requirements • Use tool functionality to aid in the definition of business procedures • Assess business procedures along with candidate tools

Table 2.8: Four Methods for Evaluating Generic Tools

The first methodology, Picture Comparison, is considered to be particularly suitable when there are a large number of tools, ideally between five and 50, involved in the evaluation (Sharland, 1991). The concept is to construct a 'picture' of each tool using information obtained from sales brochures, technical overview manuals, and other accessible literature. However, in order to perform a comparison of the tools the picture formed must adhere to a basic template. The picture of each candidate tool is compared with one another using the business requirements identified during the initial phase of the methodology. Firstly, one tool may stand out more than any other in which case the choice is obvious. Alternatively, the number of candidate tools is reduced to a manageable size where it is possible to perform a detailed evaluation.

The second methodology is the Detailed Evaluation option that is ideally used in a situation where evaluating tools of high strategic performance (Sharland, 1991). What

differentiates this method from the others is that each tool is compared, in isolation, with the business requirements. In essence, this means that what is required of the tool (as stated in the business requirements) is compared with what is provided by each tool. Furthermore, weights are used to assign importance to various evaluation criteria in order to aid the selection of the most appropriate tool.

The third method, Implemented Evaluation, is most suited to a scenario where the tools being evaluated are of low cost or are non-strategic (Sharland, 1991). Low cost refers to the price of purchasing the tool being less than the cost of the actual selection procedure. Once a short list of tools has been identified one is purchased from the relevant vendor and is installed and tested. Ideally the potential users of the tool should perform the testing since they understand the functionality and data required from the tool. The decision to accept or reject the tool is based on the results from the evaluation. If the tool is accepted then the tool is kept and the selection process concludes. However, if the tool is rejected then the tool is discarded and another one purchased for evaluation. With each cycle of evaluation it should be possible to refine the criteria and apply it to subsequent evaluations.

The final method, Package Led Evaluation, is ideal for use when the business area for which a tool is being sought is relatively new (Sharland, 1991). Due to the novelty of the area it is difficult to clearly specify the business requirements for the tool. Therefore, the tools themselves are used to identify and refine the business requirements. Essentially the tools are investigated using techniques such as experimentation with the tool using test data, site visits to observe the tool in use, and sales visits or demonstrations. As each tool is investigated, the knowledge obtained will contribute to

the requirements until an organisation is confident about the business area and is able to make a final objective evaluation of the tools.

2.6.2 Discipline Specific Evaluation and Selection Guidelines

As is the case with generic tool selection a multitude of guidelines exist that have been designed to be used to evaluate tools that have been designed for a specific discipline. For instance, Berryman *et al.*, (1994) and Buckleitner (1999) describe a methodology for the selection of educational software. Furthermore, in addition to the existence of guidelines for testing tools (Poston and Sexton, 1992) there are also approaches for evaluating testing tools used in an educational environment (Horgan and Mathur, 1992). The presence of different guidelines within one discipline is also evident in the health care environment. For instance, McDonald (1996) outlines a framework for the purpose of evaluating tools to be used in the administration area of healthcare. Whereas, Parnas *et al.*, (1990) and Dupuy and Leveson (2000) provide a framework for safety-critical tools which include software for aircrafts, military, nuclear plants, and medical equipment. Within the discipline of Information Systems there also exists numerous frameworks and methodologies. Hlupic (1997) and Nikoukaran *et al.*, (1998) provide guidelines for the evaluation and selection of simulation software. Furthermore, Hlupic and Paul (1996) have produced a more specialised framework for the purpose of selecting a simulation tool to be used in a manufacturing environment. Forte (1992) and Mosley (1992) have both designed methodologies for the assessment and selection of CASE tools. Finally, Preece *et al.*, (1997) have created a methodology that measures the correctness and completeness of knowledge-based systems. The remainder of this section investigates the guidelines designed for use within three different disciplines: healthcare; education; and Information Systems.

McDonald (1996) describes a study where a framework was designed in order to evaluate primary health care tools. A team was formed for the purpose of identifying requirements for a primary health care tool. The team consisted of various representatives from all levels of the health care services and a computer expert. In addition, 26 nurses selected from each of the regions participated in the study. During an initial meeting a framework was devised that would be used for evaluating the tool. The results of a market survey indicated that four software tools could potentially be used in a primary health care environment. This number was reduced to two as a result of demonstrations by each of the tool vendors. The nurses attended training sessions lasting a period of two days for each package. Prior to this the nurses were unable to contribute to the evaluation framework due to their lack of experience with primary health care software. However, after the training sessions the framework was refined because it was obvious that the nurses were unable to understand the questions contained within the framework. Each of the tools were then field tested for a duration of two months and then evaluated using the framework. The resultant framework is displayed in Table 2.9.

CRITERIA	SCORE
1. The task to register a new patient is easy	1 2 3 4 5
2. There are convenient means to search for a patient	1 2 3 4 5
3. The tool provides for all Primary Health Care services	1 2 3 4 5
4. The tool screens correspond closely to the old (manual) way of doing things	1 2 3 4 5
5. It is easy to find what you need to do within the tool	1 2 3 4 5
6. The amount of typing required is minimal	1 2 3 4 5
7. The quality of the on-line help is...	1 2 3 4 5
8. The quality of the documentation is...	1 2 3 4 5
9. The interaction with the tool is clear and understandable...	1 2 3 4 5
10. Your productivity will increase by using the tool	1 2 3 4 5
11. The tool is very easy to use	1 2 3 4 5
12. It was easy to learn to use the tool	1 2 3 4 5
13. It is never necessary to wait to use the tool due to processing	1 2 3 4 5
14. The capturing of data minimally interferes with interaction with the patient	1 2 3 4 5
15. This tool is ideal for the computerisation of Primary Health Care services	1 2 3 4 5
16. The training and after training support was good	1 2 3 4 5
17. The dataset is comprehensive and provides for all prescribed routine data	1 2 3 4 5
18. The clinical patient record is comprehensive	1 2 3 4 5

Table 2.9: Evaluation Framework for Primary Health Care Services

(Adapted: McDonald, 1996)

Another discipline that has numerous evaluation and selection frameworks is the educational environment. Furthermore, within this discipline there exist frameworks for the various subjects such as, Mathematics, English, Science, etc. However, the framework discussed here is related to the evaluation and selection of any educational tool (Berryman *et al.*, 1994). The framework in question was developed using three different approaches including, analysing the existing literature on tool evaluation, interviewing educational institutes that had previously been involved in evaluating and selecting a tool, and information obtained during empirical investigation of the tools and tool reviews. The resultant framework was presented in the form of a pamphlet similar to that illustrated in Table 2.10.

Before You Evaluate

- ✔ What part of the curriculum are you considering?
- ✔ Have you considered other ways to teach this? Is the computer the most appropriate?
- ✔ What teaching and learning methods do you want to use for this part of the curriculum?
- ✔ What learning methods are the students used to?
- ✔ What tool are other people using? What is available?
- ✔ Are there any previous evaluations of the tool you are considering that you could locate?

Factors to Consider in Method of Evaluation

- ✔ Do you want to use a form, or would you rather use an informal method?
- ✔ Will an individual or team based evaluation be more appropriate?
- ✔ Can students be involved in the evaluation?

Evaluating

- ✔ Does the content support your curriculum goal? Is the content accurate? Is the tool consistent with your preferred method of teaching?
- ✔ Does the learner have adequate control of the process?
- ✔ Will the tool support different learning needs and levels?
- ✔ Are there any race or sex biases? Have other equity issues been taken into consideration?
- ✔ Is it easy to use?
- ✔ Is it interesting? Fun? Challenging?
- ✔ How does the tool facilitate learning? Does the tool support broader educational goals?
- ✔ Is the tool compatible with your hardware?
- ✔ Is it technically reliable?
- ✔ What is the cost of the tool?

After You Evaluate

- ✔ Does the tool have any other potential use?
- ✔ How can you store this information so that it is useful and accessible to others?
- ✔ Can other users add to the results of the evaluation?
- ✔ Is it worth using? If you decide to purchase can use your evaluation to justify funding?

Selecting Resources

- ✔ The tool manual itself.
- ✔ Magazine or journal reviews.
- ✔ Subscription services.
- ✔ Friends, colleagues.
- ✔ Demo copies.
- ✔ Books.
- ✔ Local resource people e.g. computer laboratories – special education services, resource teachers, software retailers.

Wider Issues to Consider

- ✔ Setting up a team review process within the school region.
- ✔ Sharing resources with others.
- ✔ Tool evaluation can be time consuming – try to set some time aside for this purpose and establish a school policy for this.
- ✔ Training and professional development in the use of computers in education, including tool evaluation.
- ✔ Ongoing evaluations of purchased tools will show its effectiveness in different situations.

Table 2.10: Evaluation Framework for Educational Software Tools

(Adapted: Berryman *et al.*, 1994)

Both sets of guidelines that have just been described are directed at two completely different disciplines to the field of Information Systems. However, since knowledge management tools can be considered as an area within the discipline of Information Systems (Onge, 2001) it may be useful to look at another guideline within this

discipline. Therefore, the following guidelines have been designed for the evaluation and selection of CASE tools.

There are numerous guidelines for the evaluation and selection of CASE (Computer Aided Software Engineering) tools (Forte, 1992; Mosley, 1992). However, the particular version of guidelines described in this dissertation consists of a methodology and evaluation framework (Mosley, 1992). The methodology has been designed specifically so that it applies only to CASE tools. However, the core of the evaluation framework is generic and can be applied to any type of tool. Furthermore, the framework has a tailorable section that can be catered for use with any type of tool. The framework is embedded into a methodology that describes the procedure to be undertaken during tool evaluation and selection as illustrated in Figure 2.7.

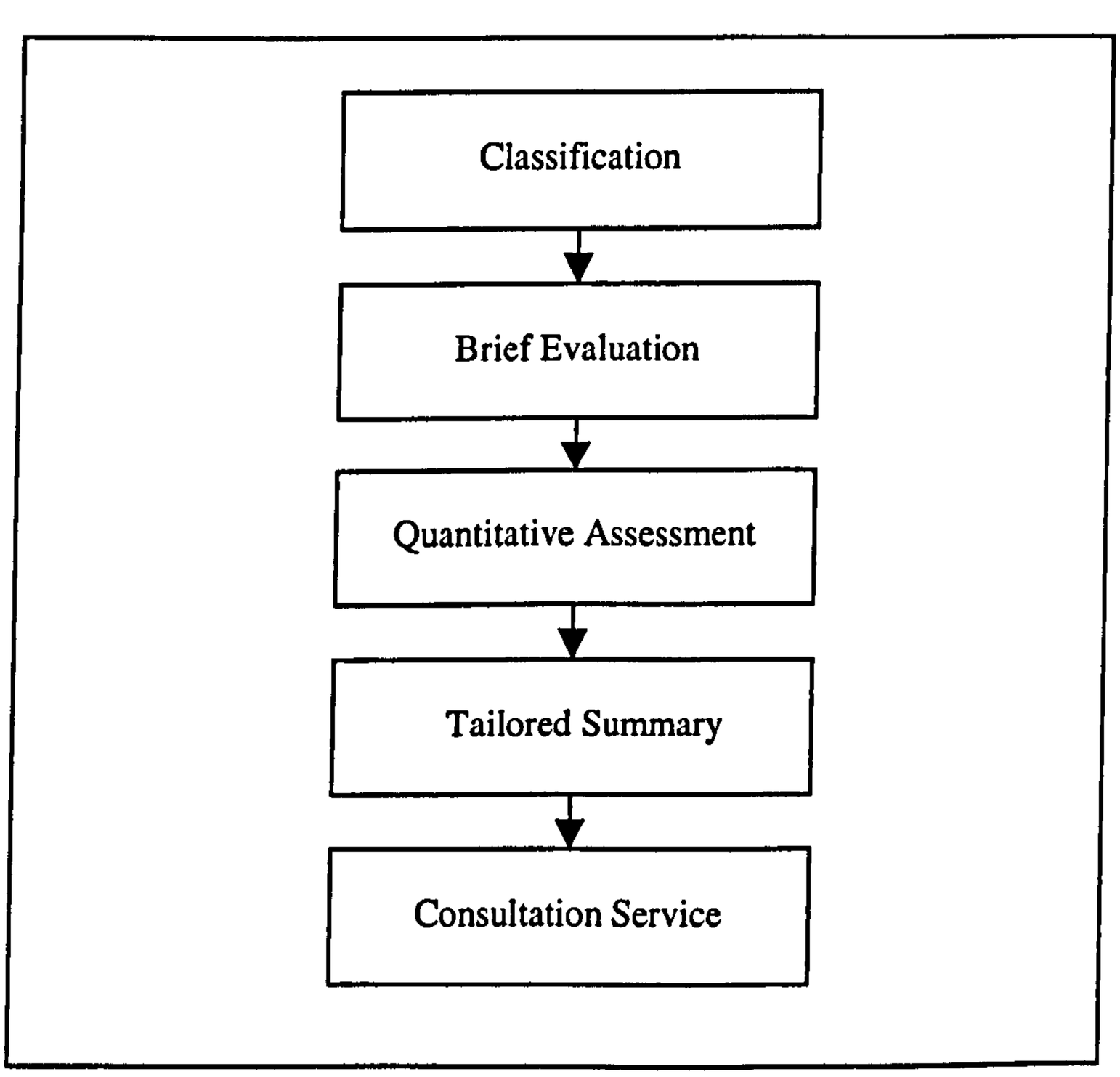


Figure 2.7: Five Phases of CASE Tool Evaluation and Selection (Source: Mosley, 1992)

Phase one of the methodology is compulsory and all, some, or none of the remaining phases are undertaken depending on conditions such as the nature of the evaluation, time and resources available, and the user requirements. The purpose of the first phase is to capture technical information about the tool such as, the platforms supported by the tool, any additional hardware or software requirements, and its function(s). The second phase of the methodology entails constructing a brief evaluation of the tool. This involves identifying how well the tool performs, its strengths and weaknesses, and any other important information about the vendor or product.

The third phase, Quantitative Assessment, enables a detailed evaluation, and if necessary a comparison, of the tool to be conducted. The detailed evaluation is obtained by means of a questionnaire consisting of 140 generic questions and between 30 and 100 tool specific questions. The questions are divided into a number of categories each of which are assigned a weighting. The evaluator works through the questions assigning a score from one to three for each. The scores obtained from each category can then be compared with other tools along with the maximum and median points possible for each category. The purpose of the Tailored Summary phase is to consider the critical and essential points in accordance with the user requirements with the aim of achieving a true interpretation of the scores. The final phase involves identifying the top three tools and presenting them to the users. The users are given an opportunity to experiment with the tool and one tool is selected for implementation.

2.7 Critique of the Tool Evaluation and Selection Literature

In comparison to the availability of guidelines for knowledge management tool evaluation and selection there are a myriad of general guidelines and discipline specific guidelines (Curry and Bonner, 1983; Martin and McClure, 1983; Anderson, 1990; Sharland, 1991; Mosley, 1992; Berryman *et al.*, 1994; McDonald, 1996; Buckleitner, 1999; Dupuy and Leveson, 2000). For the purpose of this research, both types of frameworks were investigated in order to incorporate any useful concepts into the guidelines for knowledge management tools. With regards to the generic guidelines that are designed to be used for the evaluation and selection of any tool, the first and second studies by Curry and Bonner (1983) and Martin and McClure (1983) both provide details of how to go about selecting a tool but it is the responsibility of the evaluator to identify criteria against which to evaluate the tools. The third study by Anderson (1990) provides a list of categories that contain several criteria that can be used to evaluate tools against. Furthermore, there is a provision within the framework for including criteria that are specific to particular tools. However, as with the previous two studies the evaluator decides what criteria will be included in the categories specific to different tools.

Anderson (1990) designs an evaluation framework that is used in combination with five different methodologies, similar to those described by Curry and Bonner (1983) and Martin and McClure (1983) to evaluate a number of tools falling under one of three categories (WordProcessing, Spreadsheet, and Database). The essence of the five techniques presented by Anderson (1990) is to calculate the quality of each tool. This is achieved either by assigning weights to the various categories within the evaluation framework or by ordering the tools according to the assigned ratings. Although it is not

evident from the way the methodologies have been described in this research but it is essential for the evaluator to have some mathematical ability in order to adopt any of the techniques. In Anderson's (1990) study, the methodologies have been expressed in the form of mathematical formulas requiring time and effort to be invested in translating the phases of each method. With regards to the individual method, once they have been understood mathematically, the phases are quite straightforward to implement.

The first technique, the Linear Weighted Attribute, involves calculating the quality using the weights and the rating. However, the decision of the weight allocated to each category is left up to the evaluator to decide. The Linear Assignment framework appears to be the most thorough and rigorous approach. However, due to the necessity of deriving all of the permutations this technique is most suited where the number of tools to be evaluated is low. For instance, four tools were used in the example that resulted in 24 permutations. By simply adding one more tool for evaluation the number of combinations to identify would drastically rise to 120. The three remaining techniques are not so mathematically oriented however none of them can be considered as a robust approach either. Justification for this theory is discussed in the following paragraph.

Maximax involves identifying and listing the tools according to the highest rating received and selecting the one at the top. The shortcoming of this is that if a tool received a high rating for one category but the others were exceptionally low it is likely that this tool will be, if not at the top, somewhere very near to the top of the list. The Elimination By Aspects (EBA) methodology compares each tool against a list of ordered categories and using a minimum performance rating. Although slightly more sophisticated than the previous methodology it is possible for more than one tool to be

identified as the highest quality tool. Furthermore, it is also possible that the 'best' tool is identified after only considering the first criterion without confirming that the tool conforms to the minimum performance rating for the subsequent criteria. The final methodology, Lexicographic Ordering, uses a similar approach to Elimination By Aspects except that the list of criteria ordered according to importance is used to identify the tool(s) with the highest performance rating. The limitation with this methodology is opposite to one from the previous method where it was possible to identify several tools as the best. With Lexicographic Ordering it is possible to result in none of the tools being identified.

The final set of generic guidelines that were investigated were those proposed by Sharland (1991). The Picture Comparison methodology that involves creating a 'picture' of each tool and comparing them. The 'picture' is created using information from brochures, technical manuals and other easily accessible literature. The shortcoming of using this approach is that the resultant 'picture' consists of information provided by the vendor and is likely to be subjective in nature. Furthermore, if a third party review configures within the 'picture' it is difficult to identify whether or not an objective evaluation has been conducted. Following this, the Detailed Evaluation methodology compares each tool against a list of requirements. Again, as with previous approaches, it is left up to the evaluator to determine what evaluation criteria should be used. The third methodology, Implemented Evaluation, entails a tool to be purchased and evaluated until a suitable one can be identified. This obviously is extremely time consuming and requires users to get deeply involved in the process. The final methodology, Package Led Evaluation, is designed for use where the area for which a tool is being sought is relatively new and unknown. The tools themselves are used in order to define and refine

criteria. The limitation of this approach is that it can be extremely time consuming to evaluate numerous tools. Furthermore, the resultant criteria identified can be considered as subjective in nature.

The main purpose of investigating discipline specific guidelines was to identify concepts and ideas that could be used during the design of the knowledge management tool guidelines. The most prevalent difference between the generic guidelines and the discipline specific is the emphasis on a framework against which the features of a tool can be evaluated. For instance, the first study within this section by McDonald (1983) was aimed at selecting a tool for use within primary health care. The design and use of the evaluation framework was described in great detail. However, although the manner in which the tool was obtained was briefly described the existence of an explicit methodology was lacking. With regards to the second study on evaluating and selecting educational software (Berryman *et al.*, 1994) an evaluation framework is presented and the importance of a methodology is acknowledged. However, again no methodology is explicitly described.

The shortcomings of these two studies are that although the provision of an evaluation framework is made, the criteria within these are specific to the type of tool being evaluated. Therefore, the more general aspects of tool evaluation and selection such as costs, support, documentation, etc cannot be evaluated using these frameworks. In order to do so, it would be necessary to adopt another framework designed for this purpose. The final study about guidelines for CASE tools (Mosley, 1992) adopts both a methodology and an evaluation framework. The former is catered specifically for CASE

tools and the latter is predominantly generic. However, a section of the evaluation framework can be adapted to contain criteria specific to the type of tool being evaluated.

Therefore, the guidelines designed as a part of this research for knowledge management tools should be comprehensive in that all aspects, general and specific, of the knowledge management tool can be evaluated. Furthermore, existing guidelines provide either a methodology for the selection of a tool or a framework for the evaluation of a tool. In one case these are combined (Mosley, 1992). Considering that one appears to enhance and support the other a combination of both methodology and evaluation framework would be appropriate.

In addition, referring back to the studies on knowledge management tools described in Sections 2.4.1, 2.4.2, and 2.4.3 of this chapter, it was noticed that all three studies had inadvertently designed a classification system for knowledge management tools. This could be beneficial as part of the guidelines as a way of identifying where in the plethora of knowledge management tools the tool being investigated fits in. Furthermore, with the rapid rate at which new knowledge management tools are entering the software market, a taxonomy would help control and keep track of the various tools. Finally, again the increasing speed of knowledge management tools appearing on the software market indicates that developers are busy designing and implementing knowledge management tools. Therefore, it would be beneficial if they were provided with guidance as to what is actually required by the users of knowledge management tools.

Overall, the guidelines that will be created as a part of this research will be an evaluation framework, a frame of reference, a taxonomy for knowledge management

tools, and requirements for future development of knowledge management tools. The framework will enable the evaluation of knowledge management tools and will consist of general and specific criteria. This will facilitate the evaluation of all aspects of purchasing a knowledge management tool. In relation to the tool evaluation and selection literature previously described the frame of reference can be equated to the methodologies. However, the reasons for referring to it as a frame of reference as opposed to a methodology is that when the term 'methodology' is used it, often refers to a rigid structure which must be followed without any deviation. However, the frame of reference is intended as a descriptive guideline that can be adapted according to an organisation's requirements and therefore has been referred to using more reflective terms. The purpose of the frame of reference will be to aid the selection of a suitable knowledge management tool. The aim of the taxonomy is to provide a classification system for knowledge management tools. The requirements are intended to aid and direct developers in future versions of knowledge management tools.

Although it was previously acknowledged that during a knowledge management initiative the components (culture, business processes, and technology) should receive equal and combined attention it is not possible to cover all of the areas within this research. Therefore, the intention of this research is to focus on the technology component of knowledge management in isolation. However, it would be interesting to see if and how the other components and knowledge management activities have any impact on the technology component when it is investigated in isolation.

2.8 Summary

In summary, this chapter has illustrated that although the area of knowledge management is undefined and confusing, there is some agreement within the literature with regards to the components (culture, business processes, and technology) and activities (generation, organisation, and sharing). The context of this research fits within the technology component of knowledge management, and is related to knowledge management tools. A limited amount of work has been undertaken in this area, and the provision of guidelines for the evaluation and selection of knowledge management tools is non-existent. Although it would be possible to use one of the numerous generic methodologies that exists these are not specific enough to cater for the features present in knowledge management tools. Therefore, discipline specific guidelines were analysed in order to gain an understanding of how they work and how they were designed.

It was evident that guidelines exist in the form of an evaluation framework or a selection methodology, although in one case these were used in combination. Therefore, it was concluded that the guidelines that are developed as a result of this research should consist of an evaluation framework, a frame of reference, a taxonomy, and requirements for future development of knowledge management tools.

Chapter 3.

Empirical Investigation of Knowledge Management Tools

3.1 Introduction

The purpose of this chapter is to demonstrate the empirical investigation of a sample of knowledge management tools. The aim of the evaluation is to identify features that could contribute as potential criteria within the evaluation framework in addition to areas that require further development. The chapter begins by detailing the reasons for conducting empirical evaluation of knowledge management tools. This is followed by a discussion of the tools selected for empirical investigation. Following this is a detailed description of each of the knowledge management tools involved in the empirical investigation. The features that exist in each of the knowledge management tools are identified. Furthermore, a critique of each tool is provided focusing on its strengths and weaknesses. The chapter concludes with a summary providing an overview of the chapter.

3.2 Reasons for Conducting Empirical Investigation

As established in the previous two chapters, Section 1.4 of Chapter 1 (see page 8) and Section 2.7 of Chapter 2 (see pages 55 & 56), one aspect of the guidelines for knowledge management tool evaluation and selection will be a framework that can be used to evaluate knowledge management tools. The evaluation frameworks described in Section 2.6 of the previous chapter (Curry and Bonner, 1983; Anderson, 1990; Mosley, 1992; Berryman *et al.*, 1994; McDonald, 1996) all consist of criteria against which the features of a tool can be evaluated. In some cases, the criteria are divided into categories so that weightings can be applied to the various categories. Therefore, it would appear appropriate to follow suit and develop a framework that consists of categories and criteria.

In order to achieve this it is necessary to identify categories and criteria that are applicable to knowledge management tools. Berryman *et al.*, (1994) accomplished this for a framework designed to evaluate educational software by three different means. Firstly, by analysing the literature in order to identify relevant and important points to consider when evaluating software tools. Secondly, by conducting interviews with educational institutes that have previously been through the process of selecting an educational software tool. Thirdly, by conducting empirical evaluation of the tools. With regards to this research the first was achieved to some extent in Chapter 2. The second approach is described in detail in Chapter 4. The final technique is the focus of this chapter. Therefore, the software market was investigated in order to identify features present in knowledge management tools. The objective was to convert these features into criteria within the evaluation framework.

3.3 Knowledge Management Tools Investigated

The nature of this research entails that numerous knowledge management tools should be investigated in order to produce a comprehensive set of guidelines that would ideally apply to all knowledge management tools. In total, 44 knowledge management tools were investigated, however, due to time constraints it was only possible to conduct detailed investigations of four of the 44 tools. Details of the method of evaluation used for the remaining 40 tools are described in Section 6.3 (see page 177) of Chapter 6. This chapter focuses predominantly on the detailed investigation of four of the knowledge management tools. The tools used by the institutions participating as case studies described in Chapter 4 predominantly determined the choice of the four tools that were investigated in detail. Therefore, the case studies use three of the four knowledge management tools investigated. The fourth tool that is included in the empirical evaluation was selected because a complete copy of the software was available for research purposes along with a full set of user manuals. This is unusual since evaluation copies of software tools usually have a limited access period or limited functionality. Furthermore, it is not common for user manuals to be provided with evaluation copies of tools.

Moreover, as was identified in Section 2.3.2 (see page 20) of the previous chapter, a knowledge management tool should support one or more of the knowledge management activities (Ruggles, 1997; Kramer, 1998; Ferran-Urdaneta, 1999). Therefore, the selection of knowledge management tools for empirical investigation collectively support each of the knowledge management activities. Figure 3.1 illustrates the

knowledge management activities supported by each of the knowledge management tools evaluated within this study.

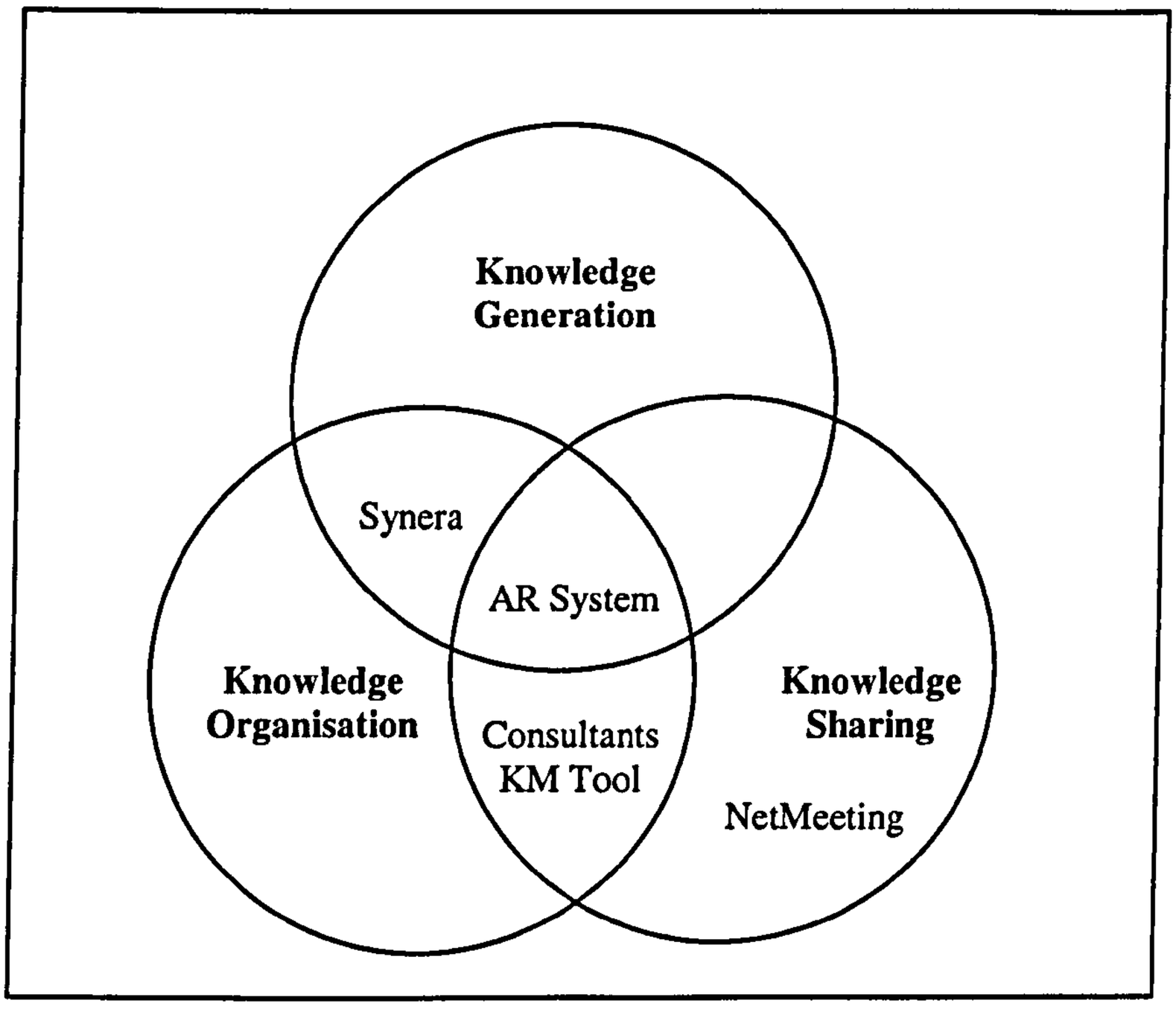


Figure 3.1: Knowledge Management Activities and Evaluated KM Tools

Although the resultant framework is aimed at the evaluation and selection of commercial knowledge management tools, internally developed knowledge management tools have also been included in the empirical investigation. It is natural to question the inclusion of features from internally developed tools if the framework is focused towards the evaluation of commercial knowledge management tools. The reasons underpinning this decision is that knowledge management tools that have been developed internally are likely to contain features that are unavailable in existing commercial knowledge management tools. Therefore, by investigating knowledge management tools that have been developed internally more specific criteria may be included in the evaluation framework. Although these criteria may not be applicable to

the current commercial knowledge management software market as more and newer tools are commercially developed, they are likely to contain such features. Therefore, by including the more specialised features that exist in internally developed knowledge management tools, it is feasible that the evaluation framework will reflect the rapidly evolving software market. Furthermore, although a wide range of software such as, email, word processing packages, etc can be classified as knowledge management tools only those that explicitly claim to be knowledge management tools are considered in this study.

3.4 Tool 1: Synera (The Intelligent Exploration Suite)

During the time of evaluation, this knowledge management tool was marketed as Synera. Since then, although the tool does not appear to have been altered in any manner, Synera has been renamed the Intelligent Exploration Suite. However, for the purpose of this dissertation the tool will be referred to using its original name and the name that was in use when the evaluation was conducted. Furthermore, Synera is not one of the tools that is being used by the case study companies. Synera is a commercial knowledge management tool developed by Synera Systems and can be classified as a knowledge generation and knowledge organisation tool. Knowledge is generated within Synera via the identification of hidden patterns, relationships, trends and associations within a collection of data known as the knowledge base. Synera consists of a suite of programs as illustrated in Figure 3.2.

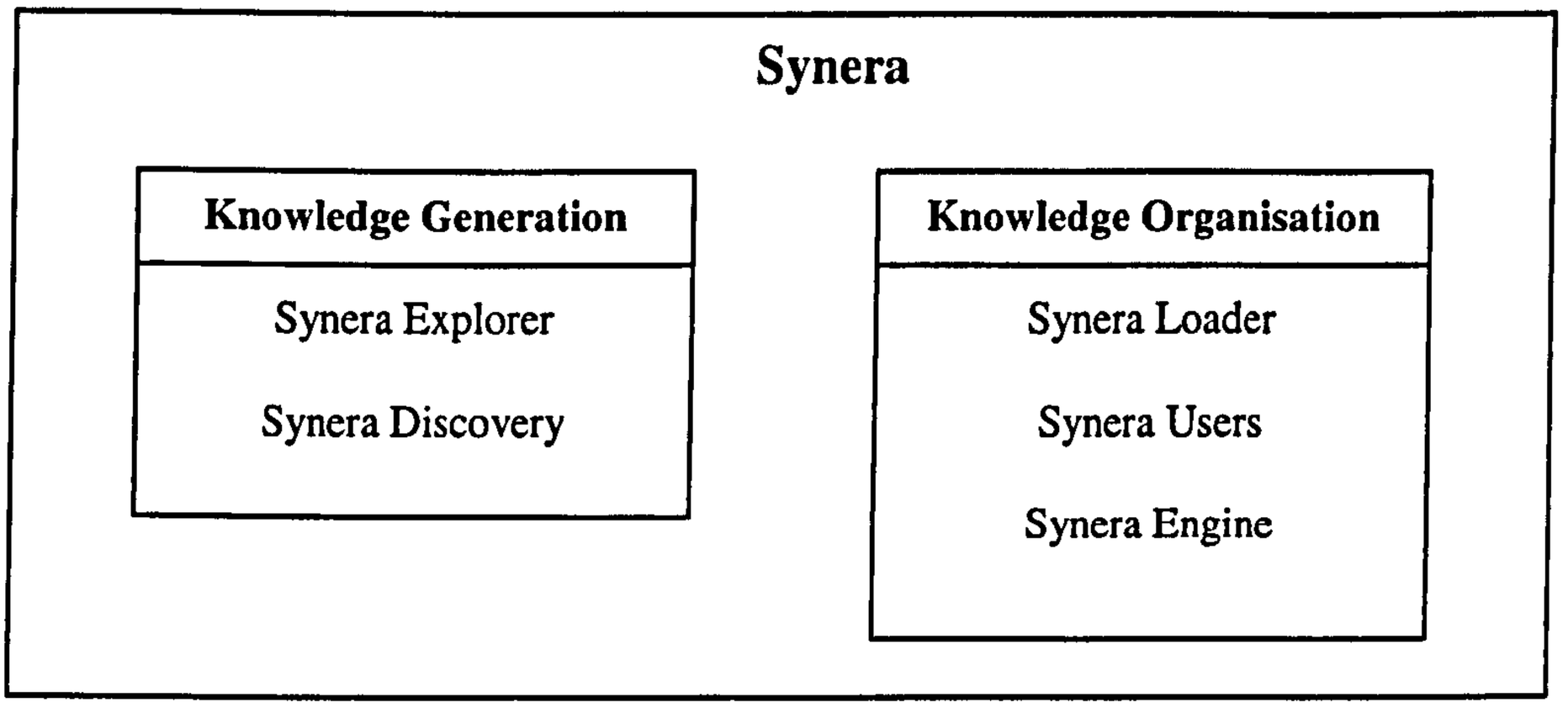


Figure 3.2: Suite of Programs Contained within Synera

Classified under the knowledge generation category are Synera Explorer and Synera Discovery. As the name suggests Synera Explorer can be considered as a vehicle that enables the exploration of data, the manipulation of queries, the creation of reports, and the ability to perform analysis using the knowledge base. Synera Discovery is perceived as the 'real' knowledge generation component of this suite of programs. The main difference between the two is that Synera Discovery has the ability to extract patterns and relationships without the need for posing a hypothesis. This means that the user does not have to be concerned about asking the right questions.

Classified under the knowledge organisation category are Synera Loader, Synera Users, and Synera Engine. The first of the three, Synera Loader, is primarily used for importing data into the knowledge base. The second, Synera Users is a mechanism for defining access to the knowledge base. For instance, for allocating general user or administrator privileges. The third, Synera Engine, is the knowledge base and can be considered as the heart of the suite of programs since all access and retrieval occurs here.

The first step towards using Synera is to ensure that a knowledge base exists so that Synera Explorer and Discovery can access it. This can be achieved in one of two ways: if the knowledge base already exists in another format, such as a Microsoft Access database, then it can be imported into the Synera Engine using the Import facility, or a knowledge base can be created from within the Synera Engine. If the former method is deployed, then the knowledge base can be imported using the Import Wizard allowing the knowledge base to be loaded into the Synera Engine. The file to be imported can be in one of many formats including: text files; Microsoft Access; Microsoft Excel; Fox Pro; Paradox; Dbase; HTML; ODBC; and Lotus 1-2-3.

In order to achieve optimised data storage data is imported vertically, as opposed to the traditional horizontal approach, so that the data can be stored at value level rather than record level. This means that an item of data need only be stored once regardless of the number of relations it is linked to. In order to create a knowledge base within Synera Engine it is simply a matter of entering items and attributes into a dialog box. Unlike traditional database systems the structure does not have to be designed beforehand. Once the knowledge base is in place or has been created it is possible to define users for the knowledge base. Two types of user can be defined, Administrator and User. Administrator privileges allow the manipulation of the knowledge base in anyway and from any angle, it also enables the set-up of users, and, only this level of user has the ability to shutdown the knowledge base. The users are able to view the contents of the knowledge base in addition to inserting data, updating and managing the contents of the knowledge base.

As previously mentioned, the contents of the knowledge base can be accessed via Synera Explorer or Synera Discovery. When the former is loaded the screen is in the form of a Multiple Document Interface (MDI) where the left side of the screen contains the items and the right side by respective attributes. Figure 3.3 illustrates a screenshot of Synera Explorer using a knowledge base about the world.

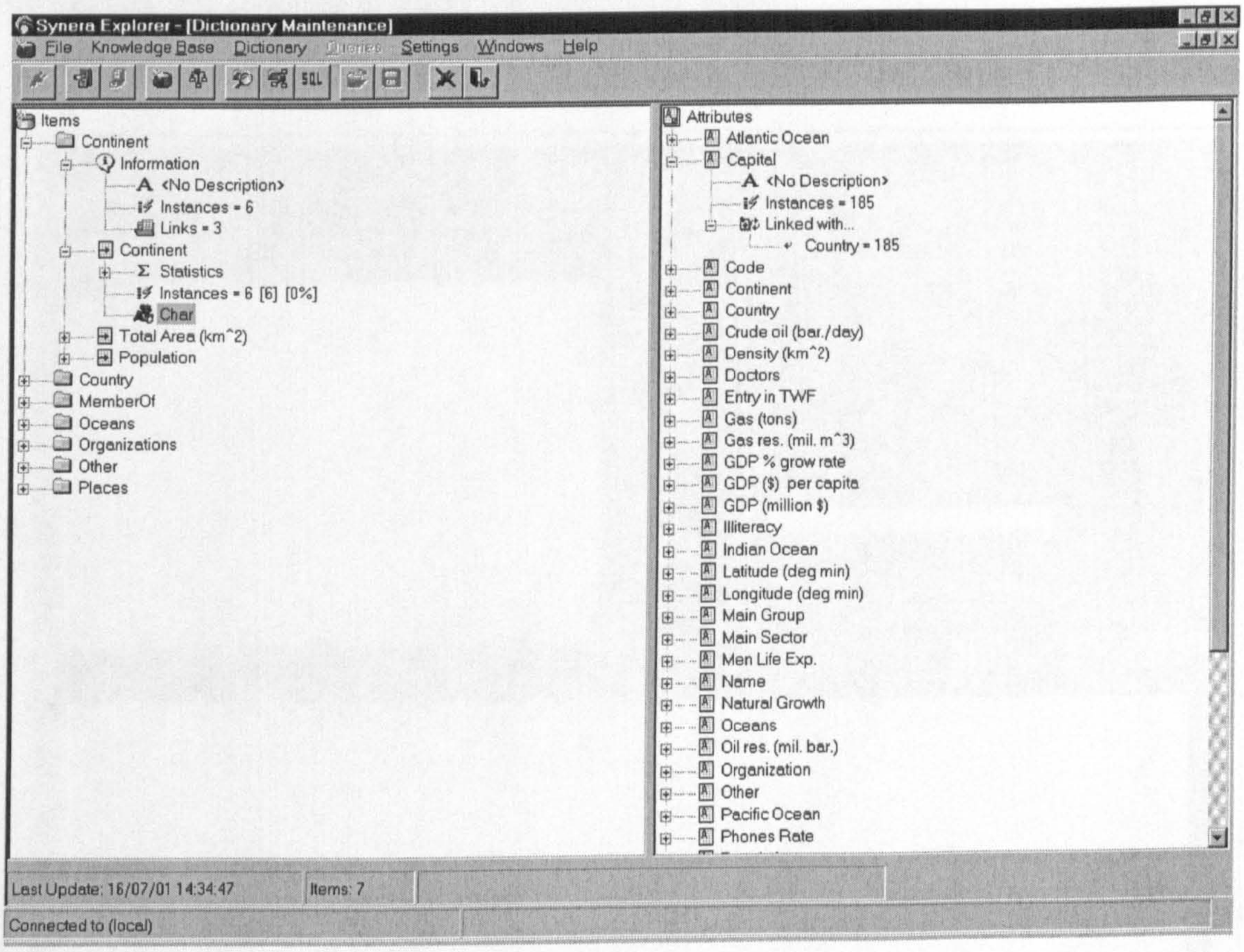


Figure 3.3: Screenshot of Synera Explorer

The items can be thought of as similar to the column names in traditional databases. Therefore, using the world knowledge base example displayed in Figure 3.3 the items include Continent, Country, and Oceans. The item Continent has been expanded and shows that it has six instances and it is linked with three attributes (Continent, Total Population Area, and Population). The attributes are listed separately in another window to the right of the screen. The attribute Capital has been expanded in Figure 3.3 and

shows that there are 185 instances of this particular attribute and it exists within the item Country. Statistics such as frequency of an attribute can be derived from the knowledge base, without the need for posing any queries, by simply selecting the option by clicking the right mouse button. Furthermore, the results can be displayed in both, value format similar to that of an Excel spreadsheet or in graph format. In order to extract further knowledge, it is possible to query the knowledge base.

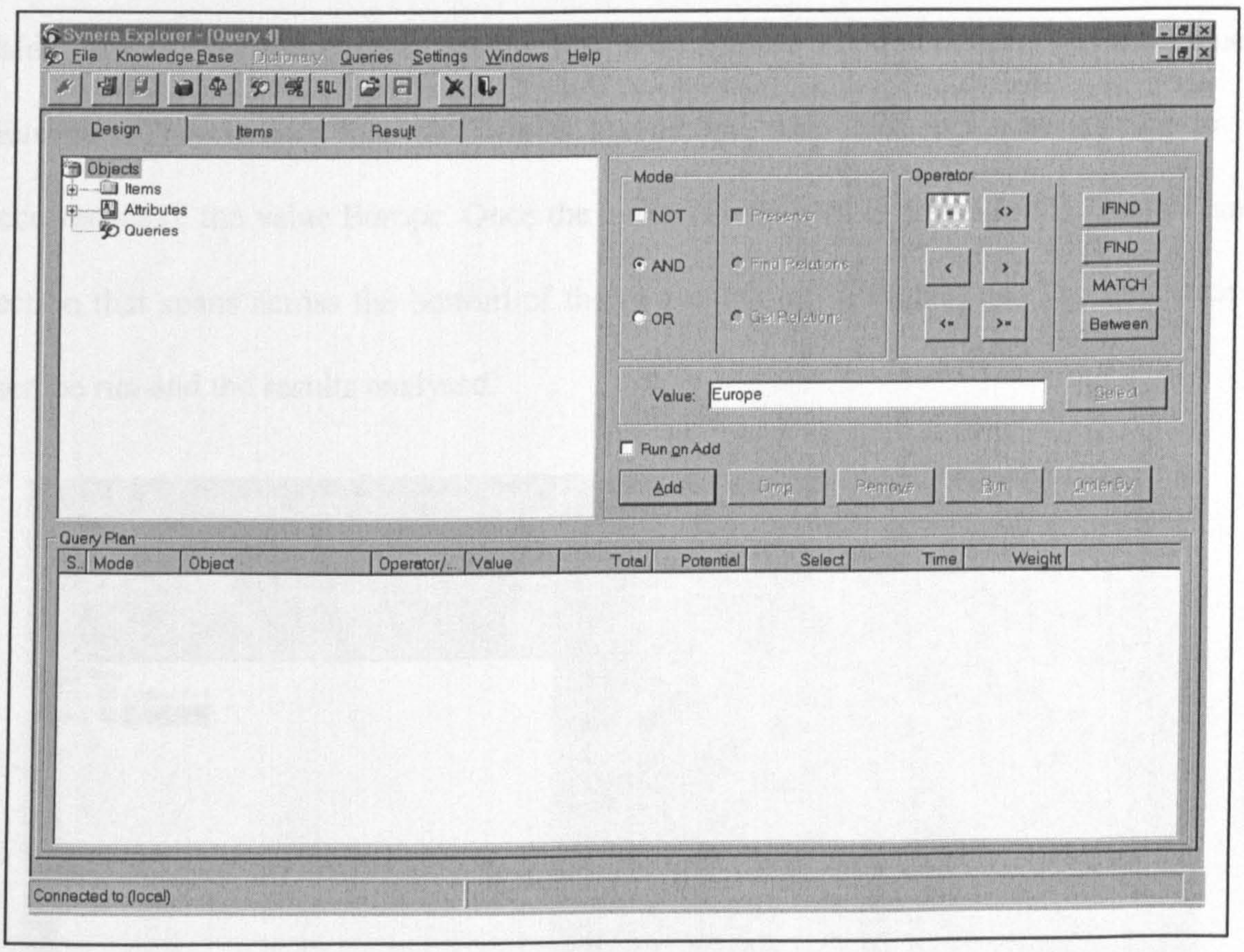


Figure 3.4: Screenshot of a Query within Synera Explorer

The purpose of querying the knowledge base is to identify instances that match certain criteria. The differentiation between queries in a traditional database environment and Synera Explorer is that the latter has the ability to support incremental queries. This

means that a query can be added to any number of times in order to refine and improve it. Furthermore, queries are multithreaded and asynchronous, which means that several queries can be executing at the same time and, other tasks can be performed while a query is being executed respectively. Figure 3.4 demonstrates the structure of a query that has been created from within Synera Explorer. In the top left window Objects has been highlighted, which means that the whole of the knowledge base should be analysed during this query. The window on the top right contains details about the operator and value. In this case the equals operator has been applied in conjunction with the value 'Europe'. This means that the whole knowledge base will be searched for any occurrences of the value Europe. Once the query is created it is added to the Query Plan section that spans across the bottom of the two windows in Figure 3.4. The query can then be run and the results analysed.

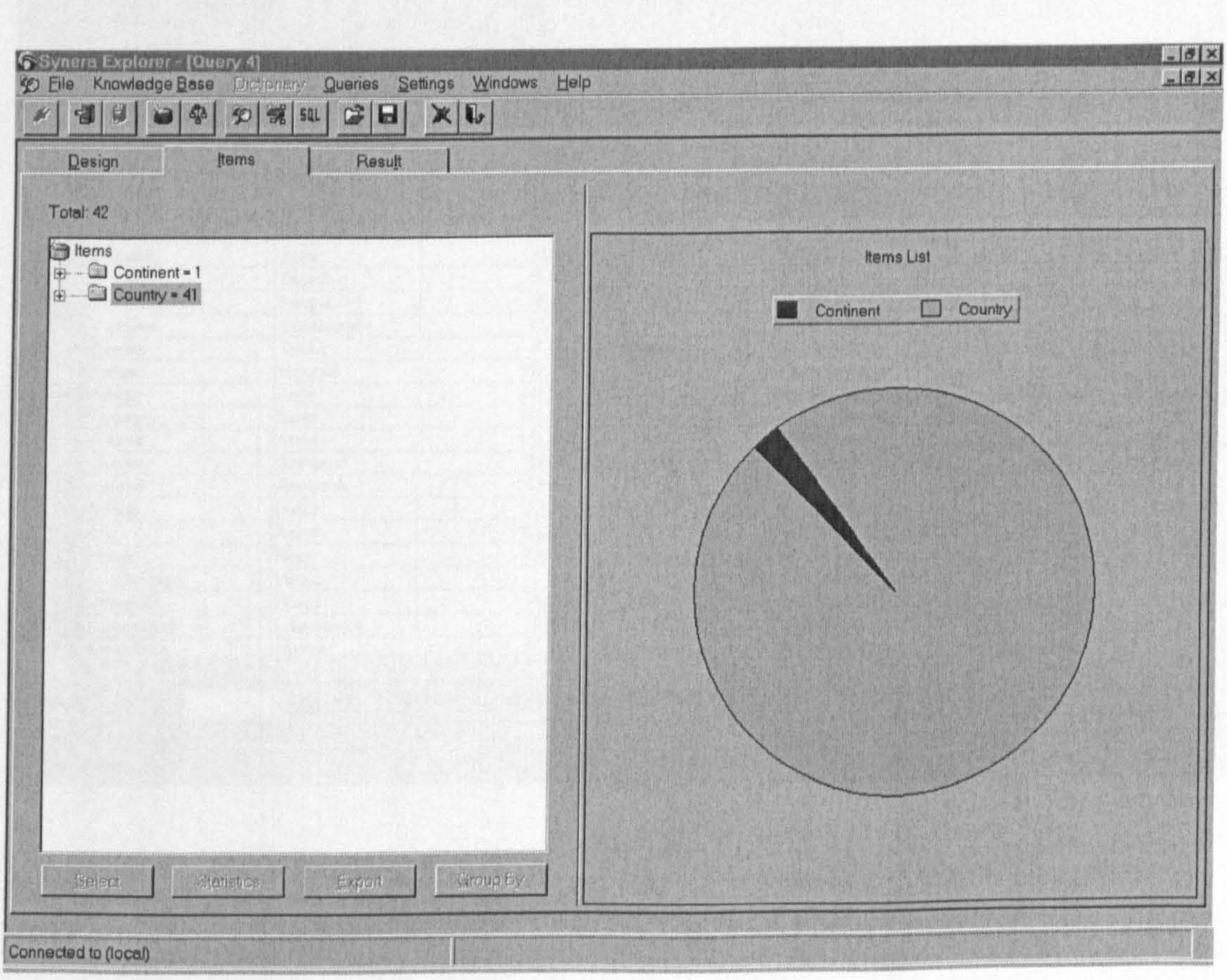
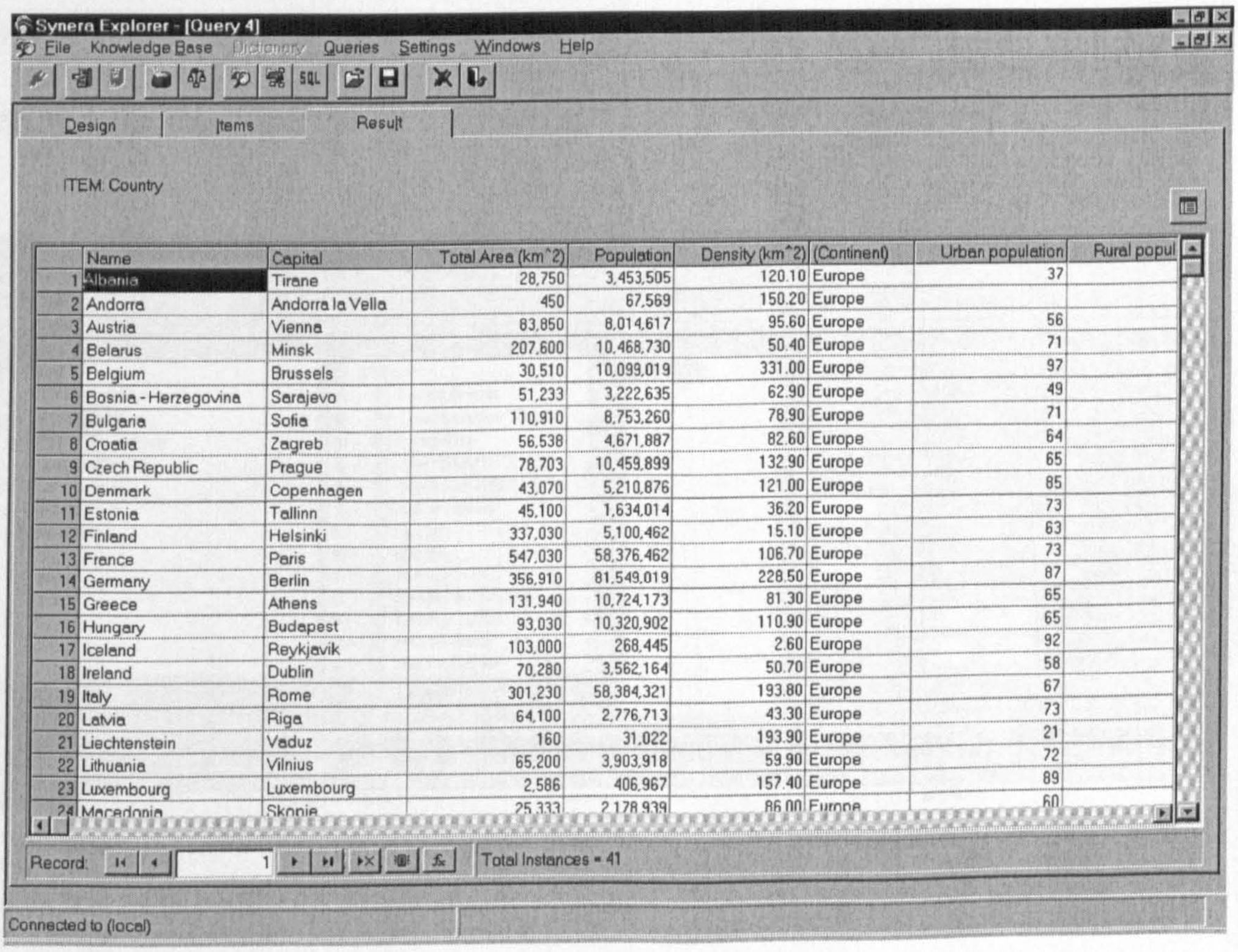


Figure 3.5: Graphical Representation of the Results from a Query

As with the statistics, results from queries can be displayed in value or graph mode as demonstrated in Figure 3.5 and Figure 3.6. Figure 3.5 shows that the item Continent has one instance of the value Europe and the item Country has 41 occurrences. Figure 3.6 displays all of the instances of Country that contain the value Europe. In addition to analysing the results of a query within Synera it is possible to export the results to a file, printer, clipboard, or database. The final facility provided within Synera Explorer is the Analysis Tool that allows the analysis of knowledge difficult to achieve using queries. It works by simply dragging and dropping the relevant items into the analysis tool. Once the analysis is complete the results can be viewed in table format or as a 3-D graph.



	Name	Capital	Total Area (km^2)	Population	Density (km^2)	(Continent)	Urban population	Rural popul
1	Albania	Tirane	28,750	3,453,505	120.10	Europe	37	
2	Andorra	Andorra la Vella	450	67,569	150.20	Europe		
3	Austria	Vienna	83,850	8,014,617	95.60	Europe	56	
4	Belarus	Minsk	207,600	10,468,730	50.40	Europe	71	
5	Belgium	Brussels	30,510	10,099,019	331.00	Europe	97	
6	Bosnia - Herzegovina	Sarajevo	51,233	3,222,635	62.90	Europe	49	
7	Bulgaria	Sofia	110,910	8,753,260	78.90	Europe	71	
8	Croatia	Zagreb	56,538	4,671,887	82.60	Europe	64	
9	Czech Republic	Prague	78,703	10,459,899	132.90	Europe	65	
10	Denmark	Copenhagen	43,070	5,210,876	121.00	Europe	85	
11	Estonia	Tallinn	45,100	1,634,014	36.20	Europe	73	
12	Finland	Helsinki	337,030	5,100,462	15.10	Europe	63	
13	France	Paris	547,030	58,376,462	106.70	Europe	73	
14	Germany	Berlin	356,910	81,549,019	228.50	Europe	87	
15	Greece	Athens	131,940	10,724,173	81.30	Europe	65	
16	Hungary	Budapest	93,030	10,320,902	110.90	Europe	65	
17	Iceland	Reykjavik	103,000	268,445	2.60	Europe	92	
18	Ireland	Dublin	70,280	3,562,164	50.70	Europe	58	
19	Italy	Rome	301,230	58,384,321	193.80	Europe	67	
20	Latvia	Riga	64,100	2,776,713	43.30	Europe	73	
21	Liechtenstein	Vaduz	160	31,022	193.90	Europe	21	
22	Lithuania	Vilnius	65,200	3,903,918	59.90	Europe	72	
23	Luxembourg	Luxembourg	2,586	406,967	157.40	Europe	89	
24	Macedonia	Skopje	25,333	2,178,939	86.00	Europe	60	

Figure 3.6: Tabular Representation of the Results from the Query

The main feature that differentiates Synera Discovery from Synera Explorer is the ability to identify patterns and correlations without the need for a hypothesis. Figure 3.7 illustrates a screenshot of Synera Discovery using the world knowledge base previously described. The top left of the screen displays the items and attributes. The top right displays the analysis window where conditions for knowledge discovery are established. The window underneath displays a summary of the results from the knowledge discovery process. In order to execute the Synera Discovery process it is necessary to set-up appropriate conditions. This is achieved by highlighting the desired item, which also includes any other items the selected item is linked to. In Figure 3.7 the item Country is highlighted as the point from which the discovery will take place. The window on the right is used to specify analysis conditions. Once the conditions are specified, the discovery can be executed and a set of rules is discovered.

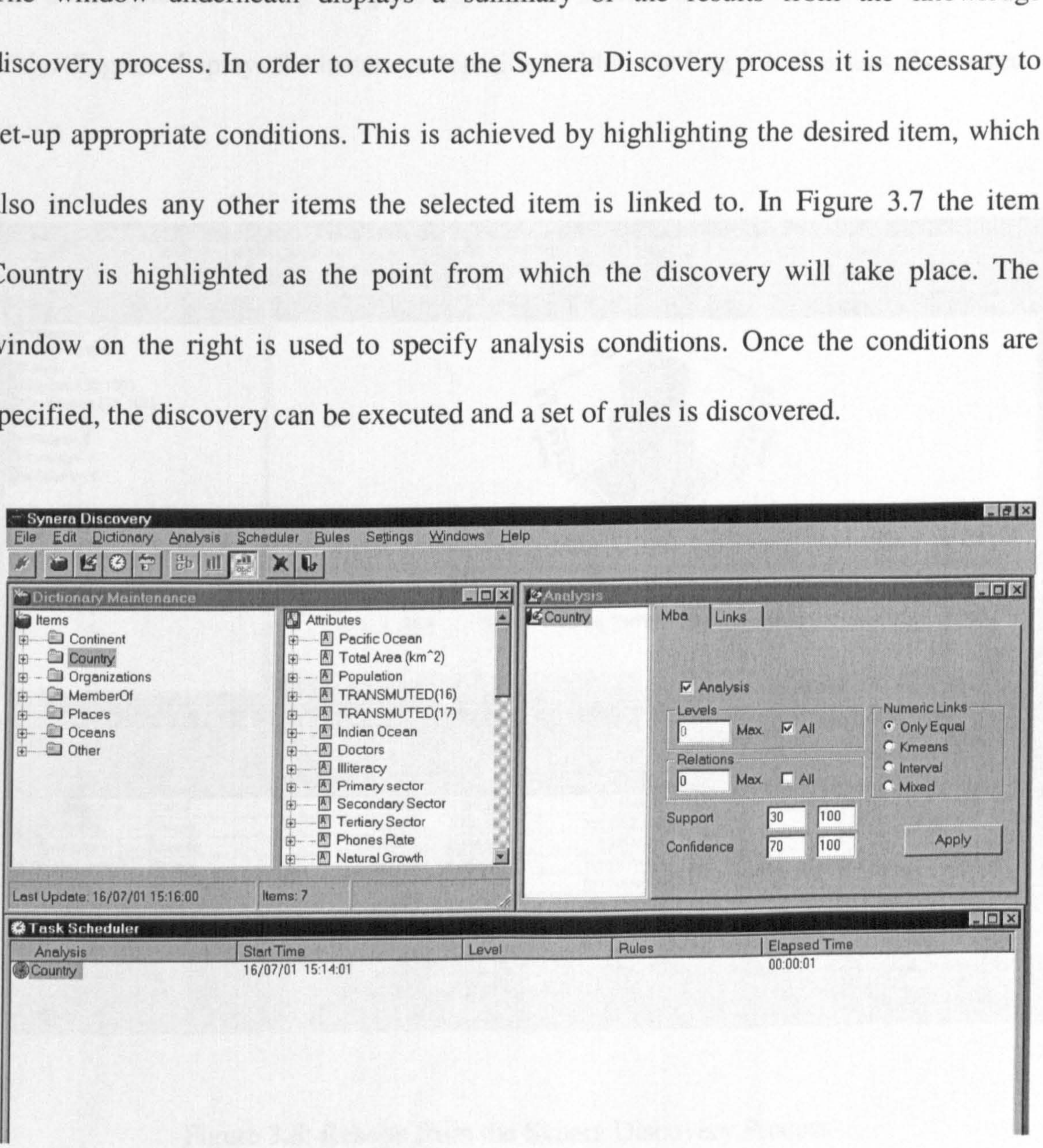


Figure 3.7: Screenshot of Synera Discovery

Having completed the discovery process, it is possible to view the results by right clicking on the item in the Task Scheduler window. Figure 3.8 displays the results from the discovery process. The window on the top right shows a graphical version of the rules identified. These can be explored by selecting the options available by right clicking the mouse. The window below this displays a text version of the rules that can also be analysed further by using the right mouse button. The window at the very bottom of the diagram displays the instances contained within the first rule that was discovered.

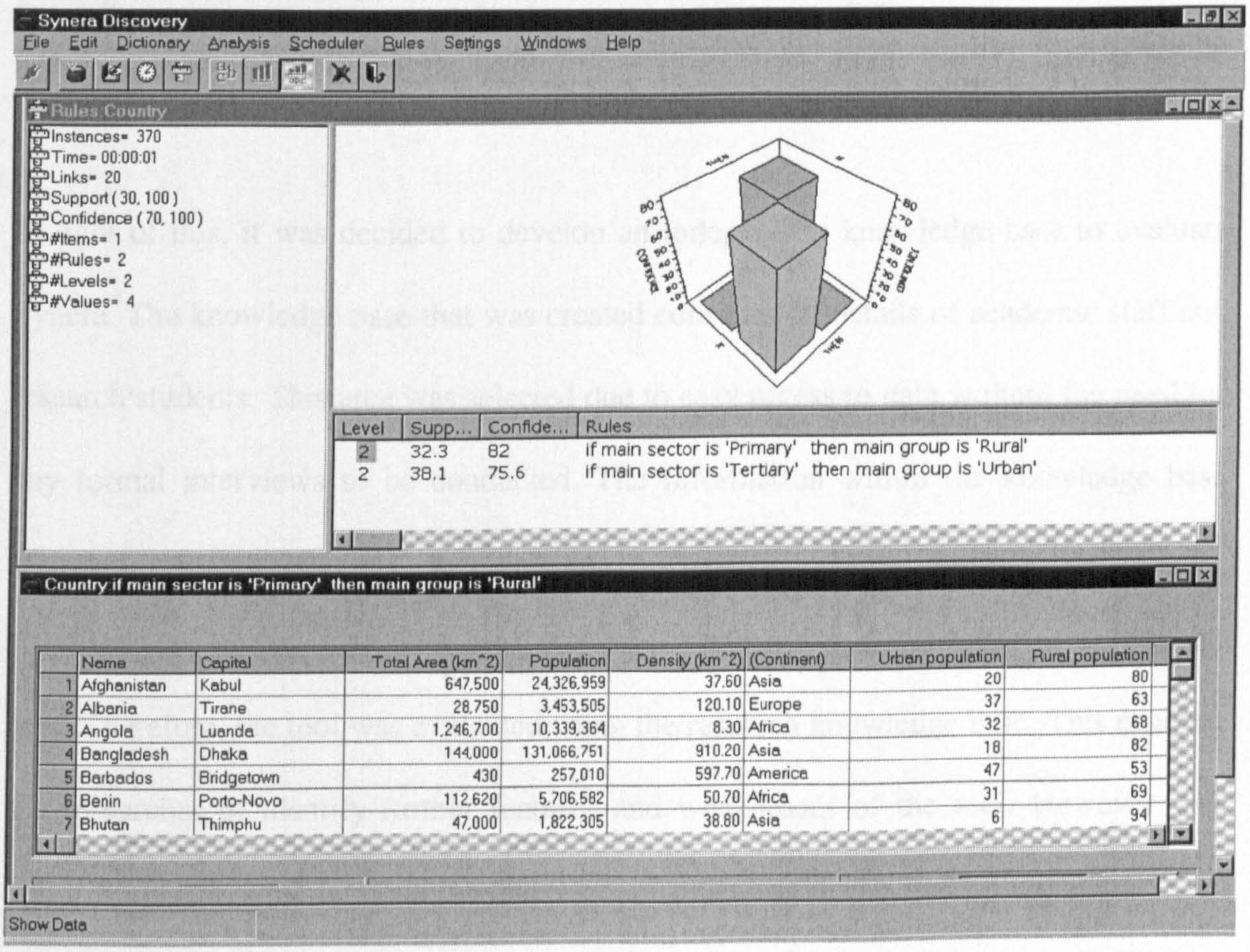


Figure 3.8: Results from the Synera Discovery Process

3.4.1 Features within Synera

In order to learn to use Synera a two-day training session was provided which was attended by the researcher. During this session, details about how to install the tool and make use of its basic functions were demonstrated. Furthermore, as previously mentioned a full set of user manuals was provided with this software, therefore these were used in order to gain an initial understanding of the tool. As the researcher progressed through the user manuals, features of the tool were noted down. However, this did not enable a true reflection of Synera to be obtained since the user manuals were leading the evaluation. Obviously, the user manuals are designed to provide a smooth and error free introduction to the tool.

In light of this, it was decided to develop an independent knowledge base to evaluate Synera. The knowledge base that was created consisted of details of academic staff and research students. This area was selected due to easy access to data without the need for any formal interviews to be conducted. The information within the knowledge base included research interests, membership of research centres, teaching duties, etc. Although not intentional this knowledge base consisted predominantly of text based data. Therefore, the tool was evaluated using the research knowledge base. This enabled the researcher to identify further features and weaknesses of the tool. However, the major finding was the fact that the discovery of rules was only based on numerical data. Table 3.1 summarises the features identified within the Synera suite of programs along with a brief description. Furthermore, the features are divided according to the various components within Synera.

FEATURES	DESCRIPTION
General	
MDI user interface	The tool has a variety of different screens
Language options	The tool can be used in English (US), Spanish, and Catala
Training	Training is provided in order to learn how to use the tool
Users manuals	User manuals are provided with Synera
High learning curve	It takes a long time to learn to use Synera
Client/Server architecture	The client provides user interface capabilities and the server provides data and services between the clients
Personalisation	The ability for the user to define work environment
Explorer	
Querying	The tool enables the contents of the knowledge repository to be queried
Metadata Querying	Queries can be performed using metadata instead of data
Incremental Queries	The ability to add to a query any number of times
Query qualifiers	A query can be conducted with or without qualifiers (item or attribute)
Query values	A query can be conducted with or without values
Asynchronous queries	Other tasks can be performed while a query is running
Multi-threaded queries	Several queries can process at the same time
Analysis Formats	Enables the analysis of results in various formats including: visualising totals, selecting aggregates, changing colours, etc.
Reports	The ability to create professional reports
Graphical results	It is possible to display the results of a query
SQL Statements	Synera supports sub-set of the SQL SELECT commands
Searches based on structure and content	The search facility analyses the structure of the repository as opposed to simply the content
Discovery	
Non-hypothesis based searching	It is not necessary to specify criteria in order to discover knowledge
Discovers patterns, correlations, associations	The discovery process is able to identify patterns, correlations, and associations
Discovery of rules based on numeric data	Rules that are discovered are based on the numerical aspects of the data
Loader	
Import facility	The ability to import data into the knowledge base
Variety of import data formats	Data can be imported in following formats: Microsoft Access, Microsoft Excel, Fox pro, Paradox, Dbase, HTML, ODBC, Lotus 1-2-3
Import wizard	A facility to aid the importing of data
Import fixed text files	Allows fixed text files to be imported
Import delimited text files	Allows delimited text files to be imported
Export items	Synera can export SQL Statements, Statistics, and Analysis results
Export results	Allows results to be exported to file, printer, clipboard, or database
Users	
Define user groups	The ability to define different user groups
Define access levels	The ability to assign various access levels
Supports multiple users	The knowledge base can be accessed by several users at the same time
Engine	
Optimised data storage	Data is stored at value level not record level
Limited administration	A low level of administration is required to support tool
High performance despite size or complexity	Size or complexity of knowledge base does not effect performance
Minimum size knowledge base	The minimum size of the knowledge base must be 12 megabytes
Predefine size of	It is necessary to know the size of the knowledge base beforehand

knowledge base	
Supports structured data	The knowledge repository supports structured data
Facilitates data and metadata	Synera supports two different kinds of information

Table 3.1: Synera Components and Respective Features

3.4.2 Critique of Tool 1: Synera

In essence, Synera was relatively quick and straightforward to install although it takes some time to become accustomed to the various components of the suite of programs. Furthermore, in order to import or create a knowledge base, it is necessary to specify the size of the data spaces required which can be difficult for the novice user even though basic guidelines are provided. Navigating Synera Explorer and Synera Discovery is initially quite confusing and takes some getting used to due to the Multiple Document Interface (MDI). It is difficult to remember which window should be used for a particular purpose. Moreover, if the user wants to pose a specific question it is confusing to know which of the components, querying, analysis, or discovery, is most appropriate and will achieve the best results.

During the use of the querying facility it became apparent that previous knowledge of set theory and the structure of querying was desirable. Furthermore, although Synera facilitates incremental queries (an existing query can be complimented any number of times in order to refine and improve it) it is not possible to remove part of a query that has already been run. Finally, Synera was evaluated using the sample knowledge base provided with the tool and with a knowledge base created by the researcher. The difference between the two is that the former is numerically oriented whereas the latter

is mostly text based. During the discovery process it was determined that rules could only be identified using numeric data. Therefore, the tool is most suited for use with predominantly numerical knowledge bases. With further reference to the discovery of rules within Synera it was noticed that rules could only be discovered based on one item. For instance, the rules discovered in Figure 3.8 are based on the item Country. However, if two or more items needed to be used in order to discover rules this would not be possible.

Another area of Synera that appears unnatural is related to the attributes. In order to add an attribute to an item it is necessary to create a new attribute and then link it to the relevant item. It seems more natural to highlight the item and simply add the attribute and the link is automatically created. The way Synera currently allows attributes to be added it is quite possible that attributes could easily exist without being linked to any items. Furthermore, if the type of an attribute needs to be changed it is necessary to delete it first and then re-create it. Synera would be much more user-friendly if the attribute could be accessed and the type simply changed. Overall, Synera could be a useful and insightful tool but the more experienced user will achieve the best results.

3.5 Tool 2: Consultants KM Tool

The name of the second tool that is empirically investigated is not disclosed due to confidentiality agreements made with the company responsible for the tool. This knowledge management tool has been internally developed for exclusive use by consultants within the company and for the purpose of this dissertation will be referred to as the Consultants KM Tool. The use of this tool within a company is described in

further detail in Section 4.5 of Chapter 4. The aim of the tool is to act as a hub for information about projects, products, consulting procedures and company policies for consultants. Consultants have the ability to add information to the knowledge repository related to the projects they are working on. Therefore, in relation to the knowledge management activities the Consultants KM Tool can be classified as a knowledge organisation and knowledge sharing tool.

Since consultants are predominantly situated at client sites, the tool is accessed via the Internet and is in the form of a website. It is accessed through a Virtual Private Network (VPN) using a series of usernames and passwords in order to provide wide area access with reliable security. Once access to the tool is gained, the consultant is presented with a homepage that has a layout similar to that of the Yahoo directories. Knowledge is classified into various categories such as projects, policies and procedures, training, etc. The consultant can select any of these categories that are linked to further directories and documents. This hierarchical directory structure is familiar to the majority of Internet users making the tool simple and easy to use. Figure 3.9 displays the structure of the directories similar to that of the Consultants KM Tool.

The directories and files can be navigated in two modes; as a Viewer where all files are read-only, and as a Manager where the directories and files can be manipulated and the knowledge repository added to. However, consultants cannot simply change or add to any areas of the knowledge repository that they wish unless they are adding to the area related to a project that they are working on.

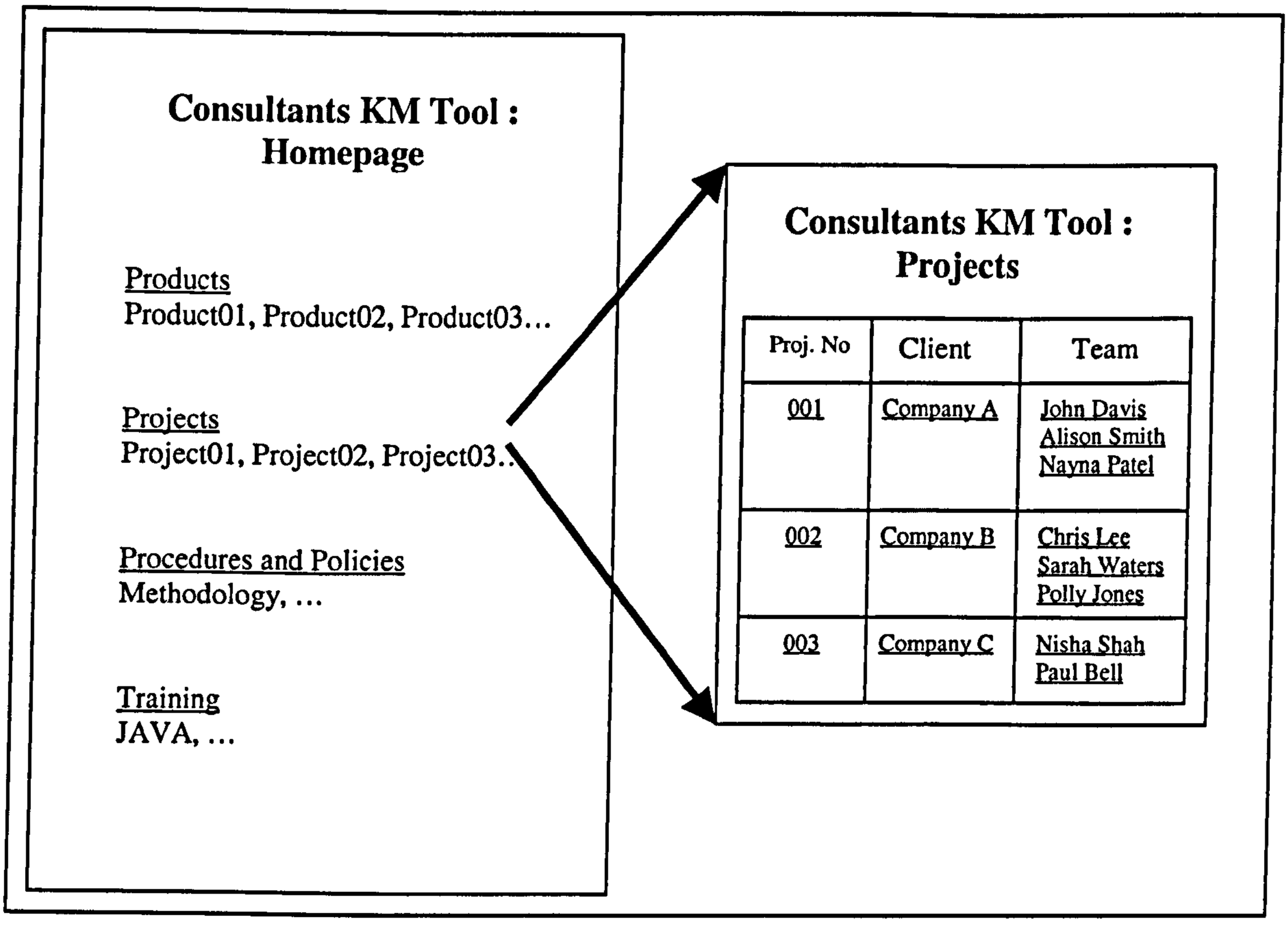


Figure 3.9: Structure of the Consultants KM Tool

Otherwise, all submissions to the knowledge repository must go through a moderating team. In addition to navigating and manipulating the directories, the consultants have a facility for conducting searches and advanced searches on the knowledge repository based on their current position within the website. A search enables a regular keyword search to be performed and the contents of the knowledge repository are analysed for matching occurrences. An advanced search allows the consultant to specify precisely what to search and where to search for it. For instance, if a file related to financial projects needed to be located and the consultant knew that it was in the form of a Power Point presentation. Instead of having to search the whole knowledge repository the advanced feature could be used to search for anything related to 'financial projects'

within the presentations area of the knowledge repository. With regards to projects, the Consultants KM Tool has a more interactive nature providing project-specific discussion groups, information broadcasts, and virtual team rooms where consultants can work together regardless of location.

Discussion groups are useful when a consultant needs a specific question answered and cannot locate an answer within the existing knowledge repository. A question can be posted to a discussion group and any member of the group can provide an answer that can be viewed by all participants. Moderators monitor the discussion groups for common questions and topics and those occurring more frequently are added to the main directory. Another useful facility for making an announcement to a number of consultants simultaneously is the broadcast feature that delivers messages via email. The third interactive feature, the virtual team rooms, is a closed-discussion group to enable a dispersed group with related aims to have a place to discuss something asynchronously. Finally, the Consultants KM Tool has a tracking facility that monitors the usage of the tool in terms of areas visited and accessed by each consultant.

3.5.1 Features within the Consultants KM Tool

Since this tool is not a commercial knowledge management tool but was developed internally access for evaluation purposes was limited. A username and password controlled access to the tool and therefore the researcher was required to conduct the empirical evaluation at the company site. User manuals were not available with the tool and empirical investigation was of a more explorative nature. The links to all the various areas of the tool were investigated and any features identified were recorded. A

summary of the features along with a description from the Consultants KM tool is displayed in Table 3.2.

FEATURES	DESCRIPTION
Designed for specific use	The tool is designed for exclusive use by consultants.
Search Engine Interface	The display of the screens are similar to that of an Internet search engine
Internet Platform	The tool runs on the Internet
On-line help with tool	An on-line help facility is provided with the tool
Usage tracking	The tool has a facility that monitors activity within the tool
Directory storage	The knowledge repository is organised in a directory fashion
Varying access modes	The knowledge repository can be viewed either in read-only or manager mode where the latter has complete manipulation access
Variety of document formats	Knowledge repository contains various formats of documents e.g. Word, Power Point, Spreadsheets, source code, and video files
Search facility	The ability to search the knowledge repository
Advanced search facility	The ability to conduct an advanced search
Discussions groups	Enables an open discussion to take place
Broadcasting	A facility for making announcements
Virtual team rooms	Enables a team to work in a closed-group

Table 3.2: Features Derived from the Consultants KM Tool

3.5.2 Critique of Tool 2: Consultants KM Tool

Overall, the tool is easily accessed so long as the correct username and password are used. The interface is simple in design and easy to navigate because of its similarity to the layout of the Yahoo search engine and websites in general. Furthermore, directories and documents are effortlessly accessed by simply clicking on the relevant links. The one area of the Consultants KM Tool that can be improved is related to the usage tracking facility. Currently the tool has a feature that collates data about the areas of the website accessed by each consultant. However, other than analysing usage this data is not used for any specific purpose. It is suggested that this data could be exploited by informing consultants of new material related to areas that they have shown an interest in being added to the website. For instance, if the usage data demonstrates that a consultant has been frequently viewing the area representing training courses then when

details of a new training course are added to the website the consultant could be informed of this via an email containing a link to the relevant page. This feature would be useful because it would save the consultant from having to constantly analyse the website searching for information about future training courses taking place.

3.6 Tool 3: NetMeeting

The third tool is a commercial knowledge management tool for the purpose of knowledge sharing and is a free product developed by Microsoft. As with the previous tool, NetMeeting is also used by one of the case studies. The aim of NetMeeting is to enhance real-time collaboration between groups without the need for being in the same location, saving time and travelling costs. This is achieved through the provision of a number of facilities including a text chat, video and audio conferencing, whiteboard, file transfer, program sharing, advanced calling, Internet directory, and remote desktop sharing. When NetMeeting is loaded a screen is displayed similar to the one demonstrated in Figure 3.10 that shows a video conference taking place.

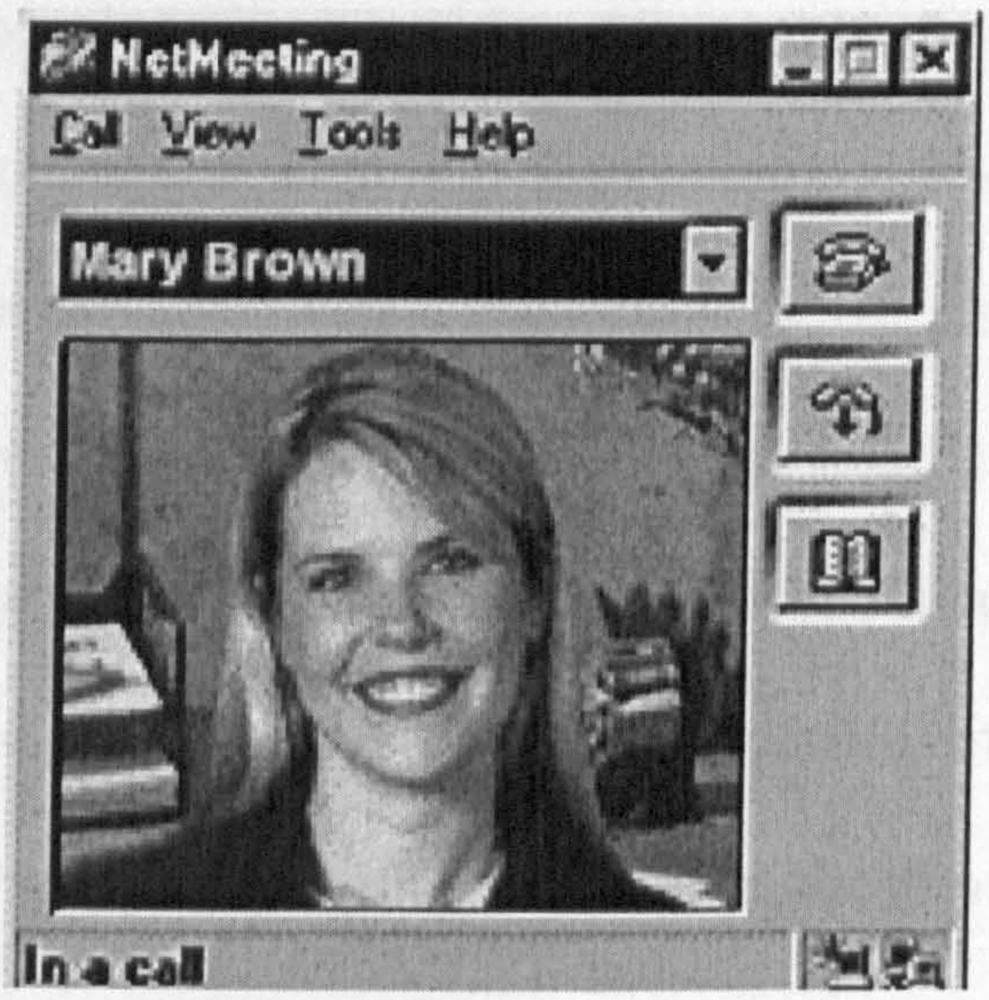


Figure 3.10: Screenshot of NetMeeting Interface (Microsoft, 2001)

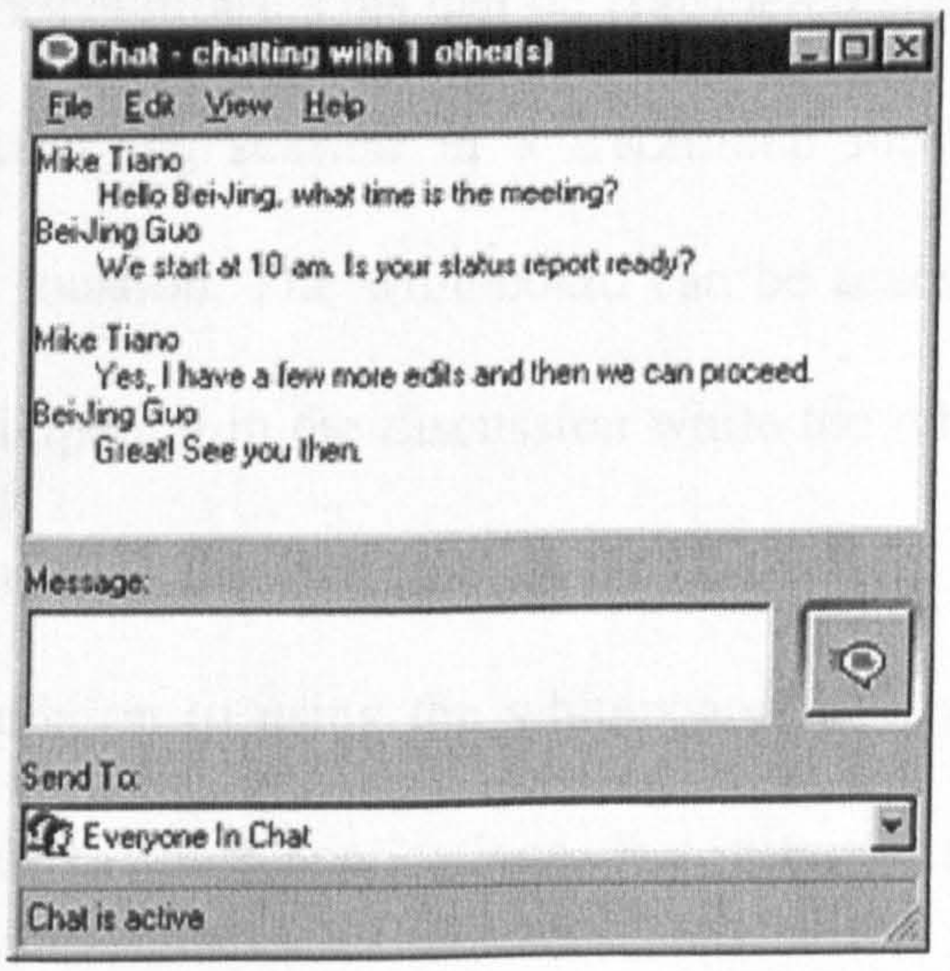


Figure 3.11: Screenshot of Chat Interface (Microsoft, 2001)

From this screen, it is possible to invoke a number of the features previously described. The chat facility enables a text-based discussion to take place between two or more people. Again, the interface for this is extremely simple and intuitive, text is entered into a message box the contents of which can only be viewed by the sender. Once they are satisfied with their message, they deliver the text to the main window by selecting the chat icon to the right of the message box. The message can now be seen by all of the people involved in the discussion. In order to maintain a record of the conversation that takes place the contents of the discussion can be saved to a file or printed. The chat facility can be used on its own or in conjunction with one of the other features. For instance, if the whiteboard facility was being used to demonstrate a diagram, then the chat feature could be used to describe the diagram or for people to ask questions if they require further explanations. An example of the Chat facility is provided in Figure 3.11.

The interface of the whiteboard facility is similar to that of Microsoft Paint as can be seen in Figure 3.12. The purpose of the whiteboard feature is to enable a group of people to work together using graphical representations. This can be considered similar to the use of a flip-chart during a brainstorming session in a traditional meeting environment where everyone is at the same location. The whiteboard can be accessed and edited by any member of the group participating in the discussion while the others can view what is being done. Furthermore, as with the chat session the contents of the whiteboard can be saved for later use. In addition to using the whiteboard facility to share graphical information it is also possible to share applications. For instance, if a member from a project team wanted opinions from the other people working on the project about a requirements document they had written in Word then this could be

achieved using the Program Sharing facility within NetMeeting. This facility is invoked by simply selecting the relevant icon from the main window and entering the name of the program to share. The owner of the document has exclusive control although control can be granted to any member of the project team who requests it. Therefore, one of the project team members may feel that a number of requirements have not been included within the document so the owner passes control of the document over to them and they are able to add the additional requirements while others can view what is being done. Figure 3.13 illustrates an example of a program being shared within NetMeeting.

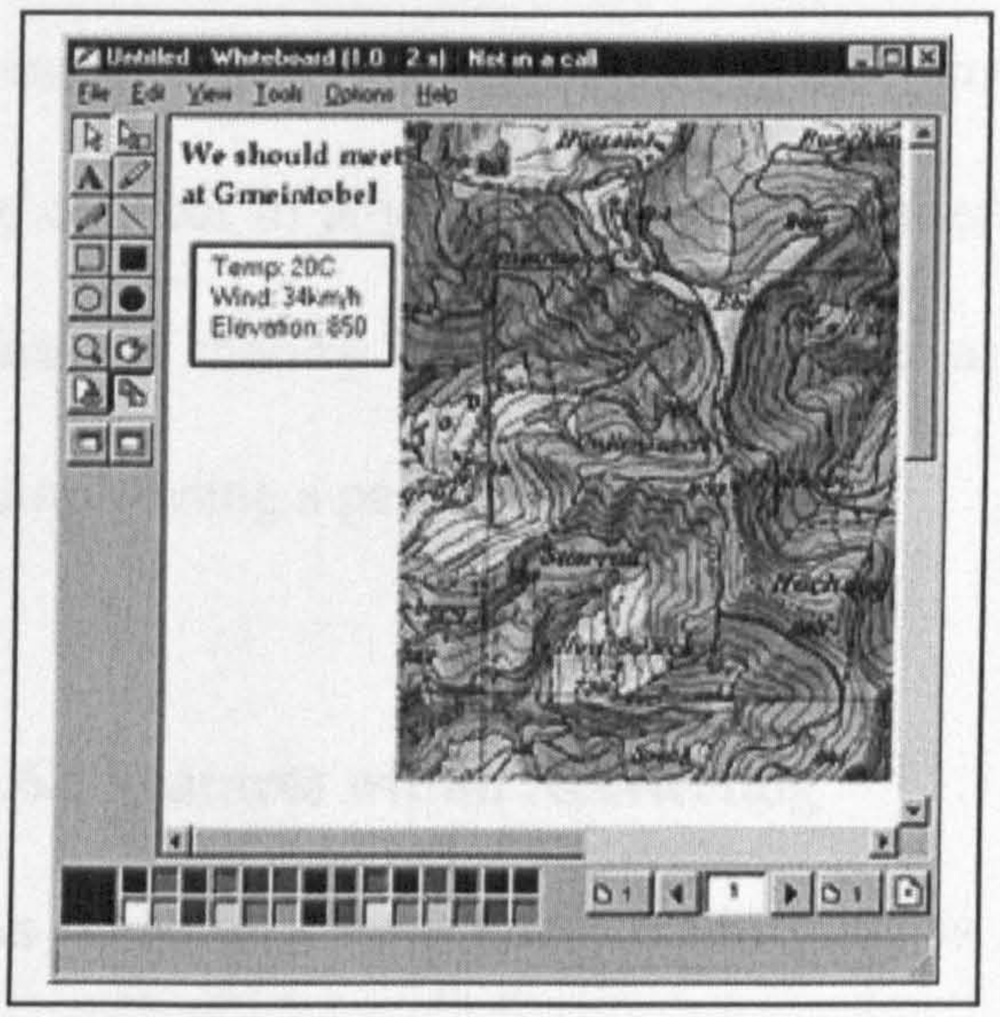


Figure 3.12: Example of the Whiteboard Facility (Microsoft, 2001)

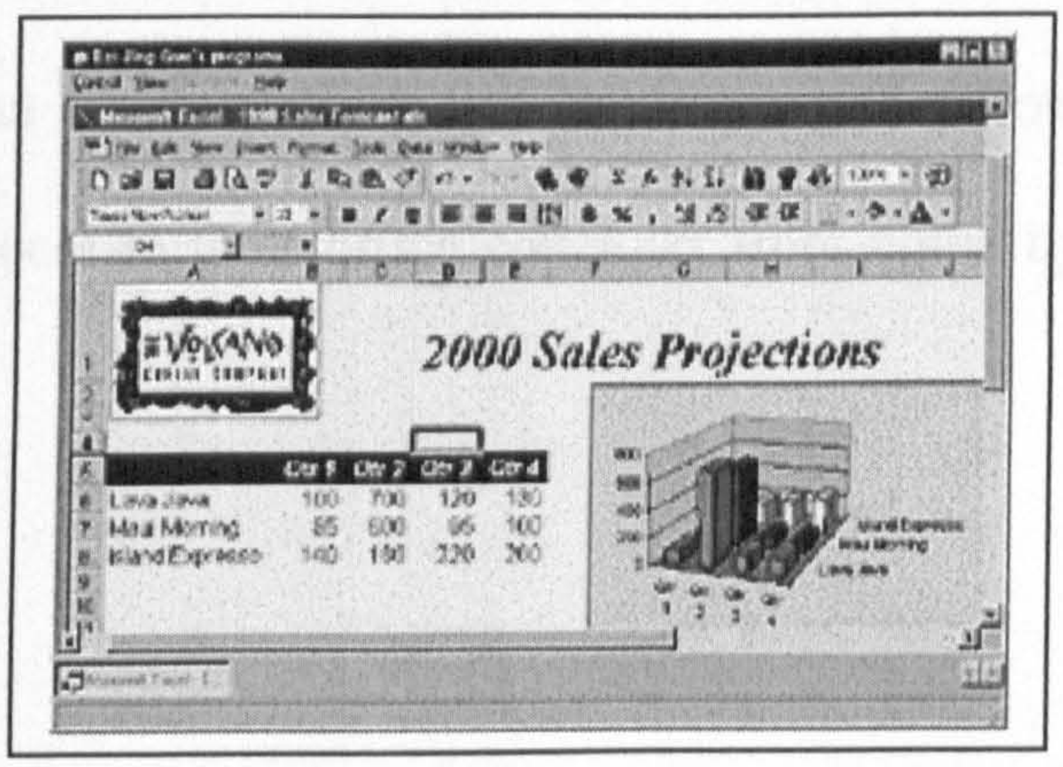


Figure 3.13: Program Sharing within NetMeeting (Microsoft, 2001)

In addition to being able to share programs within the NetMeeting environment it is also possible to send files to one another within the group. The traditional method of achieving this is via an attachment to an email. This facility has been provided so that while a meeting is taking place, perhaps via the chat facility, somebody indicates that

they have a document that is relevant to what they are discussing. The other people participating in the discussion request that they be sent this document. Normally, this would have to be fulfilled once the meeting is finished. However, using the File Transfer facility provided within NetMeeting this can be done whilst the meeting is taking place. This feature is executed similar to the others, by clicking on the relevant icon. In order to enhance meetings NetMeeting provides a video and audio feature where it is possible to view and hear the person that you are talking to. However, in order to exploit the video feature it is necessary to have a camera although if this is not the case it is still possible to speak to and hear another person even though it is not possible to see them. NetMeeting also provides an Internet Directory making it possible to connect to anyone listed. Another useful feature provided by NetMeeting is remote desktop sharing which allows the user access to their office computer from home by simply using a password.

3.6.1 Features within NetMeeting

As previously mentioned, NetMeeting is available free of charge from the Microsoft website (Microsoft, 2001). Therefore, no restrictions were placed on the period of time that empirical investigation could take place. Similarly to the Consultants KM Tool, described in Section 3.5, no user manuals were provided and therefore the tool predominantly controlled the evaluation. However, the on-line help facility and Microsoft website (Microsoft, 2001) were useful for providing guidance where necessary. The features identified within NetMeeting are demonstrated in Table 3.3 along with a brief description.

FEATURES	DESCRIPTION
Free of charge	The tool is available free of charge
Text chat	The ability to chat via text
Video conferencing	The ability to view the other person involved in the meeting
Audio conferencing	The ability to hear the people involved in the meeting
Whiteboard	The ability to share a graphical representation between a group of people
File transfer	The ability to transfer a file between people
Program sharing	The ability for a group of people to share an application or program
Internet directory	Provides access to other people using NetMeeting
Remote desktop sharing	The ability to access desktop remotely
Intuitive interface	NetMeeting is simple and easy to use
Record of chat	The ability to save and print the contents of a chat session
On-line help	NetMeeting has an on-line help facility
Website	Assistance and further information may also be accessed via a website
MDI Interface	Multiple document interface means that the various features, chat, whiteboard, etc can be used simultaneously.
Record of whiteboard	The ability to save the contents of whiteboard for later use
Owner controlled	The owner of a shared document has ultimate control with regards to access
Shared control	Control of meeting can be swapped any number of times during a meeting so long as the owner grants it

Table 3.3: Features Derived from NetMeeting

3.6.2 Critique of Tool 3: NetMeeting

Overall, NetMeeting is simple to download and use with the majority of features invoked by simply clicking an icon. The only features that may require further investigation is video conferencing and the Internet Directory. The former is restrictive in that only one person can be viewed via the video facility at any one time. This means that if a meeting is taking place between more than two people, then it is not possible to view everyone. With regards to the Internet Directory feature, there appears to be the risk of unwelcome attention since anyone is able to contact you. However, it must also be pointed out that during the installation it is possible to opt for not being listed in the directory.

3.7 Tool 4: Action Request System (AR System)

Action Request System (AR System) is a commercial knowledge management tool developed by Remedy Corporation and has been designed for exclusive use by IT Helpdesks. This tool is also used by one of the case study companies described in Section 4.4 of Chapter 4. The aim of the tool is to manage information about submitted requests and to enable their tracking. Furthermore, users can access solutions to previously submitted requests saving the Helpdesk from having to repeatedly provide the same solution to the same problems over and over again. AR System is accessed via one of three available modes: requester, support, or management. As the name suggests the requester mode enables a request to be submitted. The support mode facilitates the viewing and manipulation of submitted requests along with the submission of possible solutions to requests. The management mode enables the approval of solutions as well as the generation of reports.

When AR System is accessed using the requester mode three options are presented on the screen: one for submitting a new request, another for checking the status of a previously submitted request, and the third for completing a survey expressing the requester's satisfaction of the handling of the request. When the first option, submitting a new request, is selected a form is displayed where the priority of the request must be specified from low, medium, high, or urgent. The type of request must then be identified either from the predefined set of options or if none of these match then a new request summary can be entered. If the former method is deployed then further details of the request is automatically displayed otherwise the requester must enter additional details.

Once these details are established a date must be entered to indicate when the request must be fulfilled by. If a request, for which a solution already exists, is entered then a 'Solution Available' button is highlighted and the requester can select this to view details about how to solve the problem. Furthermore, instructions about what to do if this solution does not rectify the problem are also provided along with information about the person whom initially submitted the solution. Once a request has been set-up it can be submitted to the Helpdesk by selecting the 'save' button. Figure 3.14 illustrates the screen for submitting a request.

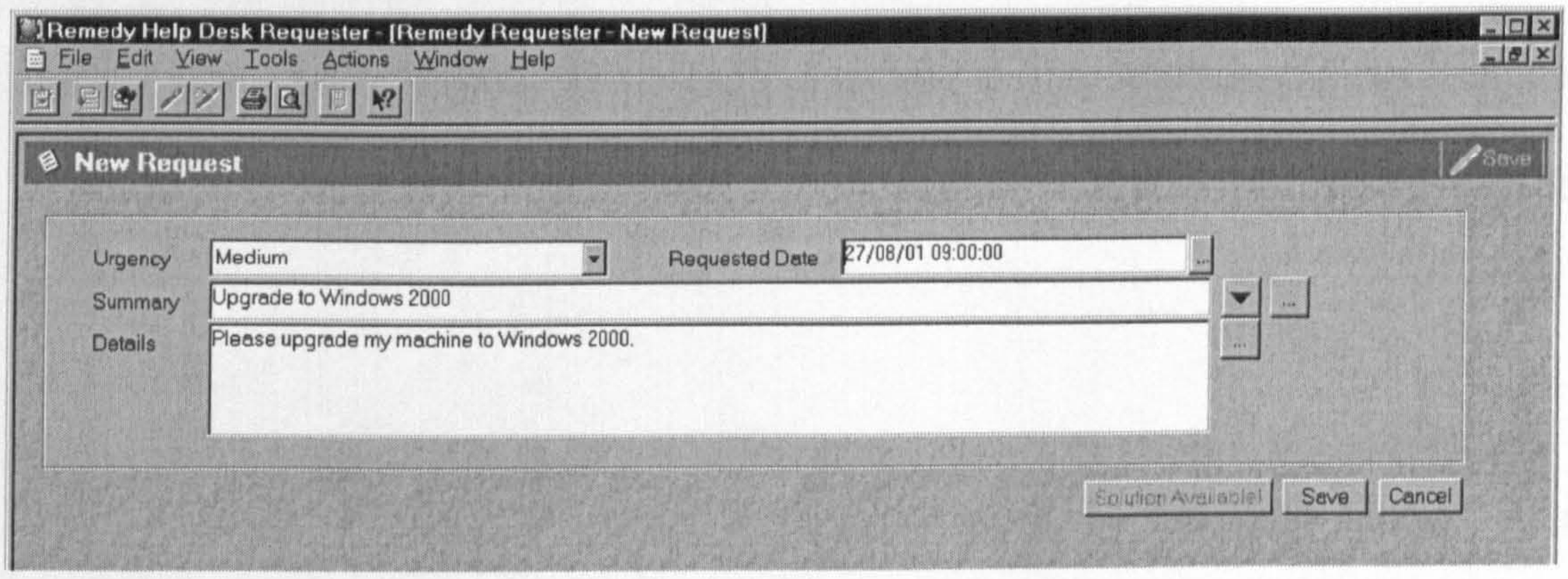


Figure 3.14: Submitting a Request

Confirmation of the request is sent back to the requester along with details regarding the classification assigned and a unique identification number for reference purposes. The request can be defined either as a change request or helpdesk request. If the former is assigned then the reference number has the letters CH prefixed to it, if the latter is allocated then the letters HD are placed before the reference number. A helpdesk request simply refers to request for a new service, hardware or facility. A change request refers a request for a change to an already existing service, hardware or facility.

Subsequent to a request being submitted it is possible for the requester to check the progress of the request using the second option button. The advantage of this feature is that the requester does not have to call the Helpdesk when they require an update on their request. When the 'Check Status' button is selected all of the requests that have currently been submitted are displayed in a list along with a short description of the request, its current status, and the name of the support person handling the request. In order for the requester to view their request it is necessary to scroll down the list and locate the appropriate reference number. Once the relevant request is highlighted it is possible to view further information by selecting the 'Details' button. The final option within the Requesters view is the survey button that is used by requesters to complete a questionnaire detailing their satisfaction of the manner in which the request was dealt with.

When the AR System is accessed using the Support mode, the main screen displays several options including: New Request; Search for Request; Bulletin Board; Reporting; and Track Assets along with a list of requests currently in the system. When the first option is selected two further choices are offered enabling the support staff to specify whether the new request should be classified as a Helpdesk or a Change case. In general, the two screens are predominantly the same apart from the latter, which contains additional details about the person/group assigned to the case. The support staff completes the details and submits the form similar to the manner described in the requester's mode. Once the request has been submitted confirmation is returned detailing the name of the group dealing with the request.

The second option, 'Search for Request' is a feature that allows the support staff to locate a request using a number of different keywords or a combination of keywords. As with the previous option, if this option is selected then the support staff must decide whether the request to be searched for is a change request or a helpdesk request. Depending on the selected option, a blank screen is displayed where the support staff can enter search criteria such as request reference number, category, type, etc. The matching record(s) are displayed in tabular format at the top of the screen with further details of the highlighted entry along the bottom of the screen. The third facility is the Bulletin Board that enables support staff to broadcast messages and alert employees of critical situations. Support staff can add messages, delete messages, and view details of already listed messages. Although unlikely to be of any great use to an individual member of support staff option four enables the production of reports similar to the one displayed in Figure 3.15.

In order to create a report it is necessary to select an area from which to report from e.g. Helpdesk Cases, Helpdesk Satisfaction, Asset Information, etc. The example illustrated in Figure 3.15 uses Helpdesk Cases as the area to report from. Once the area has been established it is necessary to select precisely what information to report on. The options available are specific to each of the areas. For the example used in Figure 3.15, the information that is being reported is the volume of open requests assigned to each of the support staff. The final option in the support mode is the Track Assets facility that enables the management of asset information. Again, this feature is likely to be of most use to a manager. This would enable the capture of information such as the number of

requests passing through the system, the speed at which these are dealt with, and past and present issues that have occurred.

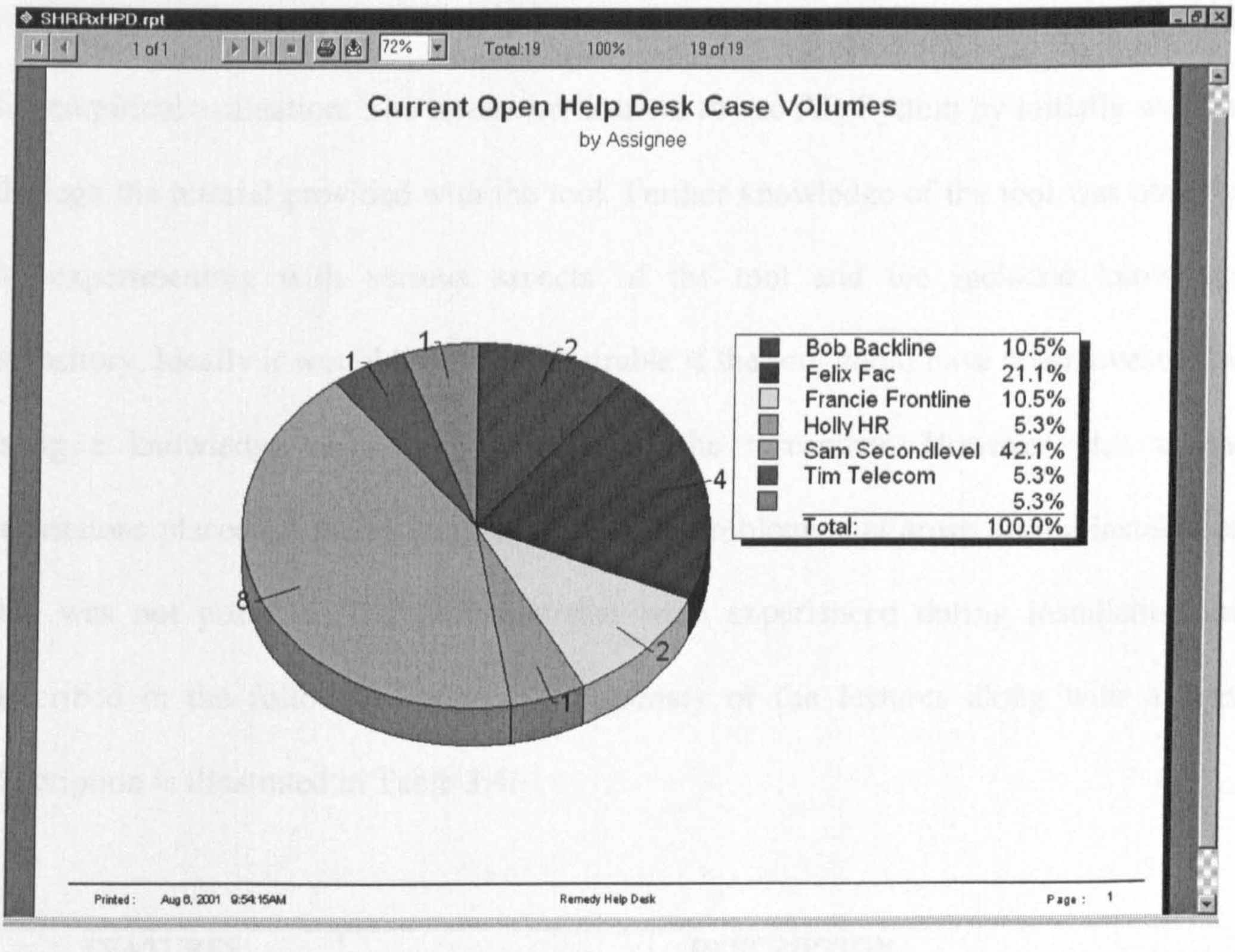


Figure 3.15: Example of the Report Facility

The Manager's Mode is much the same as the Support Mode apart from the inclusion of an additional option that enables a Manager to approve solutions to queries that have been submitted by the support staff. This is presented as an option from the main window and once it is selected the proposed solutions are displayed in a list. Further details about the solutions may be seen by highlighting the solution and selecting the 'Details' button. The details of the proposed solution may be viewed and if adequate, can be approved by simply clicking a button. This makes the solution available for users and support staff to view and utilise.

3.7.1 Features within Action Request System (AR System)

In order to evaluate Action Request System an evaluation copy of the tool was obtained and installed. However, there was a constraint of 30 days placed on the time available for empirical evaluation. The researcher learned to use AR System by initially working through the tutorial provided with the tool. Further knowledge of the tool was obtained by experimenting with various aspects of the tool and the included knowledge repository. Ideally it would have been desirable if the tool could have been investigated using a knowledge repository designed by the researcher. However, due to the restrictions placed on the evaluation period and problems that arose during installation this was not possible. The problems that were experienced during installation are described in the following section. A summary of the features along with a brief description is illustrated in Table 3.4.

FEATURES	DESCRIPTION
Designed for specific use	AR System is designed for exclusive use by IT helpdesks
Users submit requests	Requests can be submitted by the users
Tracking of requests	Enables requests to be tracked and progress status to be obtained
Access to solutions	Users have access to solutions for previously resolved requests
Access modes	AR System can be accessed via three modes: requester, support, and management
Survey	Provision of questionnaire to obtain satisfaction feedback from users
Priority setting	Priorities for requests can be specified: low, medium, or high
Keyword search	Enables a request to be searched for using one keyword
Combined keyword search	Enables a request to be searched for using a combination of keywords
Tabular display	The results of a search are displayed in tabular format
Bulletin Board	Enables the broadcasting of messages
Reporting	The ability to produce reports
Track assets	
Automatic confirmation	User is sent automatic confirmation of submitted request
Technical support	Vendor provides a user support group if any problems are experienced
Installation	Installation of tool was difficult and quite technical
Tutorial	A tutorial is available in order to learn to use the tool

Table 3.4: Features Derived from Action Request System (AR System)

3.7.2 Critique of Tool 4: Action Request System (AR System)

Problems were experienced with AR System from the outset during the installation of the tool. Installation was attempted a number of times by the researcher without successful completion. Therefore, a technical person was approached for assistance with installing the final part of the tool. It was a coincidence that the technical person had prior experience with AR System. However, although this was initially perceived as an advantage by the researcher the installation was still unsuccessful. At this point another person, whom had previously used AR System became involved. However, they were not able to resolve the problem either.

After many attempts it was decided that there was no other alternative but to contact the Technical Support group to obtain help with the last part of installation. It is natural to question that if such a facility is available then why this step was not taken earlier. The reason is that the evaluation copy specifies that only 3 calls can be made to the support group before charges are incurred. Therefore, the researcher did not want to waste these on trivial queries and waited until it was absolutely necessary. The support group was very helpful and eventually guided the installation of the tool. However, at this point at least seven days had already elapsed and since the initial part of the tool had been installed the 30-day evaluation period had already been invoked. This left very little time for the empirical investigation of the tool.

Nevertheless, once the tool had been installed the exploration of the tool was relatively easy. The tutorial was used as an initial introduction to the tool and provided a step-by-step guide that was simple to follow. The majority of the weaknesses identified within

AR System are related to the use of and misinterpretation of terms. For instance, when a user submits a query they are asked to enter a "Requested Date". This was interpreted, by the researcher, to mean the date the request was submitted. However, it was only evident from the tutorial that this referred to the date the request needed to be completed. Another example is the use of a "Save" button to submit the request. It is of the opinion that "Submit" would have been a much better term to use.

When the user is in 'Requester' mode and wanting to view the status of a previously submitted request, a list of all the requests currently being processed is displayed. Therefore, it is necessary to scroll down the list in order to locate the relevant request. This is not problematic if the list of requests is short. However, if the list is long then it could take time to identify the relevant request or there is a chance that it will not be found amongst the lengthy list of numbers. It is believed that a search facility enabling the user to enter the request reference number would be much more efficient. Alternatively, search criteria more familiar to the user such as a combination of first and last names would make the tool user-friendlier. Furthermore, a search facility for the request reference number is already available in other modes (Support and Manager) therefore it should not be too difficult to make this facility also available in the Requester mode.

Following on from the previous shortcoming when a user is viewing the requests list, it is possible to view further details about their request. This is achieved by highlighting the relevant request number once it has been located within the list and clicking the 'Details' button. Once the current status of the request has been obtained the window is closed and the user is taken straight back to the main window. This is not problematic if

the user only wants to view the details of one request. However, if the status of more than one request needs to be viewed then it is necessary for the user to move through the series of windows again before reaching the further details.

3.8 Summary

In summary, the selection of knowledge management tools that was chosen for empirical investigation collectively supported all of the knowledge management activities. In total, detailed analysis was conducted of four knowledge management tools and all features noted along with the strengths and weaknesses of the tools. The intention of this was to convert the features into criteria to contribute to the evaluation framework. The aim of the following chapter is to support and enhance the findings from the empirical investigation using case studies.

Chapter 4.

Case Studies

4.1 Introduction

The previous chapter, Chapter 3, demonstrated the evaluation of four knowledge management tools carried out by the researcher. However, due to the subjective nature of this approach case studies are used to support and enhance the findings from Chapter 3. Therefore, the main aim of this chapter is to present the case studies that were undertaken as a part of this study. The objectives of the case studies are twofold. Firstly, to identify the features present in knowledge management tools. Secondly, to investigate the factors and issues taken into consideration during the selection of a knowledge management tool. The chapter begins by providing some background information about the case study strategy and data collection and analysis techniques. Following this is a description of each of the four case studies and their respective findings. The chapter concludes with a summary providing an overview of the chapter.

4.2 The Case Study Strategy

As established in Section 1.5 of Chapter 1, the strategy selected for conducting the research is the case study approach. There are many variations of what a case study entails and how they should be executed (Galliers, 1990; Yin, 1994; Silverman, 2000). However, for the purpose of this research, one of the most frequently referenced authors of the case study strategy, Yin (1994) is adopted as a guideline. According to Yin (1994) a case study can be defined as, "...an empirical enquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used".

In essence, the aim of a case study is to constitute a fair representation of the data that has been gathered during empirical research. In relation to this research, the main objective is to investigate the issues surrounding the evaluation and selection of a knowledge management tool. In particular, issues investigated include: the features that exist in knowledge management tools; the steps and factors taken into consideration during the evaluation and selection of a commercial knowledge management tool; if the knowledge management tool was developed internally were any commercial tools considered; and requirements for the further development of knowledge management tools.

Furthermore, within this strategy, it is possible to adopt either a single or a multiple-case study technique. As the name suggests, the former consists of conducting one case study and drawing conclusions based on that single case. Theoretically, this variant of case studies could be adopted although this would not achieve the objective of drawing

together the experiences of several cases. In addition, the resultant guidelines would be particularly biased towards the institution involved in the case study. In light of this the latter variant, the multiple-case study approach, is deemed most suitable. Furthermore, in line with Yin (1994), the assumption is that the underlying principle of the case study strategy, whether single or multiple, is the same. Therefore, four case studies are undertaken to constitute a multiple-case study strategy. The number of case studies included within this research is simply attributed to the studies that could feasibly be secured and undertaken in the time available. Furthermore, Eisenhardt, (1989) suggests that the number of studies used should be between four and ten. However, more recently Creswell (1998) has claimed that the number of case studies should not exceed four.

Two of the institutions used as case studies have purchased and are using a commercial knowledge management tool whereas the other two have developed a knowledge management tool internally. The former are directly applicable to this research in that both studies have been through the process of evaluating and selecting a knowledge management tool. In contrast, the contribution of the latter studies may not appear so obvious at first glance. However, studies where a knowledge management tool has been developed internally were also considered valuable since a wider range, and more specific, features could be captured. The concept supporting this theory is that in cases where a knowledge management tool has been developed internally suggests that no commercial tool exists that adequately meets their requirements. Therefore, a knowledge management tool was developed that includes these additional features.

Another factor that needs to be taken into consideration before undertaking the case study is to decide the type of data that is required in order to address the research areas. Since this research focuses on discovering how institutions go about obtaining a knowledge management tool the resultant data is likely to be predominantly of a qualitative nature. Having established that this study will adopt a multiple-case study strategy with emphasis placed on the collection of qualitative data it is possible to proceed with the actual collection of data. The following section describes the methods adopted for the gathering of data for each of the case studies.

4.2.1 Data Collection

In order to obtain information about each of the case studies multiple sources of evidence are used. This is referred to as data triangulation and is believed to be a major strength of the case study strategy because findings and conclusions are likely to be more accurate due to converging lines of enquiry (Yin, 1994; Silverman, 2000). Moreover, each individual data collection technique has its associated strengths and weaknesses and therefore the more sources of evidence that are employed and used in combination the more robust the results. This particular research makes use of three data collection methods including: documentation; interviews; and direct observation. Table 4.1 illustrates the strengths and weaknesses of each of the three approaches.

The first method of data collection that is employed is the obtaining of any documentation related to the case study. The primary purpose of this is to acquire some background knowledge about the case studies involved in the research. The documents consist of white papers, annual reports, media articles, journal/conference papers, and

information from each of the case studies websites. However, it is important to acknowledge the possibility that the material being presented within these documents is likely to be biased and has been written with a specific audience in mind. In light of this, the information gathered from these documents was used to create areas of further investigation during subsequent phases of data collection. Furthermore, the documentary evidence is used to corroborate and augment findings from other data collection methods.

Source of Evidence	Strengths	Weaknesses
Documentation	• Stable – can be reviewed repeatedly • Unobtrusive – not created as a result of the case study • Exact – contains exact names, references, and details of an event • Broad coverage – long time span, many events, and many settings	• Retrievability – can be low • Biased selectivity, if collection is incomplete • Reporting bias – reflects (unknown) bias of author • Access - may be deliberately blocked
Interviews	• Targeted – focuses directly on case study topic • Insightful – provides perceived causal inferences	• Bias due to poorly constructed questions • Response bias • Inaccuracies due to poor recall • Reflexivity – interviewee gives what interviewer wants to hear
Direct Observation	• Reality – covers events in real time • Contextual – covers context of event	• Time consuming • Selectivity unless broad coverage • Reflexivity – event may proceed differently because it is being observed • Cost – hours needed by human observers

Table 4.1: The Strengths and Weaknesses of the Three Data Collection Techniques

(Source: Yin, 1994)

The second method for data collection is interviews. Initially, it was planned to conduct two rounds of interviews at each of the case study sites. The reasoning behind this was

based on the fact that the area of research is relatively new and therefore it would be necessary to gain some idea of whether the correct path was being pursued. However, due to the restricted time available from each of the case study sites it was only possible to conduct one round of interviews. Consequently, questionnaires were utilised in order to obtain the information that was originally planned to be gathered during the first round of interviews.

The value and quality of using questionnaires has been debated for some considerable time (Dillman, 1978). However, since the questionnaires will be coupled with interviews the associated shortcomings will be avoided. The process of designing a questionnaire takes a great deal of thought, and practice, and is not simply a matter of listing a series of questions. Furthermore, factors such as the possible influence of the previous question on the following question need to be taken into consideration. According to Czaja and Blair (1996) and Youngman (1982) the task of designing a questionnaire begins with the identification of the goals that the questionnaire aims to achieve. With regards to this particular research the main goals of the questionnaire is to obtain information about the following:

1. The features present in various knowledge management tools
2. The process adopted by institutions for evaluating and selecting a commercial knowledge management tool
3. The factors contributing to the internal development of a knowledge management tool

The purpose of the first goal is to derive a list of common features available in knowledge management tools in order to contribute to the evaluation framework. The aim of the second goal is to establish the phases undertaken in order to evaluate and select a commercial knowledge management tool. The outcome of this goal is intended to contribute to the frame of reference outlining the steps that need to be taken into consideration during the selection of a commercial knowledge management tool. The objective of the third goal is to investigate if any commercial knowledge management tools were considered prior to one being implemented internally and why they were deemed unsuitable. The results from this are likely to contribute to both, the evaluation framework and frame of reference. In light of the three goals that have been identified, it appears that three different groups of people need to be approached including: users of knowledge management tools; people that have been involved in the evaluation and selection of a commercial knowledge management tool; and people that have been involved in the internal development of a knowledge management tool.

It is possible that one questionnaire is designed in order to accommodate the three different groups of people. However, this idea was immediately dismissed, as the resultant questionnaire would be extremely lengthy and may discourage respondents from completing it. Therefore, three separate questionnaires were designed, one for each of the groups. The foundations of the questions were the same across the three groups but were slightly altered to accommodate their situation. For instance, one of the base questions was about the level of satisfaction with the tool. The users were asked, 'Are you satisfied with the knowledge management tool that you are using?' Whereas the people involved in the evaluation and selection of a commercial knowledge

management tool were given the variation, 'Are you satisfied with the knowledge management tool that was purchased?' The group where the knowledge management tool has been developed internally had the question, 'Are you satisfied with the knowledge management tool that was developed?' The final versions of the three questionnaires along with the base questions are provided in Appendix A.

However, before the questionnaires could be completed by the various people involved within the case studies it was necessary to pre-test the questionnaire as recommended by Youngman (1982). The first draft of the three questionnaires was distributed to various colleagues and their task was to evaluate the instructions, the questions, and the response system. The feedback from colleagues was incorporated into the questionnaires and the new version was given to a consultant from one of the case studies who had kindly offered to go through the questions. In light of the feedback received, the questionnaires were updated and distributed amongst the participants within the case studies.

Once the completed questionnaires were returned, the responses were analysed and points for further investigation were noted and interview questions created. Similar rules apply to the creation of interview questions as with the questionnaires (Foddy, 1993; Oppenheim, 1996). Furthermore, similarly to the questionnaires, and perhaps even more so, the interview questions were predominantly of an open-ended nature. In total 59 people were involved in the questionnaires and follow-up interviews across four different institutions. Where possible, the interviews were conducted at the site of the case study using a face-to-face technique. However, with regards to two of the case

studies, one of which is partially and the other which is completely situated overseas, it was necessary to conduct the interviews over the telephone. Since questions for the interviews had been derived as a result of the responses from the questionnaires, the interviews were of a structured nature. However, these were conducted in an informal manner. In order maintain the flow of the interviews without having to constantly stop to take notes, to save time, and have a precise record of the interview each of the interviews were taped with permission of the interviewees and the case studies. The interviews were transcribed and combined with the data from the questionnaires and documentation ready to be analysed.

4.2.2 Data Analysis

According to Yin (1994) the data analysis aspect of case studies is the most difficult since the theory for this is least developed. To add further to the confusion, no common techniques exist for the purposes of data analysis (Miles and Huberman, 1994). In addition, each study is unique and therefore requires an individual approach of analysis (Patton, 1990). In order to address this, Patton (1990) suggests that it is necessary for the researcher to adapt an existing technique that suits their requirements (Patton, 1990). Therefore, the first stage of conducting analysis is to decide the manner in which the case studies will be viewed. Yin (1994) suggests two ways of achieving this. Firstly, there is within case analysis whereby analysis is conducted for each case involved in the research. Therefore, if four case studies were used as part of a research project, conducting within case analysis would result in four separate units of data analysis. Secondly, there is cross case analysis in which the data is pooled from each of the case studies, combined and subsequently analysed. For instance, again if four case studies are

included in a research project, then in order to analyse the data the results from the four cases would be combined and then analysed as a single unit. In essence, within case analysis enables the context of the data being analysed to be taken into consideration. Cross case analysis means that the data is removed from its context and analysed in isolation.

If the purposes of this research had simply been to identify the features that exist in knowledge management tools then cross case analysis would be the most appropriate method to adopt because the context of the source would not be relevant. However, one of the concerns of this research is to investigate how institutions undertake the task of evaluating and selecting a knowledge management tool. The purpose of this is to obtain data to contribute to a frame of reference that will specify the factors and issues to take into consideration when selecting a knowledge management tool. Therefore, it is important to identify whether the evaluation and selection process resulted in a satisfactory knowledge management tool for each case study. In order to achieve this, it is necessary to consider the content of each case study individually. Therefore, the within case analysis or case analysis as it is referred to by Patton (1990) is adopted for this research.

According to Patton (1990) case analysis involves three phases. The first is concerned with ensuring that the data for each case is as complete as possible. The second includes merging all the sources of data to create a case record. The final phase entails constructing the case study. The case analysis technique resulted in a descriptive version of the case study to be obtained. However, in order to identify the features common in

knowledge management tools a more structured approach that would enable the extracting of features was required. Subsequent to analysing numerous data analysis techniques and the many variations of each it was concluded that content analysis most closely matched the requirements of the researcher.

However, content analysis itself involves many variations from simply counting the occurrence of certain words to enabling categories and themes to emerge from the data (Insch *et al.*, 1997; Denzin and Lincoln, 1998; McNeese-Smith, 1999; Silverman, 2001). Furthermore, content analysis can be utilised to analyse data in both a quantitative and a qualitative manner (Nandy and Sarvela, 1997). However, for the purposes of this research, the method deployed falls somewhere in the middle. Counting the frequency of features that were identified could be utilised. For instance, if the feature 'supports database querying' was identified during data analysis, then the number of times this feature is highlighted by a participant could be counted. However, this research is focused simply on capturing these features and therefore counting the frequency would serve no purpose. Furthermore, the researcher knew what information was required from the data and therefore the questionnaires and interviews were designed based on this. Therefore, the categories that would be used to organise the data had also been considered prior to the case studies being carried out. In light of this, using a data analysis technique that enables categories and themes to emerge from the data would be useless.

Patton's (1990) view of content analysis was employed and adapted for the purposes of this research. This involves three phases including: reading through the data making

notes about how the various parts of data could be utilised; identifying the categories; and labelling the data according to the categories. Therefore, the case record that was created as part of the case analysis technique whereby all sources of data are combined was used for the first phase. The categories that were used to extract the relevant parts of the data were focused on issues related to the features of the knowledge management tools. These include the features and the associated positive and negative aspects. The remainder of this chapter describes each of the case studies using case analysis and content analysis.

4.3 Case Study I: CASM

The first case study is that of a simulation research group called CASM (Computer Aided Simulation Modelling) that is based in the Information Systems and Computing Department at Brunel University. The objectives of the group are to contribute to simulation modelling in terms of high quality research, teaching, and consultancy. In addition, the research group focuses specifically on problems related to discrete event computer-based simulation modelling. This case study was the first to be conducted due to familiarity with the group and therefore access was not constrained in any way. Furthermore, all three of the data collection techniques were to be exploited therefore this would be a good opportunity to develop and refine data collection skills prior to undertaking the remainder of the case studies. The research group has been selected to participate in this study because a sub-set of its members is using a commercially available knowledge management tool to create simulation models. However, although this does not appear to be unusual in any manner, the fact that the modellers are located

in different parts of the building, country, or even across the world makes this an interesting case study.

In total nine people participated in the case study and from this one person was responsible for selecting the knowledge management tool and the other eight are users of the tool. As previously mentioned all three of the data collection techniques (documents, interviews, and observation) were utilised during this case study. Data in the form of documents include published papers that describe the research group's use of a knowledge management tool and reviews of the tool. Subsequent to all of the participants from this case study completing the questionnaire interviews were conducted in a face-to-face manner. During these interviews they were asked to elaborate on the answers that they had provided in the questionnaire. This also provided an opportunity to gain a deeper insight into the research group, the tool they use, and their opinions. For instance, the responses from the questionnaire illustrated that a keyword search on the web was used to identify potential knowledge management tools and from this two tools were short-listed. However, the questionnaire was unable to capture information such as: how many tools were identified as a result of the keyword search, the names of the tools, and the reasons for short-listing only two of the tools from the search. Therefore, the interview was deployed to obtain such information.

In order to further enhance the understanding of the case study, direct observation was also utilised as a method of data collection. This included observing one of the group members using the knowledge management tool during the design of a simulation model. In addition, a conference and a workshop was attended where the group

demonstrated how they use the knowledge management tool to develop simulation models when the modellers are remotely located. The remainder of this section describes the case study in relation to the knowledge management tool.

4.3.1 Acquiring the Knowledge Management Tool

The need for a tool was prompted by the requirement to, "share a simulation application's visual display via a remote computer" and for communication during collaborative design. Furthermore, since the case study is part of a research group, the ability to create simulation models remotely was being investigated by its members with the aim of introducing this concept into industry. Therefore, the objective of the required knowledge management tool was to support low cost collaboration between members of a modelling team. More specifically, features that were required by the knowledge management tool included: conferencing via the Internet; application sharing; easy installation; and most importantly of all, at a low cost.

The process used for locating such a tool was a keyword search on the term 'groupware' using the World Wide Web (WWW). This resulted in numerous knowledge management tools being highlighted. At this stage the users of the intended tool were involved. Their role was to empirically evaluate the various tools and provide feedback. Subsequent to this, two tools were short-listed including NetMeeting and Eroom. Thereafter, NetMeeting was selected as the knowledge management tool to be utilised because its features matched the requirements specified previously by the group namely: conferencing via the Internet; application sharing; and the deciding factor is that it is available free of charge.

4.3.2 NetMeeting and CASM

In relation to this particular case study, the knowledge management tool NetMeeting is used to aid the design of simulation models in circumstances where the modellers are remotely located. When a model needs to be developed all members of the modelling team connect to the same NetMeeting session. This enables each group member to have the same view as the person controlling the session. Therefore, each member is able to view the simulation model in question via the application sharing facility. The members are also able to discuss the model using the chat facility. Furthermore, one person has control over the model and can highlight areas that are being discussed for the other members to see. However, if one of the other group members would like to illustrate a point then control can easily be transferred to them.

As previously mentioned the budget available for the tool was extremely limited and therefore cost was a major factor during the evaluation and selection of a tool. Fortunately, NetMeeting can be obtained free of charge from the Microsoft website. Furthermore, if difficulties are experienced during the use of the tool, the main sources of assistance are obtained from the on-line help that comes with the tool and from the website for NetMeeting. In general, the opinion of the user interface is that 89% of respondents feel that it is easy and simple to use. It was believed that previous versions of NetMeeting appeared cluttered, however the current version is small and simple yet effective. Furthermore, its likeness to other Microsoft products increased its usability and makes it intuitive. However, although the tool itself is relatively small, once other applications are opened within NetMeeting it is difficult to manage the multitude of

windows. In this particular case training was not provided or necessary to learn to use the tool.

NetMeeting has many features that are utilised by the simulation research group. These are illustrated in Table 4.2 along with the positive and negative aspects highlighted by the participants of the case study. With regards to ways in which NetMeeting could be improved only two suggestions were made. Firstly, 44% of the participants were of the opinion that the video conferencing feature needs to be enhanced so that more than two people are able to participate in a meeting. Secondly, 10% of the participants believed that although NetMeeting enables a record of a meeting to be saved this feature would be further enhanced by providing a way of cataloguing and annotating these.

4.3.3 Reflections of the Evaluation and Selection Process

All of the participants in this study are satisfied with the tool that was selected although it is generally acknowledged that NetMeeting is not 'perfect'. Nevertheless, according to one of the participants, "despite the limitations inherent in free software NetMeeting was the most able application overall providing the greatest number of collaborative working tools". If the exercise of evaluating and selecting a knowledge management tool were to be repeated, exactly the same process of using a keyword search on the web would be deployed. Furthermore, the users input within the evaluation process is vital and is likely to result in greater user acceptability.

FEATURES	POSITIVE ASPECTS	NEGATIVE ASPECTS
Video Conferencing	See and hear the person you are talking to	Poor quality Restricted to 2 people
Conferencing	The ability for numerous people to share a cyberspace environment in real-time	Not ideal for large meetings Poor quality
Application Sharing	Supports collaborative design environment Attendees have access to same application	
Email	Can be used in conjunction with email	
Real-time Messaging	Allows a chat in real-time to take place	
Remote Desktop Sharing	Supports collaborative design environment Allows another attendee to view and take control over another members desktop	
Record of Session	Save details of all communication that takes place during meeting Translate to minutes	
File Transfer	Save details of all communication that takes place during meeting Ability to send simulation models	
Communication via Internet	Internet available to majority of people Ability to conduct meeting via the internet	
Low Cost	It is free of charge	Poor quality
Easy to Use	Simple interface Intuitive	
Drawing Tool	Ability for people to collaboratively work on a diagram	Lack of functionality
ILS Directory	A directory of people using NetMeeting Option for not being included in directory	Can attract unwelcome attention
Frequently Crashes		NetMeeting is prone to crashing
Licence	No licensing restrictions	
On-line help	Can be very useful	
Website help	Good when assistance cannot be obtained from on-line help	
User Interface	Easy and simple to use	Difficult to manage with MDI
Microsoft Interface	Increased usability Intuitive	
Training	Not necessary	

Table 4.2: Features and Associated Positive and Negative Aspects of NetMeeting

4.4 Case Study II: Computer Centre

The second case study that was undertaken is that of the helpdesk of Brunel University's Computer Centre who are responsible for providing hardware, networking, printing, and centralised software facilities. This particular case study was chosen for investigation for this research for two main reasons. Firstly, and most importantly of all, the helpdesk

in question uses a commercial knowledge management tool called Action Request System (AR System) in order to support helpdesk activities. Secondly, the proximity of the location for the case study and the flexibility with regards to the levels of access granted made it a suitable choice. However, the familiarity with this case was not as great and the accessibility was not as flexible as in the previous case study.

Similarly to the first case study, all three data collection techniques were used in order to obtain information. Documentation was in the form of white papers and technical reports available from the case study website. Interviews were conducted in the same format as the previous case study, that is questionnaires followed by interviews. The interviews were of a face-to-face format and were conducted at the case study site. This is a bigger institution than the previous case study, 22 people were interviewed; more than double the number that participated in the previous case study. Of these 22 people, one was involved in the evaluation and selection of the tool and the remaining 21 are daily users of the tool. Observation of the tool being used was also used to enhance the knowledge gained through the documentation and interviews. This consisted of spending a day with the helpdesk and recording how various users used the tool.

4.4.1 Acquiring the Knowledge Management Tool

A knowledge management tool was sought after due to the number of staff and students at the university increasing at a rapid pace. This was making it difficult to keep a record and track helpdesk tasks that could not be resolved immediately. In order to achieve this, a set of business objectives was specified. These included: faster turn around of calls to support services; better audit trail handling; statistical data gathering; and a good

front-end to the end-user. In light of these objectives, the required knowledge management tool should be capable of tracking a task between service groups (user support, PC support, systems, and networks) within the helpdesk in order to maintain an audit of the work that has been undertaken. Furthermore, the tool should be capable of gathering statistical information so that the number of tasks coming into the system can be monitored and details of the handling groups recorded. Most importantly of all, the tool should facilitate the organised storage and retrieval of knowledge, i.e. a knowledge base, so that the same task does not need to be solved over and over again.

Once the business requirements for the tool were specified, the technical requirements were identified. Consequently, a Unix server based system that had clients available for Sun workstations, Windows 3.1 machines, and NT workstations was required. Furthermore, the system was also required to interact with email as this was the dominant communications medium. In addition, it was important that the Computer Centre could do any changes that needed to be made to the tool. In order to go about locating a suitable knowledge management tool, the first task was to contact the University and Colleges Information Services (UCISA). The Software Group within UCISA had conducted a survey on the various tools available for a helpdesk environment. In light of the results of the survey coupled with the business and technical requirements, three knowledge management tools were short-listed for further investigation including, AR System, RMS Helpdesk, and RedBox. At this stage potential users of the tool were included in the evaluation and selection process. Their main task was to ascertain ease of use of the tool. Furthermore, demonstrators were

supplied from each of the vending companies and sites where the tools were already in use were visited.

As a result of further investigation, the latter two knowledge management tools were considered unsuitable. RMS Helpdesk was ruled out since email was not yet available and any changes needed could only be made by the vending company. RedBox was discarded simply because it was far too expensive. AR System was selected because it was available at a reasonable cost, it could be configured locally, it was easy to install, very flexible, good support was provided, and at the time the vending company was a key market player and is now currently one of the major providers.

The initial cost of purchasing AR System was £17 000 and included a server package, clients, manuals, initial training and some consultancy time. Furthermore, the basic license package was included in addition to five extra licenses. Additional costs were incurred for the purchase of extra user licenses and ARweb package totalling just over £7 000. ARweb is the web interface for AR System however problems were experienced during installation and therefore is not currently being utilised. However, the Computer Centre are hoping to include this when a new version of AR System is installed. Once the tool was purchased it was necessary for the tool to be adapted in order to conform to the work practices of the Computer Centre. It was strongly emphasised that they required a tool that could be moulded into their system rather than the tool dictating working practices. The main changes that were made to the tool were to the escalators and information flow, which was found to be relatively easy.

4.4.2 AR System and the Computer Centre

In relation to this particular case, AR System is used to support a Computer Centre's helpdesk. In essence, a task enters the system and is assigned to one of the four appropriate groups (user support, PC support, systems, and networks). Through the process of the task being resolved details of its progress are constantly logged into the system. If further information is required by the helpdesk, then the task has a "Pending Information" status. Once the task has been resolved the job is 'closed' and removed from the task list. It is important to point out that the Computer Centre use AR System slightly differently to what was intended by the tool vendor and as was described in Section 3.7 of Chapter 3.

The tool has been designed so that general computer users can submit a request via the tool and view its status. However, the Computer Centre does not provide access to users, University staff and students, in this manner. Instead the user is required to submit their request to the Computer Centre via email, telephone, or in person. Following this, a member of the Computer Centre's helpdesk logs the request in the AR System. However, the user is sent confirmation detailing that their request has been logged and a reference number should they require further information. If this should be the case then the user cannot view the status as intended by the tool vendor. In place of this the user must contact the Computer Centre again via email, telephone, or in person and ask for a report on the progress of the request. The reasons for not granting general users access was due to the need for the software to be installed on every single machine, which was considered to be impractical. Furthermore, it was also thought that allowing general users access to the system in order to submit requests would hinder the

quality of the service provided by the Computer Centre. This conclusion is based on the assumption that the users may not provide all of the required details when a request is submitted. Consequently, support staff would have to spend time chasing up the additional details and this would mean that requests take longer to fulfil. However, if the support staff is responsible for submitting a request, then they can ensure that all the relevant information is available prior to the request being submitted. In essence, this avoids the system being clogged up with requests that are waiting for additional information.

The unanimous opinion about the interface for the tool is that there is room for improvement. Issues with the interface include the confusion over the multiple document interface being too difficult and confusing to navigate quickly enough. Furthermore, the tool needs to be more intuitive since the method for specifying a Boolean query is not immediately obvious. If the support staff experience any problem using the tool, then there are several options for seeking assistance. Firstly, 55% of the participants claimed that user manuals can be consulted however, these are of most use to the programmers within the team. The second source of assistance is the on-line help that comes with the tool that was identified by 73% of the participants. Failing these, 41% of the participants suggested that colleagues are consulted for advice, particularly those that have attended a training course.

For 77% of the support staff training was not provided and learning to use the tool was achieved using documentation and colleagues that had attended the training course. However, 68% of the participants were of the opinion that training should have been

provided since self-teaching was time consuming and inefficient. 86% of the participants have a positive attitude towards the tool although many caveats were included within the comments. For instance, it was suggested that although the tool is useful, it is important that continuous maintenance and development is undertaken. The features that were identified by the case study participants along with the positive and negative aspects that apply are demonstrated in Table 4.3.

A number of suggestions were made as to how AR System could be improved for future development. Firstly, the ability to filter information within one window would be extremely useful. Currently, it is necessary to open a multitude of windows to view the various tasks being carried out. Furthermore, comparison would be made easier if all of the tasks could be viewed at the same time. Another suggestion that was made was to enable the users access to the system so that they can view the status of their request. This would omit the need for helpdesk staff to look up the status of a task for a user. In addition, this would ensure that time was spent completing tasks as opposed to providing progress reports.

The querying aspect of AR System could also be considered during future versions of the tool. Currently searching the knowledge base is restricted in that it can only be searched using certain fields. Therefore, it has been suggested that a search on all fields should be supported with optional pattern matching. Furthermore, as opposed to simply searching using fields, it should be possible to conduct a general keyword search that would search the existing problems and solutions within the knowledge base. AR

System would also benefit from reporting and improved printing facilities. Currently only a selection of the fields can be printed and the format is not always correct.

FEATURES	POSITIVE ASPECTS	NEGATIVE ASPECTS
Task Tracking	Ability to track task throughout system Ability to see why task has been held up	
Flexibility		Difficult to add more information in the field list
Performance Indicators	Statistics about number of tasks resolved	Could often be inaccurate
Macros	The ability to run commands Can create semi-completed forms or queries	
No User Access		Users cannot view progress of task Increased workload for helpdesk
Authentication	Enables security	
Log of Calls	A database facility that logs caller details	Independent to similar databases Incorrect details
Action Request	The ability to assign appropriate group to task	
Task Logging	The ability to record tasks currently being resolved	Not all tasks are logged Two people can edit same log simultaneously Takes too long to complete form
Knowledge Base	Record of tasks and solutions previously resolved	Searching for previous tasks is very slow Only allows searching of certain fields Too large and difficult to maintain
Database Capabilities	Can use database queries to locate information Can create/customise forms	
MDI		Too many windows Query and submit often confused
Time Logging	Ability to record time taken to resolve query	
Time Scheduling	Ability to specify hours of work and holidays taken into account during calculation of performance	
Adaptability	Ability to adapt and customise tool Ability to build own applications from scratch	Adapting tool is very difficult
Updating	Ability to add additional information	
Complexity		Tool is quite complex Too many categories to handle
Email Facility	Automatic email for callers	Cannot be cancelled or edited Contains unnecessary details Sent too frequently
Controlled Access	Everyone can view task log but only authorised people can change it	
Monitoring	The progress of a task can be automatically monitored	
Notification	Relevant person is notified of any changes in status of task	

Table 4.3: Features and Associated Positive and Negative Aspects of AR System

Since AR System is being used as a helpdesk tool to support the computer system of a university the users predominantly consist of students and staff. Therefore, the university administrations department has a database containing various details about students and staff that must be kept updated at all times. The Computer Centre also has a separate repository of user details so that should it be necessary to contact a user the details can be obtained. However, it is often the case that the details are outdated and time has to be invested in tracking down the user. In order to address this it has been suggested that if AR System could be linked to the university database then a great deal of time would be saved and there would be no need to have two copies of essentially the same data.

4.4.3 Reflections of the Evaluation and Selection Process

Overall, 90% of the participants are satisfied with AR System because it provides a useful method of keeping track of problems and their associated solutions enabling staff in different locations to work on a problem. Furthermore, the tool is useful for handling and managing tasks without any being lost in the system. In addition, the development of the knowledge repository means that the data that is collected can be used for other purposes such as statistical analysis and reports without the need for the data having to be collated separately.

AR System does meet the requirements that were specified prior to purchasing the tool. Furthermore, if the evaluation and selection process were to be repeated only minor changes would be made. This would involve investigating how the helpdesk's history data can be extracted and imported into a new tool. Furthermore, additional input from

the day-to-day users of the tool would also be obtained. It was useful to have the users involved in the selection process because it was useful to know what individuals thought of the tools on offer. Moreover, they can raise important issues that the selection team may not have considered. Another important factor for the users being involved in the selection process is that it leads to greater user acceptance.

Finally, the advice that would be given to anyone wishing to undertake a similar task is to ensure that working practices are clearly defined and to find a tool that fits into or can be moulded into current working practices. When viewing vendor demonstrations it is easy to be influenced by an attractive tool only to find that it is inflexible. Ensure that the selection team has good knowledge of their business and are able to ask the relevant questions. Furthermore, ensure that all relevant staff are involved in the selection team.

4.5 Case Study III: Content Management Consultancy

This third case study is that of a company where a knowledge management tool is used in order to aid consultants that are based at client sites. The tool, the Consultants KM Tool, was described in detail in Section 3.5 of Chapter 3. The knowledge management tool was developed internally and consists of an intranet. One of the conditions that was requested by the case study company was to keep the company and any details that may indicate their identity confidential. Therefore, the names of the tool and company have not been disclosed. This case study consists of 21 participants of whom six were involved in the development of the knowledge management tool and the remaining 15 are users. However, seven of the participants were based overseas therefore telephone interviews needed to be adopted in these instances. Of the number of participants

located overseas four were developers and three were users. Therefore, with regards to the participants of the case study that are based within the UK the three methods of data collection were deployed. In the case where the respondents were situated overseas documentation and telephone interviews were used as the data collection techniques.

Documentation consists of the Annual Report from 2001 along with information obtained from the company website. Subsequent to responses from the questionnaires further questions were identified for interview purposes. Participants from the UK were interviewed using a face-to-face manner and were conducted at the case study site. The overseas participants were interviewed using the telephone. With regards to the observation aspect of data collection, this consisted of observing a consultant from the UK using the tool.

4.5.1 Developing the Consultants Knowledge Management Tool

Several disparate knowledge management tools already existed prior to the development of the consultants' knowledge management tool. However, in addition to these being disparate the tools were difficult to navigate, contribute content to, project information was not searchable, and did not enable the tracking of key data. In light of these problems a new system to combine and refine the current knowledge management tools was required. Therefore, the aim of the tool was to provide a central point where consultants are able to locate any information about past and present projects along with resources and product details at any time, from any location. The assumption is that if this could be achieved then consultants would spend less time attempting to track down the relevant information and this time could be better utilised trying to improve

customer service. Furthermore, a central repository of all project related information would omit the need for having to 're-invent the wheel' as well as saving on costs.

STEPS	DESCRIPTION
1. Problem Definition	What problem needs to be solved
2. Identify Relevant Fields	Identify the areas that are related e.g. knowledge management, content management, etc
3. Identify Field Experts	Find out about current state of the art, who the key players in the field are, and their associated strengths and weaknesses
4. Create Vendor List	Build list of potential suppliers of software based on research/research analysts
5. Gather Product Information	Collect information about the product from the supplier
6. Create Initial Supplier List	This consists of building a list of suppliers that need to be contacted for further information
7. Contact Suppliers	This involves sending suppliers document detailing high level problem definition and asking them to write a proposal specifying how their product addresses the problems
8. Meet Suppliers	Arrange a meeting with the supplier with the aim of receiving their proposal
9. Compare Proposal and Product Information	Cross check the details provided in the proposal with product information
10. Identify Initial Requirements	This involves identifying initial requirements for the solution
11. Identify Shortcomings	Identify any supplier/product shortcomings from cross check
12. Supplier Short-list	Build final list of potential suppliers
13. Contact Suppliers	Contact suppliers regarding initial requirements and issues raised during cross check (may involve prototypes/proposals being built be each supplier)
14. Select Supplier	Make final decision of supplier
15. Negotiate Contract	Negotiate a contract that is agreeable for both supplier and purchaser

Table 4.4: Steps for Selecting a Commercial Software Tool

In order to go about acquiring a suitable knowledge management tool, purchasing a commercial tool was briefly considered. However, due to the costs of purchasing and the effort required in investigating and customising such a tool this idea was immediately dismissed. Furthermore, since the consultants are developers by trade and their software tools enable them to build such a tool, this was considered the most suitable option. However, if a commercial knowledge management tool were to be

purchased then the company would use the strategy outlined in Table 4.4. This is a generic guideline and can be used for the purchase of any tool. However, the strategy would be adapted according to the type of tool being purchased. Unfortunately, since purchasing a commercial knowledge management tool was ruled out from the outset the ways in which the strategy would be adapted to address issues specific to knowledge management tools was not considered.

Since a commercial knowledge management tool was not to be purchased, the company had to consider how to go about developing their own tool. This was achieved by firstly exploring the existing, disparate, knowledge management tools and the concepts from each of these were combined. Furthermore, through a series of meetings, attended by senior employees and a selection of end-users, ideas and discussions were eventually translated into a detailed document that explained the envisaged knowledge management tool along with its requirements. This was then distributed to all of the consultants who would be using the knowledge management tool for further input. Additional feedback was incorporated into the document and the process of developing the tool commenced.

The knowledge management tool was developed by a team consisting of consultants and therefore would be users of the final product. Furthermore, throughout the development process other users, not involved in the development team, were asked for their feedback. Their role was to evaluate the user interface and contribute to the information content within the tool. In addition, as a part of their training new consultants joining the company were asked to develop parts of the tool. The assumptions for the high level of

user involvement was that since the consultants are to be the ones to use the knowledge management tool they know what is required and are more than capable of developing it. If the users do not have any input in its development there is a chance that they will not use it and therefore the tool would be unsuccessful.

4.5.2 The Consultants Knowledge Management Tool

In essence, the Consultants Knowledge Management tool is a repository from which consultants are able to access information about past and present projects that have been undertaken by the company. A more detailed description of the actual tool can be found in Section 3.5 of Chapter 3. In general, 86% of the users of the Consultants Knowledge Management tool appear to be satisfied and comments range from, "Like it", to, "The project areas are great because they are easy to use and time is saved by reusing other peoples efforts – speeding up engagements at client sites and thus improving customer satisfaction". The main features of the, Consultants Knowledge Management tool, identified by its users are outlined in Table 4.5 along with the associated positive and negative aspects where applicable.

In addition to the existing features, opinions on the features that the tool does not currently have but would benefit from having were also obtained. Suggestions for improvement were predominantly based on improving the search facilities. Currently the tool only searches the contents of the knowledge repository however it has been suggested by 52% of participants that the search should be expanded to analyse other websites within the company. Another recommendation that was made was to include an area that highlights any new content to the knowledge repository. This could also be

taken a stage further where individuals are notified of new content that may be particularly relevant to them. Furthermore, separate areas for 'most popular' documents and 'important issues' may also be useful.

Various tracking abilities included issue tracking, time tracking, task tracking, and team tracking were also recommended as features to consider for inclusion during future developments of the knowledge management tool. Another suggestion that was made was to enable a user to create more personalised views of the knowledge repository so that content that is not relevant to them can be filtered out. It was also believed that a cross-reference facility to connect related pieces of information would prove useful and would save the need for this to be done manually. Finally, it was proposed that having a person that could be contacted should any problems arise with the tool would be quicker and easier than having to search through the various documentation in the attempt of rectifying the problem.

4.5.3 Reflections of the Development Process

Overall, 81% of the consultants are satisfied with the knowledge management tool. The main reason for this is related to the high quality of content within the knowledge repository. However, it has also been strongly emphasised that the search capabilities need to be developed a great deal before a satisfactory standard is achieved. The Consultants KM Tool as it currently stands, does not fully meet the business objectives specified by the company. However, since the tool is an on-going development the company is confident that the business objectives will be achieved once the tool is fully developed.

FEATURES	POSITIVE ASPECTS	NEGATIVE ASPECTS
Familiar User Interface	Similar to Yahoo search engine interface Limited amount of learning to use tool Simple user interface	
Project Repository	Contains information about all client projects	Too rigid – it is necessary to know the project, file type, part of project, etc
Easy to Navigate	Clean design Simple and easy to use	Number of clicks required to reach desired destination is excessive
Upload Functionality	Ability to load data to knowledge repository Adding information to the tool is simple Self-explanatory	It is difficult to add information the first couple of times Slow at times
Download Functionality	Ability to save contents of knowledge repository locally Easy to use	
Search Facility	Enables the search of archived technical emails and online technical system Is quick No need to enquire elsewhere for documents	Not robust enough Difficult to locate documents Functionality is limited which makes searching time consuming Not wide enough – only searches small area
Virtual Team Rooms	The ability for geographically distributed teams to meet and collate information	
Recording Discussions	Enables one to trail discussions and the conclusions reached	
Directory Structure	Directory structure used to organise content Well organised Easy, obvious, and quick	
File Management	Enables files to be organised and managed	
Information Sharing	As a company information can easily be shared	
Flexibility		Not possible to move documents between projects - it is necessary to reload data
Security	Username and password required to access tool	Username and password frequently being changed and not told to users

Table 4.5: Features and Associated Positive and Negative Aspects of the Consultants Knowledge Management (KM) Tool

If the task of developing a knowledge management tool were to be repeated then the unanimous opinion was that only minor changes would be made to the process. These include increasing management support for the initiative, considering a corporate wide solution as opposed to one for consultants only. Furthermore, it was highlighted that

even if a tool is going to be developed internally it is wise to investigate commercial knowledge management tools. This would enable a general understanding of what commercial tools have to offer and ideas that could be incorporated into the developed tool. The high level of user input in the development of the tool was considered to be essential because if the users do not like the tool then they will not use it. However, with this case, the period of user involvement was limited due to other project commitments. Therefore, there were no 'dedicated' users involved in the development of the tool from start to finish. Furthermore, it is believed that involving the users in the development of the tool has resulted in greater user acceptance because they own the content.

The main advice that would be given to anyone that was considering undertaking a knowledge management exercise is to obtain management support. However, this should not consist simply of the go ahead, rather full backing with the relevant resources allocated should be obtained. Furthermore, users should definitely be involved in the evaluation process since this is the key to the success of the tool. Finally, the company feel that it is important to ensure a plan for management is in place for when the knowledge management tool is launched. For instance, if a librarian is required then they should be involved in the process from the beginning.

4.6 Case Study IV: IT Consulting and Software Services Company

The final case study that was conducted was that of an IT consulting and software services company based overseas. As with the previous case study, one of the conditions of undertaking the study was that the name of the company remains confidential. Furthermore, unlike any of the other case studies that are carried out access to their

knowledge management tool was not possible. This case study consists of seven participants although in total 47 people were approached about participating in the study. Of the seven that did participate three were involved in the development of the knowledge management tool and the remaining four are daily users. Since the company is located overseas only two of the three data collection techniques could be utilised.

Documentation was in the form of white papers and information from the company website. Subsequent to the questionnaire being distributed interviews were conducted. However, the geographic location of the company made it difficult to conduct face-to-face interviews therefore telephone interviews were utilised. Unfortunately, the geographical constraint restricted the observation of the knowledge management tool in use. However, a workshop was attended during which the Principal Knowledge Manager from the case study company gave a presentation describing their knowledge management initiative. This enabled the gathering of background information about the company and context surrounding the use of the knowledge management tool.

4.6.1 Developing the Knowledge Management Tool

Prior to the introduction of the concept of knowledge management, several tools were already in existence within various organisational pockets. Towards the end of the 1990's the decision to create a company-wide knowledge management tool was made. The company climbing the value curve initiated the need for a company-wide solution, as opposed to the existing disparate knowledge management tools. Therefore, an effective medium for rapid and efficient consolidation of expertise was essential. This was envisaged to be in the form of a knowledge repository that would be at the disposal

of each and every employee. It was anticipated that employees would share their knowledge with one another by contributing to the knowledge repository. In this manner employees would be able to learn from and re-use the experiences of others with the aim of reducing cycle times, enhance productivity, and increase quality. With this in mind the objective of the knowledge management tool was defined as, "to serve as a central knowledge sharing platform for all employees". Furthermore, requirements for the knowledge management tool were:

1. Accessibility of the system to all employees (10,000+)
2. Easy to use interface for both sharing and re-using knowledge
3. Integrate diverse forms of knowledge spread across the company and owned by different groups
4. Provide incentives through technology-driven methods
5. Built-in mechanisms for regulating the quality of the content
6. Personalisation features

Purchasing a commercial knowledge management was ruled out from the outset for two main reasons. Firstly, with the expertise available in the company it did not make sense to purchase a commercially available tool. Secondly, the knowledge management tools available on the software market were considered to be generic and would require customisation. Furthermore, factors including: the inability to interface with the existing systems; restrictive customisability; stringent licensing norms and costs; challenges of moving employees to a new system; and the lack of confidence in sustained product support made this a poor option. Since the company is a consultancy and software firm

this was also seen as a good opportunity to acquire knowledge management tool development skills should these be required for future client projects.

Therefore, with the requirements already established the hardware and software issues were considered. Finally, the decision to develop an intranet based knowledge management tool was selected due to performance, cost and usefulness. A team of developers was formed and the knowledge management tool created. The users of the tool had some contribution in the development of the tool during the requirements gathering phase and just prior to its final release. Randomly selected users were given access to the tool and asked to provide feedback.

4.6.2 The Knowledge Management Tool

With regards to this particular case study a knowledge management tool is used as a place to collate and obtain various technical knowledge. For instance, one of the participants uses the tool to, "...glean information about various topics, mostly for a preliminary understanding of the latest technologies available". The opinions on the knowledge management tool are varying from, "needless over-engineering at the cost of basics", to "It's really nicely designed. Truly professional". In essence, 86% of the participants are of the opinion that the tool is satisfactory although there is room for improvement. Furthermore, 71% of the participants are generally positive about the user interface although it was believed that the right balance of the level of information displayed needs to be achieved. For instance, the interface was described as "clutter breaking" by one participant whom contradicted this statement by also suggesting that the layout of the interface gives the impression that a lot of space has been wasted.

Training to learn to use the tool was provided but only to a certain extent. However, it was also suggested that getting started with the tool was the most difficult part but the training was able to demonstrate how easy the tool was to operate and use. Furthermore, it was also suggested that training was not required because the tool is extremely user friendly. The main features along with the associated positive and negative aspects identified by the participants of this case study are illustrated in Table 4.6.

There are many features that were suggested that do not currently exist in the knowledge management tool used by this case study. As with the previous case study these were mainly related to enhancing the search facility. Firstly, it was acknowledged by 100% of the participants that the existing search facility is not robust enough and needs to be made more efficient. One of the suggestions made for improving this is to have a search facility where a particular topic can be entered and all documents relating to this are located. Furthermore, it was suggested that the results of a search could also display links to similar documents. To develop this still further, search results could also include details of documents read by other people whom also read this document. Finally, it was also suggested that supporting searches using author or date would be very useful.

FEATURES	POSITIVE ASPECTS	NEGATIVE ASPECTS
Document Submitting Wizard	Guides submission of document to knowledge repository Document is submitted to right place Makes locating documents easy	
Search Facility	Tree structure makes searching easy Keyword search available Suggests other related documents	Complex
Reward Scheme	Automatically rewards contributor to knowledge repository Technology driven Encourages users to submit documents	
Personalisation	Enables user to design own interface	
Upload Feature	Adding information to knowledge repository is easy	Too many fields to complete
Reviewing Submissions	Ensures that the knowledge repository consist of high quality documents	
Chat Room	Enables various topics to be discussed	
Classification	Organisation of knowledge repository enables documents to be easily located	Too many classifications and sub-classifications of content Cumbersome to manage
Free Text Search	Helps to narrow search criteria	Not smart enough – relies on user specifying all the relevant areas
Topic Search	Enables documents to be searched based on topic	Dependent on how well author has defined topics
Expert Locator	Enables easy access to expert in specified area	
Newsgroups	A good place to ask specific questions	Infrequently used
Content		Content of knowledge repository is lacking on mainframe documents A certain level of knowledge is assumed
User Friendly	Easy to use	
Visual Interface	Enables users to search content using a graphical representation	

Table 4.6: Features and Associated Positive and Negative Aspects

Another suggestion that was proposed was to specify the degree of difficulty for each document so that a user is able to identify whether the document is suitable for their level of knowledge. In addition, this would save valuable time from being spent downloading the document only to find that it is too simple or too complex. Other more general suggestions that were made by 29% of the participants include making the tool more interactive, self-explanatory, and user friendly. Furthermore, one of the participants believed that the addition of more and more features has made the tool

difficult to use. Moreover, this problem could easily be rectified with a little thought and consideration. The final suggestion was to enable the archiving and searching of previous discussion threads.

4.6.3 Reflections of the Development Process

The overall satisfaction of the tool appears to be divided with 42% of the participants being happy with the tool, 29% of the participants being dissatisfied with the tool, and the remaining 29% a combination of the two. Satisfaction with the tool is attributed to user friendly searching capabilities, the arrangement of topics in a hierarchical manner, and incentives for submitting to the knowledge repository. It is believed that these have led to a good level of acceptance from the users. Dissatisfaction with the tool is related to the tool requiring greater promotion within the company. Although the facility is available it is felt that many people do not utilise it. Another area where dissatisfaction with the tool was expressed was with the lack of functionality with the search facility. The instances where mixed opinions were given with regards to the satisfaction of the tool are predominantly related to the content. It was felt that although material from the knowledge repository could be easily and quickly retrieved the results were not exactly as they had anticipated. The company is satisfied that the tool fully meets the business objectives specified prior to the development of the tool. In fact, the company feel that the "response to the tool was tremendous" and the "use of the tool has been rapidly rising and the knowledge repository growing at a steady pace".

If the company were given an opportunity to repeat the process equipped with the knowledge acquired from undertaking the task the first time, then minor changes would

be made. This would include considering how the tool will have an impact on scalability and requirement change since this caused some problems further on in the process. The users role within the process would definitely be increased as opposed to only during the requirements gathering and evaluating the tool prior to its final release. If the company were asked to give advice based on their experiences with developing a knowledge management tool they would strongly recommend that the requirements are clearly defined. Furthermore, the tool, whether purchased or developed, should align with the knowledge management strategy as opposed to defining the strategy based on the resultant knowledge management tool.

4.7 Summary

In summary, in order to draw on the experiences of several institutions a multiple case study approach was adopted. These consisted of a research group, a computer centre, a content management consultancy, and an IT consulting and software services company. Data regarding the issues surrounding the selection and development of a knowledge management were gathered through a combination of documentation, interviews, and observation. Since the context of the data were relevant to this research the data for each case study were analysed separately for each case using content analysis. The main aim of the analysis was to identify the features and associated positive and negative aspects of the knowledge management tools. Furthermore, the steps taken during the selection/development of the tool were also derived where applicable. The following two chapters describe how the data obtained as a result of the work undertaken in Chapters 3 and 4 was used in order to provide evaluation and selection guidelines for knowledge management tools.

Chapter 5.

An Evaluation Framework and Frame of Reference for KM Tools

5.1 Introduction

The aim of this chapter is to present a framework and frame of reference for the evaluation and selection of knowledge management tools. The chapter begins by introducing the evaluation framework. Following on from this is a description of how the evaluation framework was designed. The actual evaluation framework along with a description of the categories and associated criteria follows this. The chapter then demonstrates how the evaluation framework could be used to evaluate knowledge management tools. The chapter then proceeds by justifying the need for a frame of reference for the selection of knowledge management tools. A description of how the frame of reference was designed and a demonstration of the actual frame of reference follow this. The frame of reference section of this chapter concludes by discussing how the frame of reference may be applied. The chapter concludes with a summary of the chapter.

5.2 An Evaluation Framework for Knowledge Management Tools

The lack of any formal techniques that can be used to evaluate the features present in knowledge management tools means that the process of evaluating one is entirely the responsibility of the purchasing organisation. This entails time, money and effort to be invested that could be utilised elsewhere, if some form of guidelines were available. In order to address this a framework is designed to provide a basis for evaluating and comparing commercial knowledge management tools. The framework consists of a series of categories that contain numerous criteria that can be used to capture information in order to evaluate commercial knowledge management tools.

As previously acknowledged in Section 2.6.1 of Chapter 2, numerous guidelines relating to the general aspects of tool evaluation already exist (Curry and Bonner, 1983; Martin and McClure, 1983; Lynch, 1985; Breslin, 1986; Klein and Beck, 1987; Anderson, 1990; Le Blanc and Jelassi, 1991; Sharland, 1991; Montazemi *et al.*, 1996). Therefore, a framework that consists of criteria specific to knowledge management tools would suffice so long as it is used in conjunction with one of the existing generic techniques. However, this would require an organisation to become accustomed to two different formats. Furthermore, comparing the tools may prove difficult and is likely to cause confusion if results from a variety of frameworks need to be compared. It may be the case that certain areas of generic frameworks may be more applicable to knowledge management tools than others. Consequently the evaluation framework designed as a part of this research is comprehensive and can be used independently to evaluate all aspects of knowledge management tools including generic areas such as support and training.

5.3 Designing the Evaluation Framework

In order to go about designing the evaluation framework existing techniques within other disciplines were analysed. For instance, Section 2.6.2 of Chapter 2 described frameworks designed for evaluating educational tools and primary health care tools (Berryman et al., 1994; McDonald, 1996). These frameworks consist of numerous criteria that are relevant to their respective areas. Therefore, in addition to the generic criteria the evaluation framework should contain criteria that are specific to knowledge management tools. In order to obtain such criteria a number of methods were deployed including analysing the literature, the empirical investigation of knowledge management tools, and most importantly of all from conducting interviews with users of knowledge management tools.

Two main areas of literature were analysed in order to obtain criteria, including knowledge management literature and existing tool evaluation literature. Knowledge management literature was investigated in order to identify possible categories and criteria for the evaluation framework. For instance, a large proportion of the literature acknowledges that knowledge management consists of the activities: generation; organisation; and sharing (Ruggles, 1997; Angus and Patel, 1998; Kramer, 1998; Ferran-Urdaneta, 1998; Jackson, 1999; Macintosh, 1999; Zolingen *et al.*, 2001). Furthermore, it is also recognised that any knowledge management tool should support one or more of the knowledge management activities (Zolingen *et al.*, 2001). Therefore, the knowledge management activities are likely to be incorporated within the framework either as categories or criteria. Literature related to both generic and discipline specific frameworks were used to aid in the design of the evaluation framework for knowledge

management tools. Firstly, generic frameworks were useful for identifying criteria that can contribute to the more general side of the framework (Curry and Bonner, 1983; Martin and McClure, 1983; Lynch, 1985; Breslin, 1986; Klein and Beck, 1987; Anderson, 1990; Le Blanc and Jelassi, 1991; Sharland, 1991; Montazemi *et al.*, 1996). These may include criteria such as costs, documentation, training, etc. Secondly, discipline specific frameworks were used to gain an understanding of the issues that were considered during its construction and how these could be applied to this evaluation framework (Parnas *et al.*, 1990; Berryman *et al.*, 1994; McDonald, 1996; Buckleitner, 1999; Dupuy and Leveson, 2000).

The other technique that was used to identify criteria for the evaluation framework is the empirical investigation of knowledge management tools. The purpose of this was to explore the tools in order to establish the features and facilities of each tool. Consequently, the features and facilities identified contributed to the evaluation framework in the form of criteria. Chapter 3 described the detailed evaluation of four knowledge management tools and the following chapter, Chapter 6, describes the investigation of an additional forty tools. However, since the results obtained from the methods thus far could be considered as subjective a way of substantiating the results was required.

In order to determine the validity of the framework and its criteria a number of interviews were conducted. The purpose of the interviews was to establish the features and facilities considered important by various people involved with knowledge management tools. Interviewees were selected from three different groups. The first

group consists of institutions that have previously been involved in the evaluation of commercial knowledge management tools. This enabled the identification of features and facilities considered important by the team responsible for the evaluation and selection of a knowledge management tool.

The second group consists of institutions that have been involved in the development of a knowledge management tool. Although the framework is designed specifically to evaluate commercial knowledge management tools, this group is included in the study. The reason for this is that during the initial process of obtaining case studies it was evident that institutions had previously investigated the knowledge management software market and were unsuccessful in finding a tool that adequately met their requirements. Therefore, they developed their own knowledge management tool that includes the additional features and facilities. Hence, additional, and in some cases, more specific criteria for the framework.

The third group consists of users of both, internally developed and commercial, knowledge management tools. Although the two groups mentioned previously are likely to have a good deal of knowledge about the tool in question, if they do not use the tool on a day to day basis it is difficult for them to comment based on experience. Therefore, it was believed that the users would be able to provide an insight into the features and facilities of the tool that are actually used, which were found to be most useful, and not so useful. Further details about the interviews were discussed in Chapter 4.

5.4 The Evaluation Framework

The results obtained from the three sources of information were collated and combined in order to create the evaluation framework. Figure 5.1 demonstrates a high-level view of the evaluation framework including the sections and categories. The evaluation framework consists of two sections. The aim of the first section is to enable the evaluator to evaluate the more general aspects involved in purchasing a software tool. Therefore, this section could be used to evaluate any tool regardless of whether it has been designed to be used within a specific discipline or is a general-purpose tool. The section consists of several categories including financial aspects, training, support, documentation, usability, technical aspects, vendor, and client view of vendor. Each category contains a set of general criteria that can be used to derive and capture information about the various features supported by the tool.

The second section has been specifically designed for the purpose of evaluating features that are common to knowledge management tools. This part of the evaluation framework consists of four main categories including general criteria for knowledge management tools, criteria for knowledge generation tools, criteria for knowledge organisation tools, and criteria for knowledge sharing tools. The latter three categories represent the knowledge management activities that were introduced in Section 2.3.1 of Chapter 2 and are part of the frame of reference described in the latter part of this chapter and the taxonomy described in the following chapter. Each of these is further sub-divided according to the categories identified for the taxonomy in Section 6.4 of Chapter 6. Furthermore, a general category also exists within each of the latter three

categories. Each section along with the associated categories and criteria are discussed in depth subsequent to Figure 5.1.

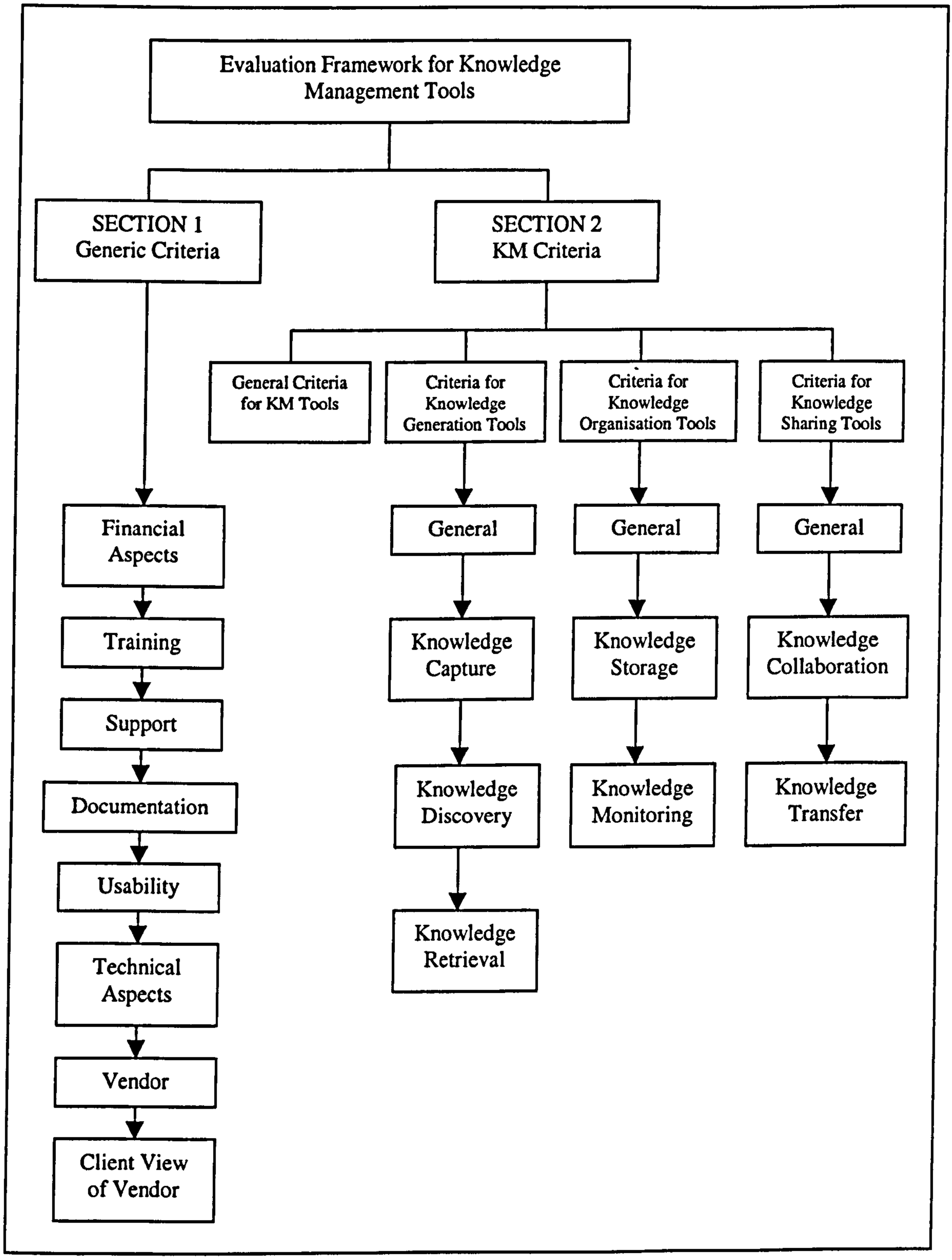


Figure 5.1: High-Level View of Evaluation Framework

However, prior to describing each of the sections it is necessary to explain the structure of the diagram in Figure 5.1. The reason for representing the categories within Section 1 in a vertical manner is simply the order in which they occur within the evaluation framework. However, this does not mean that this is the order that must be followed during evaluation. Furthermore, one category does not have to be completed before moving on to the next. In fact, all categories can be completed in parallel including those from Section 2.

Since Section 2 of the evaluation framework contains categories with sub-categories, it is displayed in a slightly different format. The four main categories are presented in a horizontal manner with sub-categories branching from the latter three in a vertical fashion. The former are presented horizontally because three of the categories, criteria for knowledge generation tools, criteria for knowledge organisation tools, and criteria for knowledge sharing tools, represent the order in which knowledge management is believed to occur (Ruggles, 1997). However, as before this is not reflective of the order in which the categories should be completed. The sub-categories of the four main categories are presented in a vertical manner for the same reasons as Section 1. The evaluation framework is presented in its entirety in Appendix B. However, for explanation purposes the evaluation framework has been divided by categories for this chapter. The remainder of Section 5.4 describes the two sections and illustrates the categories and criteria within each.

5.4.1 Section 1 of the Evaluation Framework

As previously mentioned Section 1 of the framework is designed to enable the evaluation of general aspects of purchasing a software tool. It contains eight categories, each of which consists of a set of criteria designed to extract certain information about the tool. Table 5.1 displays the first category from Section 1. The 'Financial Aspects' category is important because it determines whether the tool is affordable according to the allocated budget. This is achieved by determining if the tool falls within, or exceeds, the allocated budget and if any additional features are included in the cost of the tool. Furthermore, details about a multiple copy discount and licensing issues are also captured.

Financial Aspects			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Cost	❑ Within budget ❑ Exceeds budget		Does the cost of the tool fall within the allocated budget?
Additional features	❑ Installation ❑ Training ❑ Documentation	❑ Support ❑ Other Details:	Are any additional features included in the cost of the tool?
Bulk discount	❑ Yes ❑ No	Details:	Is there a discount if multiple copies of the tool are purchased?
Number of licences	❑ 1 – 50 ❑ 51 – 100	❑ 101 – 150 ❑ 150 +	How many licences are included in the cost of the tool?
Additional Licences	❑ Available ❑ Not Available	Cost:	Are additional licences available? If so, at what cost?

Table 5.1: Financial Aspects Category and Criteria

The objective of the 'Training' category, as shown in Table 5.2, is to derive information about the provision of training facilities. This is achieved by identifying whether training is required in order to be able to use the tool. Furthermore, the evaluation framework establishes if the tool vendor provides training and if so whether or not this

is included within the cost of the tool. If the tool vendor does support training the evaluation framework determines the options for the location of where the training can take place, how long it lasts, and the number of people that can be accommodated during a training session.

Training			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Required	❑ Yes ❑ No		Is training required in order to be able to use the tool?
Provided	❑ Yes ❑ No		Does the tool vendor provide training?
Cost	❑ Included ❑ Additional	Cost: ……	Is training included in cost of tool ? If additional, what is the cost?
Location	❑ On site ❑ Vendor site	❑ Training Centre	What are the options for the location of the training?
Duration	❑ 1 Day ❑ 2 Days	❑ Upto 1 Week ❑ Upto 2 Weeks	What is the duration of the training required?
Session Size	❑ Upto 5 people ❑ 6 – 10 people ❑ 11-15 people	❑ 16 – 20 people ❑ 21 – 25 people ❑ 25 +	How many people can be accommodated during a training session?

Table 5.2: Training Category and Criteria

In essence, the purpose of the 'Support' category, displayed in Table 5.3, is to derive information about the support provided prior to, during, and subsequent to purchasing a tool. This part of the evaluation framework attempts to discover information such as whether support is required for the tool and if the tool vendor provides it. Furthermore, information about whether support is included within the cost of the tool or is additional is also important. Other issues related to the support aspect of purchasing a software tool includes the forms of support provided, the duration of the support contract, and daily hours that support is available. Finally, if the support contract needs to be extended is it possible and if so the costs that are involved.

Support			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Required	❑ Yes ❑ No		Is support required for the tool?
Provided	❑ Yes ❑ No		Does the tool vendor provide support?
Cost	❑ Included ❑ Additional Cost:		Is support included in cost of tool? If additional, what is the cost?
Duration	❑ 1 Year ❑ 2 Years	❑ 3 Years ❑ 5+ Years	What is the duration for the provision of support?
Formats	❑ Telephone ❑ Email	❑ Internet Website ❑ On-line in tool	In what format(s) is support available?
Availability	❑ 24 X 7 ❑ Local Office Hours ❑ International Office Hours		When is direct support available?
Extension	❑ Yes Cost: ..... ❑ No		Can the support period be extended if required? If so, what is the cost?

Table 5.3: Support Category and Criteria

The 'Documentation' category, demonstrated in Table 5.4, is designed to derive information about the availability and usability of user manuals. This is achieved by establishing the target audience for the documentation and its complexity. For instance, if the documentation caters for only a technical person then it is unlikely that general users will be able to efficiently utilise this resource. Furthermore, the number of copies of documentation is important since if only one is provided and is expected to be used by 50 users again this would not be an appropriate option.

Documentation			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Provided	❑ Yes ❑ No		Is documentation for the tool available?
Cost	❑ Included ❑ Additional Cost:		Is documentation included in cost of tool? If additional, what is cost?
Content	❑ Yes ❑ No		Is the content of the documentation sufficient?
Standard	❑ Basic ❑ Medium	❑ Difficult ❑ Too Complex	What is the standard of the documentation?
Target Audience	❑ Users ❑ Managers ❑ Technical		What group(s) is the documentation suitable for?

Examples	❑ Yes ❑ No	Are sufficient examples provided within the documentation?
Copies	❑ 1 Copy ❑ According to number of licences ❑ Other Details:	How many copies of the documentation are provided?
Availability	❑ Yes ❑ No	Would the documentation be easily available to everyone?

Table 5.4: Documentation Category and Criteria

The 'Usability' category, illustrated in Table 5.5, is concerned with the actual use of the tool. Therefore, the category determines to establish information such as how easy it is to learn to use the tool. The findings from one of the case studies presented in Section 4.5 of Chapter 4 suggests that the similarity of the user interface with that of an Internet search engine makes it easy to use. Therefore, one of the criterion within this category is designed to capture whether or not the user interface is similar to any other that the user is familiar with. Another criterion within this category aims to derive if the interface of the tool is visually appealing. This refers to the combinations of colours used and the layout of the interface. Other criteria include how easy it is for the user to find their way around the tool and general ease of use of the tool.

Usability			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Learning	❑ Easy ❑ Average	❑ Difficult ❑ Too Difficult	How easy is the tool to learn?
User Interface	❑ Yes ❑ No		Is the format of the interface familiar to any other?
Visual	❑ Yes ❑ No		Is the interface of the tool visually appealing?
Navigation	❑ Yes ❑ No		Is the tool easy to navigate?
Ease of use	❑ Yes ❑ No		Is the tool easy to use?
Crashes	❑ Yes ❑ No	Details:	Did the tool crash at any point? If so, provide details.
Personalisation	❑ Yes ❑ No		Does the tool enable the user to design their own interface?

Table 5.5: Usability Category and Criteria

Technical Aspects			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Functionality	❑ Yes ❑ No		Does the tool do what you want it to do?
Tailorability	❑ Yes ❑ No		Can the tool be adapted if necessary?
Feasibility of Tailorability	❑ Yes ❑ No		Is it feasible to tailor the tool?
Compatibility	❑ Windows 95 ❑ Windows 98 ❑ Windows 2000 ❑ Windows XP	❑ Windows NT ❑ Mac OS ❑ Unix	What Operating Systems is the tool compatible with?
OS Problems	❑ Yes Details: ..... ❑ No		Are there any known problems with specific Operating Systems?
Performance	❑ Windows 95 ❑ Windows 98 ❑ Windows 2000 ❑ Windows XP	❑ Windows NT ❑ Mac OS ❑ Unix	On which Operating System(s), if any, does that tool perform best?
Cost	❑ Yes Details: ..... ❑ No		Are there any differences in cost depending on the OS?
Integration	❑ Yes ❑ No		Can the tool be integrated with other software tools?
Development	❑ Yes Details: ..... ❑ No		Is any development of the tool planed for the near future?
Upgrades	❑ Yes ❑ No		Will free upgrades be provided with new versions of the tool?
Macros	❑ Yes ❑ No		Does the tool facilitate macros?
Security	❑ Yes Details: ..... ❑ No		Are there any known security issues with the tool?

Table 5.6: Technical Aspects Category and Criteria

The 'Technical Aspects' category, shown in Table 5.6, is designed to extract all of the technical issues surrounding the purchase of a new software tool. To this extent, criteria within this category aim to determine whether the tool actually does what is required of it. Furthermore, if the tool needs to be adapted is this possible and feasible. It is also important to ensure that the tool is compatible with existing hardware and software within an organisation. In addition, the criteria are designed to determine the operating systems the tool is compatible with and if performance is particularly increased with a certain operating system. The evaluation framework also aims to establish if there are

any known problems associated with any of the operating systems. This category also attempts to discover whether it is possible to integrate the tool with other software and security issues.

Vendor				
CRITERIA	**OPTIONS**			**DESCRIPTION**
Reputation	❑ Unknown ❑ Bad	❑ Good ❑ Excellent		What kind of reputation does the tool vendor have?
Stability	❑ Stable ❑ Unstable ❑ Unknown			Is the tool vendor stable?
No. of Clients	❑ 1–10 ❑ 11–20	❑ 21–30 ❑ 31–40	❑ 41–50 ❑ 50 +	How many clients does the tool vendor have?
Client Companies	❑ Small Companies ❑ Medium Companies ❑ Large Companies ❑ Unknown			What term is most reflective for the majority of the vendor's clients?
Service	❑ Bad ❑ Low	❑ Medium ❑ High		How would you rate the quality of the service provided by the vendor?
Installation	❑ Yes ❑ No			Will vendor help to install tool?
Modifications	❑ Yes ❑ No			Is vendor willing to make modifications to the tool?

Table 5.7: Vendor Category and Criteria

The purpose of the 'Vendor' category, displayed in Table 5.7, is primarily to determine that the vendor of the software tool is reputable and reliable. Therefore, this portion of the evaluation framework aims to establish the vendor's position within the software market and details about current clients. Furthermore, information about the quality of service provided by the vendor is also recorded. This category also extracts information about whether the tool vendor is willing to make modifications to the tool if necessary.

The 'Client View of Vendor' category, illustrated in Table 5.8, is aimed at attempting to capture the client view of the tool vendor. Therefore, a client, or more if required, can be contacted in order to obtain their view of the vendor. Information that is gathered

through the criteria include the client's opinion of the service provided by the vendor and any bugs that the client is aware of that exists within the tool. The evaluation framework also attempts to establish if the client believes that the tool could be improved in any way and if so, what they would suggest.

Client View of Vendor			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Vendor Service	❑ Bad ❑ Low	❑ Medium ❑ High	What is the general opinion of the service provided by the vendor?
Delays	❑ Yes ❑ No	Details:	Were any delays encountered?
Bugs	❑ Yes ❑ No	Details:	Were any bugs discovered within the tool?
Response Time	❑ No Response ❑ Slow	❑ Average ❑ Fast	What is the general opinion for the response time to queries?
Improvements	❑ Yes ❑ No	Details:	Do the clients suggest any improvements for the tool?

Table 5.8: Client View of Vendor Category and Criteria

5.4.2 Section 2 of the Evaluation Framework

Section 2 of the evaluation framework contains categories and criteria that are specific to knowledge management tools. It consists of four main categories, three of which are sub-divided into further categories. The remainder of this section describes and illustrates each of the four categories and associated criteria. The first category is the 'General Criteria for Knowledge Management Tools' as displayed in Table 5.9. This category can be used to evaluate the more general aspects of any knowledge management tool. The criteria within this category are used to extract information such as the knowledge management activities supported by the knowledge management tool being evaluated. Furthermore, details about whether or not the tool has been designed to

be used in a particular application area is also obtained. Additional information captured by the criteria within this category includes whether the knowledge management tool caters for structured or unstructured knowledge, or even both. Furthermore, the formats of data the knowledge management tool supports such as numeric, graphics, text, etc are also derived. One of the case studies presented in Section 4.6 of Chapter 4 has successfully incorporated a knowledge management tool into the organisation. One of the success factors is attributed to a reward scheme for any contributions to the knowledge repository that is built into the tool. Therefore, one of the criteria determines whether the knowledge management tool has an in-built reward system.

General Criteria for Knowledge Management Tools			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Type	❑ Generate knowledge ❑ Organise knowledge ❑ Share knowledge		Which of the knowledge management activities does the tool accommodate?
Purpose	❑ General ❑ Specific Details:		Has the tool been designed for a specific area? E.g. Helpdesk
Type of knowledge	❑ Structured ❑ Unstructured		What type of knowledge does the tool facilitate?
Format of data	❑ Numeric ❑ Text ❑ Graphics	❑ Audio ❑ Visual	What format(s) of data does the tool facilitate?
Reward Scheme	❑ Yes ❑ No		Does the tool accommodate the deployment of a reward scheme?

Table 5.9: General Criteria for Knowledge Management Tools

The second category is 'Criteria for Knowledge Generation Tools' and is displayed in Table 5.10. As the term suggests the aim of this category is to evaluate knowledge management tools or the parts of a knowledge management tool that are designed for knowledge generation. The category is divided into four further categories the first of which is a general category for this type of tool. It includes criteria such as how knowledge is generated and the formats in which it can be displayed.

Criteria for Knowledge Generation Tools			
CRITERIA	**OPTIONS**		**DESCRIPTION**
General			
Generation	❑ Capture ❑ Discovery ❑ Retrieval		What aspect(s) of knowledge generation does the tool facilitate?
Display Format	❑ Text ❑ Graph ❑ Table	❑ Database ❑ Graphic	In what format(s) can the generated knowledge be displayed?
Knowledge Capture			
Functions	❑ User Profiling ❑ Web Spider ❑ Expert Profiling		What functions are used in order to capture knowledge?
Performance Indicators	❑ Yes ❑ No		Are details about an individual's performance captured?
Time Scheduling	❑ Yes ❑ No		Does the tool enable individual schedules to be captured?
Log Caller Details	❑ Yes ❑ No		Does the tool capture contact details about caller?
Time Logging	❑ Yes ❑ No		Does the tool capture the time taken to complete a task?
User Input	❑ Yes ❑ No		Is there a facility for an average user to submit to the repository?
Input Wizard	❑ Yes ❑ No		Does the tool guide the user when they are submitting to repository?
Ease of Input	❑ Yes ❑ No		Is it easy for the user to submit to the knowledge repository?
Knowledge Discovery			
Functions	❑ Agents ❑ Clustering	❑ Data Mining ❑ Text Mining	What functions are used in order to discover knowledge?
Discovery Data	❑ Numeric ❑ Structured Text ❑ Unstructured Text	❑ Audio ❑ Visual ❑ Graphics	Is knowledge discovery based on particular type of data?
Output	❑ Patterns ❑ Rules		In what format(s) is the discovered knowledge displayed?
Knowledge Retrieval			
Functions	❑ Natural Language Processing ❑ Meta Data Management ❑ Application Integration ❑ Full Text Search ❑ Image/Video Search ❑ Structured Search ❑ Unstructured Search		What functions are used in order to retrieve knowledge?
Database Querying	❑ Yes ❑ No		Can database queries be used to locate knowledge?
Browsing	❑ Yes ❑ No		Does the tool provide a browsing facility?
Similar Documents	❑ Yes ❑ No		Does the tool suggest others documents that may be relevant?
Ease of Search	❑ Yes ❑ No		Is it easy to search for what you want?
Results of Search	❑ Yes ❑ No		Are the results of the search as you expected?

Table 5.10: Categories and Criteria for Knowledge Generation Tools

The remaining three categories within the 'Criteria for Knowledge Generation Tools' category reflect the way in which knowledge is generated. Furthermore, these are the same categories identified for the knowledge management tools taxonomy described in Section 6.4 of Chapter 6. The first of these is the 'Knowledge Capture' category that is concerned with the obtaining of knowledge. Criteria within this category aim to determine the methods used for capturing knowledge, the types of knowledge captured, and the provisions made for users importing knowledge to the repository. The second of these is the 'Knowledge Discovery' category that is designed to evaluate knowledge management tools that support the locating of knowledge that is unknown to exist. As with the previous category, the criteria are designed to extract information about the way in which knowledge is discovered, any restrictions placed on knowledge discovery, and the presentation of the knowledge that is discovered. The third and final category within the 'Criteria for Knowledge Generation Tools' is the 'Knowledge Retrieval' category. The criteria within this category are designed to derive information about the methods used to retrieve knowledge, how easily this is achieved, and the results of the retrieval exercise.

The third category within Section 2 of the evaluation framework is 'Criteria for Knowledge Organisation Tools' as demonstrated in Table 5.11. This category is designed to enable the evaluation of the organisation, storage, and monitoring aspects of a knowledge management tool. This category is divided into three further categories including one for general aspects for knowledge organisation tools and the other two for knowledge storage and monitoring. The general category contains criteria that attempt to derive the aspects of knowledge organisation the tool supports.

Criteria for Knowledge Organisation Tools			
CRITERIA	**OPTIONS**		**DESCRIPTION**
General			
Organisation	❑ Storage ❑ Monitor		What aspect(s) of knowledge organisation does the tool facilitate?
Knowledge Storage			
Functions	❑ Manual Categorisation ❑ Automatic Categorisation ❑ Document Management ❑ Visualisation ❑ Central Interface		What functions are used in order to store knowledge?
Display Format	❑ Text ❑ Graph ❑ Table	❑ Database ❑ Graphic	In what format(s) can the knowledge repository be displayed?
Import Facility	❑ Yes ❑ No		Is it possible to import an already existing knowledge repository?
Import Formats	❑ Text Files ❑ MS Access ❑ MS Excel ❑ Dbase ❑ Fox Pro	❑ Paradox ❑ Lotus 1-2-3 ❑ HTML ❑ ODBC ❑ Other Details.....	If an import facility is provided what formats can data be imported in?
Creation of Repository	❑ Yes ❑ No		Can the knowledge repository be created from within the tool?
Optimised Storage	❑ Yes ❑ No		Does the tool store data in an optimised manner?
Size of Repository	❑ Yes ❑ No	Size:.....	Is there a limit to the size of the knowledge repository?
Cost	❑ Yes ❑ No		Is cost dependent on the size of the knowledge repository?
Task Logging	❑ Yes ❑ No		Does the tool facilitate the storage of tasks currently being carried out?
Task Knowledge Base	❑ Yes ❑ No		Does the tool facilitate the storage of details of previous tasks?
Update	❑ Yes ❑ No		Is the tool easy to update and add information to?
File Management	❑ Yes ❑ No		Is it easy to manage files within the knowledge repository?
Directory Structure	❑ Yes ❑ No		Is a directory structure used to organise content of repository?
Knowledge Monitoring			
Functions	❑ Channels ❑ Notification		What functions are used in order to monitor knowledge?
Tracking	❑ Yes ❑ No		Is it possible to perform tracking?
Automatic Progress Report	❑ Yes ❑ No		Does the tool automatically inform on progress of a task?
User Navigation	❑ Yes ❑ No		Is it possible to track a user's navigation through a website?

Table 5.11: Categories and Criteria for Knowledge Organisation Tools

The second category 'Knowledge Storage' is designed to capture information about how knowledge is stored and manipulated within the knowledge repository. This is achieved by establishing the methods used for storing and displaying data. Furthermore, the criteria determine whether the tool supports a knowledge repository to be imported from another source and possibly in another format. This category also aims to discover if a knowledge repository can be created from within the tool and whether the data within the repository is stored in an optimised manner. Further criteria involve how the data within the knowledge repository is structured and how easy it is to update.

The third category within the 'Criteria for Knowledge Organisation Tools' category is 'Knowledge Monitoring'. The purpose of this category is to evaluate aspects of a knowledge management tool that monitors a knowledge repository. Criteria within this category determine the actions that are taken once the knowledge repository has been monitored. Essentially the category attempts to extract the types of monitoring that the knowledge management tool facilitates. For instance, one of the criterion determines whether a user's navigation is monitored as they view a website.

The final category within the evaluation framework is 'Criteria for Knowledge Sharing Tools' as shown in Table 5.12. As with the previous category this is also divided into three categories the first of which being the general category. The general category is designed to establish how the knowledge management tool shares knowledge. This could be either through collaborative work or by 'pushing' the knowledge across an organisation.

Criteria for Knowledge Sharing Tools			
CRITERIA	**OPTIONS**		**DESCRIPTION**
General			
Sharing	❑ Collaboration ❑ Transfer		What aspect(s) of knowledge sharing does the tool facilitate?
Knowledge Collaboration			
Functions	❑ Communities ❑ Virtual Teams ❑ Conferencing ❑ Chat ❑ Bulleting Board ❑ Whiteboard ❑ Messaging		What functions are used in order to support knowledge collaboration?
Records	❑ Yes ❑ No		Are records of collaborative work automatically created?
Quality of Collaboration	❑ Bad ❑ Low	❑ Medium ❑ High	How would you rate the quality of the collaborative environment?
Video Conferencing	❑ Yes ❑ No	Details:	Can more than two people participate in video conferencing?
Knowledge Transfer			
Functions	❑ Application Sharing ❑ File Transfer		What functions are used in order to transfer knowledge?
Upload Facility	❑ Yes ❑ No		Does the tool enable data to be loaded to the knowledge repository?
Download Facility	❑ Yes ❑ No		Does the tool enable data to be downloaded from the knowledge repository?
Knowledge Sharing	❑ Yes ❑ No		Does the tool allow knowledge to be shared easily?

Table 5.12: Categories and Criteria for Knowledge Sharing Tools

The second category 'Knowledge Collaboration' should be used to evaluate the features of knowledge management tools that support collaborative work. Criteria within this category determine to derive information about all aspects of collaborative work. For instance, one of the criterion establishes whether a record of work carried out in a collaborative environment is automatically recorded. Another criterion establishes whether it is possible to conduct video conferencing with more than two people.

The third and final category is the 'Knowledge Transfer' category. The purpose of this category is to extract information about any knowledge transfer facilities a knowledge management tool may posses. This is achieved by obtaining information such as whether an upload and download facility exists that enables users to display and obtain knowledge respectively. Furthermore, the criteria also attempt to determine whether or not knowledge can easily be shared. Having described the evaluation framework and the various categories and criteria that exist it is possible to demonstrate how the evaluation framework could be used.

5.5 Applying the Framework

The evaluation framework presented in Appendix B can be used in one of three ways in order to evaluate knowledge management tools. Firstly, it can be used in its entirety as it is presented in Appendix B to capture the maximum amount of information about a knowledge management tool. Secondly, the evaluation framework can be used as a template as a basis for which to evaluate selected features of knowledge management tools. Finally, the framework can be manipulated to create a customised hierarchical evaluation framework allowing priority to be associated with certain criteria. The remainder of this section describes the three different methods in which the evaluation framework can be applied in order to evaluate knowledge management tools.

5.5.1 Entire Evaluation Framework

Firstly, the framework can be used in its entirety in order to gather information about various knowledge management tools. This approach may be adopted where an organisation is unsure of the requirements of the knowledge management tool to be

purchased. Alternatively, it may be used to gain a general idea of what is available on the knowledge management software market and the features and facilities provided. If the evaluation framework were to be used in this manner then the evaluator should work through the framework checking off the relevant options for each of the criteria that are applicable. The outcome should be a collection of completed evaluation frameworks containing various information about the knowledge management tools that can be used as a vehicle for comparing the tools. This can lead to either further investigations of the tools that have been short-listed from the initial evaluation or, if sufficient information has been captured in order to make an informed decision, then a suitable knowledge management tool may be selected.

5.5.2 Template Evaluation Framework

Secondly, if the organisation is confident about what they require from the knowledge management tool to be purchased then the evaluation framework can be used as a template as a basis for evaluating the knowledge management tools. This approach involves going through the evaluation framework, prior to evaluating any knowledge management tools, and checking the criteria that match the requirements for the desired knowledge management tool. The result is an evaluation framework that depicts the features and facilities that need to be supported. This can then be used as a basis from which to ascertain whether or not the knowledge management tools that are evaluated match the requirements in terms of features. In essence the evaluator works through each knowledge management tool confirming if the checked criteria are supported. Therefore, this method of using the framework enables the evaluator to test exactly what they want and omit the parts of the framework that are irrelevant. Furthermore, it is

possible to establish the extent to which each of the knowledge management tools matches the requirements and order them accordingly. It may be obvious subsequent to this form of evaluation, which of the evaluated knowledge management tools is most suitable. In this instance it is possible to proceed with further investigations. However, it is also likely that the results from the evaluation depict that the majority of the tools closely match the requirements and hence the choice of tool is not so evident. In this situation an option could be to perform the evaluation using the hierarchical framework.

5.5.3 Hierarchical Evaluation Framework

Thirdly, if the situation is such that certain features are crucial and others desirable in the knowledge management to be purchased, then the parts of the framework that match the requirements can be extracted and ordered to create a customised hierarchical evaluation framework. The difference between this and the previous evaluation framework is that the sequence of the criteria can be manipulated to reflect the order of importance for the criteria. For instance, using a very simple example, it is crucial for the purchased knowledge management tool to be compatible with a Mac OS (Operating System) and it is desirable that the cost of installation is included in the overall cost of the tool. Therefore, the criteria at the top of the evaluation framework would confirm that a Mac OS is supported and the following criteria would determine whether installation was included within the cost of the tool. It also enables the evaluator to control the depth of the evaluation so that if there are a large volume of tools then the evaluator may decide to conduct an initial evaluation perhaps only including one or two of the criteria that are crucial. Once the number of tools is manageable then a more in-depth evaluation can be conducted using additional criteria.

It is also important to emphasise that the framework does not necessarily have to be used in the order it is presented. For example, if a tool that facilitates unstructured knowledge was required it would be sensible to confirm this through the first question of the evaluation. It would be pointless and time consuming to work through the evaluation as it is demonstrated in Appendix B to find out mid-way that the tool does not facilitate unstructured knowledge. It must also be stressed that the framework has been designed in such a way that as new, more advanced knowledge management tools are developed, and more tools are evaluated the framework can be updated easily and new categories added if necessary.

5.6 Frame of Reference for the Selection of Knowledge Management Tools

The former part of this chapter highlighted the lack of any guidelines detailing criteria that could be used for the evaluation of knowledge management tools. Therefore, an evaluation framework was designed to address this issue. Similarly, no formal techniques currently exist outlining the factors and issues that need to be taken into consideration during the selection of a commercial knowledge management tool. It would be possible to use one of the numerous generic techniques that exist (Curry and Bonner, 1983; Martin and McClure, 1983; Lynch, 1985; Breslin, 1986; Klein and Beck, 1987; Anderson, 1990; Le Blanc and Jelassi, 1991; Sharland, 1991; Montazemi *et al.*, 1996). However, these would need to be adapted to accommodate characteristics present in knowledge management tools. Furthermore, other disciplines including education, the health service, the military, etc can make use of such guidelines designed specifically for their areas (Parnas *et al.*, 1990; Berryman *et al.*, 1994; McDonald, 1996; Buckleitner, 1999; Dupuy and Leveson, 2000).

Therefore, it appears feasible, to make available, a similar facility for the selection of knowledge management tools. In light of this, a frame of reference that illustrates the factors and issues that can be taken into consideration during the selection of a knowledge management tool was designed. It is important to note that the frame of reference is not intended as a rigid structure that must be followed without any deviation. In fact the opposite is true, the frame of reference is intended as a guideline and aid that can be adapted according to the requirements of the individual organisation. The following section describes how the frame of reference for knowledge management tool selection was designed.

5.7 Designing the Frame of Reference

The information, in order to create the frame of reference, was obtained predominantly from three different sources. The first was from conducting interviews with people that have already been involved in the process of selecting a knowledge management tool. The purpose of the interviews was to find out how institutions had undertaken the task of selecting and purchasing a knowledge management tool. The users contribution to the frame of reference is to confirm whether or not the knowledge management tool purchased is satisfactory. If the users are satisfied with the tool then the experiences from the associated institutions selection process can be incorporated into the frame of reference. However, if the outcome is negative then this can be incorporated into the frame of reference as issues to be aware of. More specific details about the interviews and the numbers involved were discussed in Chapter 4.

The second source of information was from existing methodologies designed for the selection of software. These include two different types: generic methodologies that can be used for the selection of any software tool; and specific methodologies intended for the selection of discipline specific tools (Curry and Bonner, 1983; Martin and McClure, 1983; Anderson, 1990; Sharland, 1991; Mosley, 1992; Berryman *et al.*, 1994; McDonald, 1996). An example of the latter is a methodology that is designed specifically for the selection of educational tools and therefore considers educational requirements (Berryman *et al.*, 1994). This type of methodology was investigated to establish how the task of designing a discipline specific methodology is undertaken and how issues that need to be addressed, with regards to the particular area, were obtained. Furthermore, methodologies designed for areas already existing within the discipline of information systems and computing such as simulation (Hlupic, 1997; Nikoukaran *et al.*, 1998) and computer aided software engineering (Forte, 1992; Mosley, 1992) were also analysed. The reasons underlying this was that, being classified under the same discipline parts of the methodology may also apply to knowledge management tool selection. Further details of existing methodologies can be found in Section 2.6 of Chapter 2.

The third and final source of information was obtained by consulting the literature related to knowledge management. The purpose of this was to identify the factors specific to knowledge management tools that need to be taken into consideration during the selection process. The results from the three different avenues of information were collated and combined in order to create a frame of reference for knowledge management tool selection. The case studies that participated in this research were then

asked to evaluate the usability of the frame of reference. This resulted in the general opinion that had such a facility been available when they had been going through the process of investigating the purchase or development of a knowledge management tool then the frame of reference would have been a good place to start.

Furthermore, it was indicated that the frame of reference did not allow for the consideration that a knowledge management tool would be developed. In addition, it was suggested that the frame of reference would be further enhanced if it catered for the various sectors within industry. For instance, if a financial institute is using the frame of reference in order to select a knowledge management tool then the factors that they should consider may be different to what a healthcare provider would need to consider. Another suggestion that was made was that the frame of reference should be extended to provide frames of reference for the organisational and human aspects. In this manner the frame of reference could be considered as an entire knowledge management strategy. This concept was further substantiated in the discussion of the current literature in Section 2.3 of Chapter 2 (see page 16) that stated that the knowledge management components should receive equal and combined attention (Borghoff and Pareschi, 1997; Davenport, 1997; Davenport and Prusak, 1998; Milton *et al.*, 1999; Trauth, 1999; Vaas, 1999, Duffy, 2001, Stewart, 2002).

Therefore, the feedback from the case studies was incorporated into the frame of reference where feasible. This included various stages within the frame of reference that would allow the consideration of developing a knowledge management tool internally if a commercial one could not meet the requirements. The suggestion about developing the

frame of reference so that it would consider the various factors according to industrial sectors was believed to be out of the scope of this research and therefore was not pursued any further within this study. However, this would be an ideal area for further research to be conducted in. Unfortunately, the final suggestion about developing the frame of reference to create a knowledge management strategy frame of reference could not be pursued in its entirety since this is also beyond the boundaries of this research. However, the frame of reference was enhanced to suggest that organisational (business processes) and human issues (cultural) must also be taken into consideration during a knowledge management deployment.

5.8 The Frame of Reference

The frame of reference, illustrated in Figure 5.2 has been designed to aid the selection of knowledge management tools and can be classified under the 'Technology' component of knowledge management. However, Figure 5.2 demonstrates that the 'Organisational' and 'Human' components have also been included within the frame of reference. The justification for this is to further substantiate the theory that a knowledge management deployment must take into consideration the three components, in combination, as opposed to one in isolation (Duffy, 2001). The frame of reference consists of five main phases, each of which requires several intermediate stages to be undertaken. In essence, the frame of reference involves: identifying requirements; creating a short-list of suitable knowledge management tools; evaluating the tools; conducting pilot tests; and finally purchasing a tool. Section 5.9 provides a detailed account of each of the five phases and the associated intermediary steps.

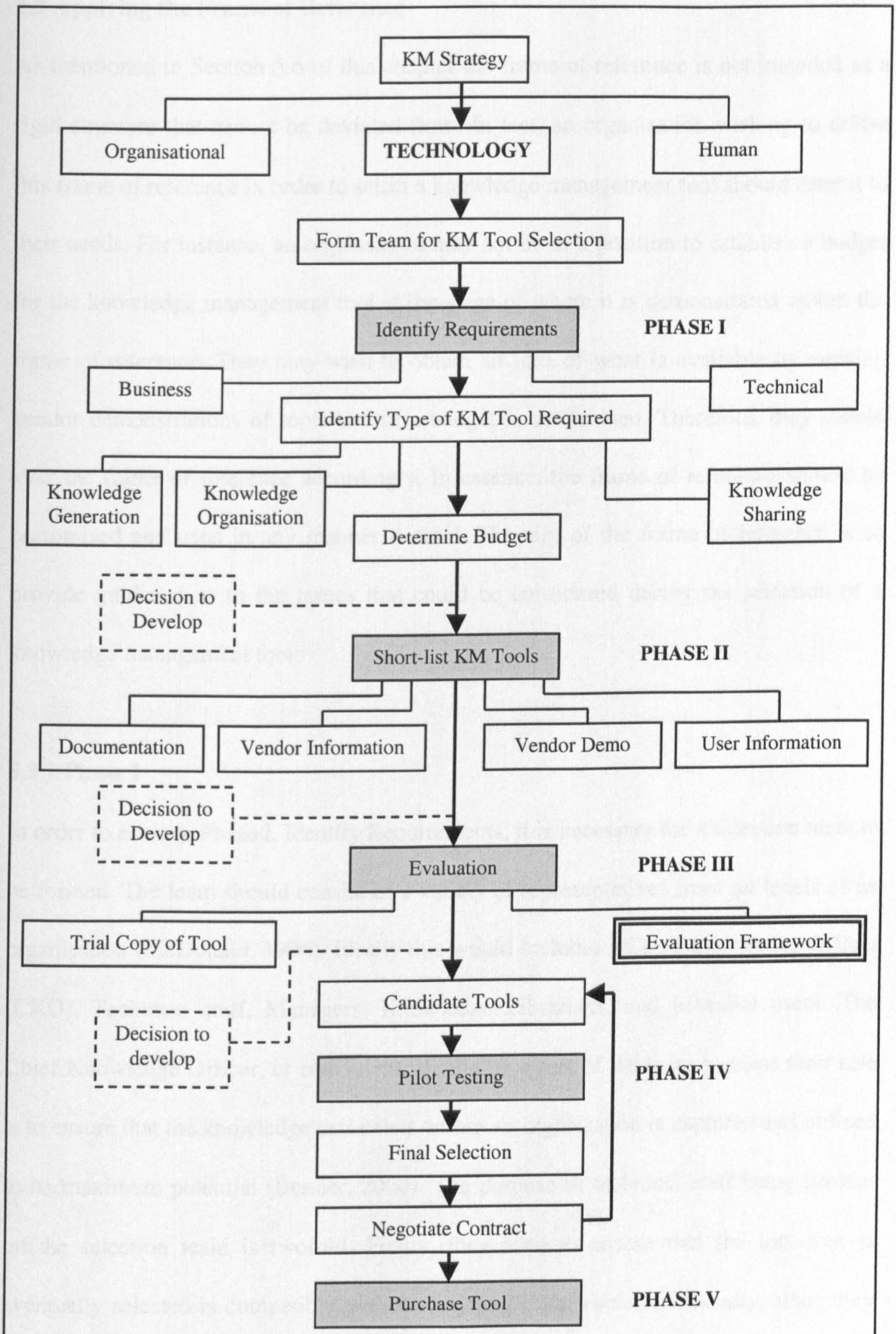


Figure 5.2: Frame of Reference for Knowledge Management Tool Selection

5.9 Applying the Frame of Reference

As mentioned in Section 5.6 of this chapter the frame of reference is not intended as a rigid structure that cannot be deviated from. In fact, an organisation wishing to utilise this frame of reference in order to select a knowledge management tool should cater it to their needs. For instance, an organisation may not be in a position to establish a budget for the knowledge management tool at the stage of where it is demonstrated within the frame of reference. They may wish to obtain an idea of what is available by viewing vendor demonstrations of tools before a budget is determined. Therefore, they should alter the frame of reference accordingly. In essence, the frame of reference should be customised and used in any manner desired. The aim of the frame of reference is to provide guidance as to the issues that could be considered during the selection of a knowledge management tool.

5.9.1 Phase I

In order to achieve Phase I, Identify Requirements, it is necessary for a selection team to be formed. The team should consist of a variety of representatives from all levels of an organisation (McDonald, 1996). Ideally this would include; a Chief Knowledge Officer (CKO), Technical staff, Managers, Knowledge Librarians, and potential users. The Chief Knowledge Officer, or equivalent, should be a part of the team because their role is to ensure that the knowledge that exists within an organisation is captured and utilised to its maximum potential (Bonner, 2000). The purpose of technical staff being present on the selection team is twofold. Firstly, they need to ensure that the tool that is eventually selected is compatible with the existing infrastructure. Secondly, since they are the ones that will be supporting the tool, their input and advice is vital. The

involvement of Managers within the selection team is crucial since they have a global view of the particular area that they manage enabling them to specify broader requirements for the tool in question. It is also important to identify and include, in the selection team, the people that will be maintaining the knowledge once the tool is installed, usually referred to as Knowledge Librarians. Finally, a number of users should figure in the selection team since, ultimately, they are the ones who will be using the tool on a day-to-day basis (Montazemi *et al.*, 1996).

Once a satisfactory team has been formed their first task is to identify both business and technical requirements (Curry and Bonner, 1983). The former entails specifying the business objectives that need to be achieved, the manner in which each will be addressed, and a description of the role of the tool that is to be purchased. For instance, a business objective for an organisation may be to improve customer service. A possible way of addressing this is to reduce the time taken for the Helpdesk to resolve a query. This could be accomplished by having a system whereby the solutions to queries that have previously been resolved can be easily accessed and used, omitting the need for the same query to be solved time and time again. In light of this, the knowledge management tool required needs to facilitate the storage and retrieval of Helpdesk queries and their respective solutions.

The identification of the technical requirements consists of establishing what hardware and software currently exists in order to ensure that the purchased knowledge management tool is compatible (Martin and McClure, 1983; Mosley, 1992). Another decision that needs to be considered at this point is if a commercial knowledge

management tool would be purchased if it required adapting in order to meet the organisation's requirements. If tools that require adapting are not to be considered, then these need to be discarded from the list of potential tools whenever such a tool is identified. There is no one single point in the frame of reference that facilitates this consideration since the necessity to adapt may be evident at any numbers of stages. If the purchasing organisation is prepared to adapt a commercial knowledge management tool then a number of issues need to be taken into consideration. These include the party responsible for adapting the tool (the vendor or the purchasing organisation) the amount of adaptation required, etc (Martin and McClure, 1983). If the purchasing organisation is relying on the vendor to adapt the tool then it needs to be confirmed that the vendor is capable and prepared to do this. If the purchasing organisation have decided to adapt the tool themselves then they need to ensure that they have the resources and expertise in order to achieve this.

Once the requirements have been established, the next stage involves identifying which of the knowledge management activities need to be supported by the tool (Ruggles, 1997; Kramer, 1998; Zolingen *et al.*, 2001). This may include one, two or, all three of the knowledge management activities. For instance, referring back to the Helpdesk example, the knowledge management activities that would be involved are knowledge organisation and knowledge sharing. The former activity will need to be facilitated by the tool in order to store and allow the manipulation of queries and their respective solutions. The latter activity needs to be catered for by the tool so that the knowledge about the queries and respective solutions can be shared between Helpdesk staff. Having

identified the knowledge management activities that the tool is required to facilitate it is necessary to determine the budget available for purchasing the tool.

In the process of considering this, it is also important to establish whether or not the budget, in addition to the cost of purchasing the tool, will include costs for training, installation, licences, etc (Mosley, 1992). Once the requirements have been identified, the type of tool required, and the budget, the software market needs to be scoured in order to identify knowledge management tools that meet these criteria. Therefore, prior to preceding to Phase II a list of all of the knowledge management tools that could potentially be purchased should be created. At this stage it may be indicative that the software market does not provide a knowledge management tool that adequately meets the criteria specified within Phase I. Therefore, it may be decided that the most appropriate option would be to pursue the development angle (Martin and McClure, 1983). This may involve developing the knowledge management tool internally if the expertise and resources are available. Alternatively, a software development company may be utilised to create the required knowledge management tool. Following this route entails a separate study and therefore is not included within this frame of reference. The boxes in Figure 5.2 representing the decision to develop are denoted using a dotted line.

5.9.2 Phase II

The aim of Phase II is to take the list created as a result of Phase I of the frame of reference and produce a streamlined short-list of knowledge management tools. This is achieved by carrying out a sequence of four steps the objective being to refine the short-list of knowledge management tools with each additional step. The first step involves

obtaining an overview and a general idea of the features provided by each of the tools in the short-list. In order to accomplish this documentation from brochures, user manuals, and reviews should be gathered and carefully analysed (Sharland, 1991). The tools that are considered unsuitable should be discarded from the list and the remaining tools should be further investigated.

The second step consists of collating information about the actual vendors of the tools. The main aim of this is to ensure, as much as it is possible, that the vendors are reputable and have a stable position within the software market (Martin and McClure, 1983). The level of information gathered during this step depends on the circumstances of the installation and support required for the tool. For instance, if the tool is to be installed, maintained, and supported by the purchasing organisation then the role of the vendor is limited and therefore basic information about the vendor will suffice. However, if the vendor is required to have a major contribution subsequent to the tool being purchased then a more thorough investigation is required. There are a variety of areas for which information can be collated about the vendor including the background of the company, contact information, and quality of service.

It is important to have some general knowledge about the vendor's background and current stance within the industry to ensure that the vendor is stable and in a position to provide a high quality service. This may involve gathering information, such as when the vendor was established, whether it is part of another company, and a current list of clients. The list of clients can be extremely indicative of the vendor since an association with reputable customers implies the ability to provide a good service (Martin and

McClure, 1983). However, it is important to emphasise that the decision of selecting a vendor should not solely be based on the client list. Another way of determining the quality of the vendor by using the client list is to actually contact the vendor's clients and gather their views on the tool and the vendor.

Contact details for the company includes where the vendor is based and the person whom is the main point of reference. The location of the vendor may be important if training is to be conducted at the vendor's site. Consequently the costs of sending employees for training need to be taken into consideration and budgeted for. If possible, it is important to communicate with the same person representing the vendor since this gives the two companies an opportunity to establish rapport. Moreover, the vendor's representative can form a clear idea about the purchasing organisation's requirements (Curry and Bonner, 1983).

The quality of the service provided by the vendor should be continuously recorded, as it is crucial that the purchasing organisation is satisfied and comfortable with dealing with the vendor. Another useful method, recommended by Curry and Bonner (1983), of separating the stronger vendors from the weaker ones is to request the vendor to write a proposal detailing how their particular tool and company can address the purchasing organisations requirements. According to Curry and Bonner (1983) high quality and experienced vendors are accustomed to responding to requests for proposals and should do so within a given timeframe (specified by the purchasing organisation). Those that do not respond can be discarded from the short-list.

The third step involves taking the further refined short-list and visiting the vendors of each of the knowledge management tools in order to view a demonstration. Ideally, the demonstration should take place at the vendor site since this provides the purchasing organisation with the opportunity to obtain further insight about the vendor (Curry and Bonner, 1983). During the demonstration of the tool it is important to ask the vendor to illustrate how to perform functions similar to the ones that the tool is intended to be used for. The responses to these requests can assist the purchasing organisation with determining whether the tool is able to support their needs and the competence of the vendor with the tool. As a result of this step the tools that appear inappropriate or the vendor weak should be discarded from the short-list.

The final step within Phase II involves contacting the actual users of the tools using the clients list that should have been obtained as a part of the second step. The clients should be questioned about the quality of service provided by the vendor and details of any problems encountered. They should also be asked for their opinions with regards to the actual knowledge management tool and Martin and McClure (1983) suggest approaching the users for their views on how the tool could be improved. After taking all of the information gathered during this step into consideration a final short-list of knowledge management tools should be drawn up ready for evaluation. As with the previous phase the result of this phase may indicate that a suitable knowledge management tool does not currently exist in the software market. Therefore, the option to develop a knowledge management tool may be considered.

5.9.3 Phase III

Phase III of the frame of reference is concerned with obtaining a trial copy of the tool and conducting evaluation (McDonald, 1996). Therefore, each of the vendors associated with the knowledge management tools contained in the short-list should be contacted and a trial copy obtained. These are usually based on a variation of a limited period of time with access to all features or no time limit but restriction placed on certain features. Once the tool has been installed it can be explored and experimented with. Trial copies usually come with a tutorial therefore this is a good place to start becoming accustomed with the tool. Once a certain level of confidence is achieved a structured and systematic evaluation of the tool should be conducted. For comparison purposes it is advisable to use a framework against which each of the knowledge management tools can be evaluated. The evaluation framework designed as another part of this research and described in the former half of this chapter is ideal for this. The framework is designed to evaluate all aspects of purchasing a commercial knowledge management tool including areas applicable across all software tools e.g. costs, training, interface, etc. Once each of the tools contained in the short-list has been evaluated using the framework those tools that are considered inappropriate should be discarded. The remaining tools should be listed according to the order of preference. The short-list now becomes a list of 'Candidate Tools' as demonstrated in Figure 5.2.

5.9.4 Phase IV

This phase involves taking the knowledge management tool positioned at the top from the list of candidate tools and conducting a pilot test (McDonald, 1983). This involves installing the tool in the environment the purchased tool is intended to be used. A

selection of users should use the tool for a period of time determined by the purchasing organisation, as though it is a replacement for the existing system. It is probably best that whenever a pilot test is being conducted to use old data from the existing system so as not to have a negative impact. However, it is important to note that while pilot testing is being undertaken the old system should continue to support the organisation. In many cases the installation of a knowledge management tool will be a completely new initiative. Under these circumstances the tool should be installed and used by people who are intended to use the tool that is finally purchased. If the data for the tool does not exist or is unavailable then representative test data needs to be created.

Once the time limit for the pilot test is reached then the users must be questioned about their views and opinions on the tool (McDonald, 1983). If the outcome is positive then the final selection can be made. However, if the outcome of the pilot test is negative then it is necessary to consult the candidate list of tools created as a result of Phase III and the next tool on the list should be pilot tested. If the results from the pilot test indicate an equally divided outcome then it may be worth extending the testing period and perhaps involving a few more users in the evaluation. This process should be repeated until a suitable tool is identified and a final selection can be made.

Having selected a tool that is approved by both selection team and users it is possible to approach the vendor to negotiate a contract. Martin and McClure (1983) provide a detailed discussion of what factors to consider when drawing up a contract. In summary, the contract should cover issues such as support, warranties, licences, etc. Furthermore, the contract is likely to be biased towards the vendor. Therefore, it is important to

negotiate new terms that favour both parties (Martin and McClure, 1983). If the vendor disagrees to draw up a new contract then the purchasing organisation should re-consider carefully another vendor or tool, or both, if necessary. If another suitable vendor that supports the required tool cannot be found or suitable terms and conditions agreed then another tool may be considered. This involves selecting the next tool from the candidate list produced during Phase III. Once an appropriate knowledge management vendor and contract have been achieved then the tool can be purchased which is the final phase, Phase V, of the frame of reference.

5.9.5 Phase V

Purchasing the knowledge management tool is the objective of this frame of reference and once this is achieved the procedure concludes. However, at this stage an entirely new procedure begins for the organisation. This involves adapting the tool, if necessary, installing, and integrating it into the organisation. This may be done by the organisation itself or the tool vendor. Regardless of who the responsible party is this can be a long drawn-out process that may require numerous cycles of testing. Once the knowledge management tool has been integrated, it is necessary to monitor the tool and ensure that it is functioning in the desired manner. It is important to note that this is an extremely brief version of activities that may take place subsequent to the knowledge management tool being purchased. However, this introduces a whole new research area altogether and therefore the discussion of what happens subsequent to a knowledge management tool being purchased concludes here.

5.10 Summary

In summary, this chapter has used the data gathered as a result of conducting empirical evaluation of knowledge management tools, described in Chapter 3, and undertaking case studies, described in Chapter 4, and developed an evaluation framework and a frame of reference for knowledge management tools. The evaluation framework can be used for evaluating the features that exist within knowledge management tools. Furthermore, the evaluation framework can be applied in three different ways including: in its entirety; as a template; and in a hierarchical manner. The purpose of the frame of reference is to describe the factors and issues that need to be taken into consideration during the selection of a knowledge management tool. The frame of reference consists of five phases including: identifying the requirements; producing a short-list of tools; evaluating a tool; pilot testing a tool; and finally purchasing a tool. The following chapter describes additional guidelines that were developed as a part of this research.

Chapter 6.

A Taxonomy and Requirements for Future Developments of KM Tools

6.1 Introduction

The purpose of this chapter is to present a taxonomy for the classification of knowledge management tools and requirements for further development of knowledge management tools. The chapter begins by presenting taxonomies that already exist for the purpose of knowledge management tools. This is followed by a description of how the taxonomy was designed as a part of this research along with details of the tools that were included. The chapter goes on to illustrate the taxonomy along with a description of the categories that are contained within the taxonomy. In addition, the functions associated with the categories from the taxonomy are also identified. The chapter concludes by proposing a set of requirements that could be incorporated into future versions of knowledge management tools. Furthermore, the relationship between the requirements and the categories from the taxonomy are also demonstrated.

6.2 Taxonomy for Knowledge Management Tools

Several attempts have been made to develop a taxonomy for knowledge management tools (Ruggles, 1997; Angus and Patel, 1998; Jackson, 1998). However, the currently existing taxonomies appear to be designed to classify either the actual knowledge management tools themselves or by the functions commonly present in knowledge management tools. Consequently, the only information that can be obtained from the two types of taxonomy, tool based and function based, is either the category for the knowledge management tool or the category for the function, respectively. This is more effectively illustrated diagrammatically. Table 6.1a shows an example of a taxonomy that is used to classify knowledge management tools whereas Table 6.1b demonstrates an example of a taxonomy where the various functions of knowledge management tools have been classified.

GENERATION	ORGANISATION	SHARING
Tool A	Tool B	Tool F
Tool C	Tool E	
Tool D		

Table 6.1a: Taxonomy for Knowledge Management Tools

GENERATION	ORGANISATION	SHARING
Clustering	Visualisation	Chat
Web Spiders	Automatic Categorisation	Conferencing

Table 6.1b: Taxonomy for Functions of Knowledge Management Tools

Therefore, using Table 6.1a as a taxonomy for knowledge management tools it can be determined that Tool C can be used for generating knowledge. However, it is not possible to ascertain what method is used to generate the knowledge. On the other hand,

the taxonomy in Table 6.1b suggests that a knowledge management tool that has a clustering function can be used to generate knowledge but the tools that facilitate this are not specified. In light of this, the taxonomy designed as a part of this research combines the two methods to provide a novel perspective. The purpose of the taxonomy is to provide a classification system to aid the clarification of the numerous knowledge management tools that exist on the software market (Angus *et al.*, 1998). By combining the two existing techniques for classifying knowledge management tools the information provided will include details of both, the category of the knowledge management tool and its associated functions.

6.3 Designing the Taxonomy

In order to design the taxonomy as a part of this research a number of methods were deployed to gather the relevant data. These include the analysis of literature related to existing knowledge management taxonomies, conducting interviews with users of knowledge management tools, and the empirical investigation of knowledge management tools themselves. Existing taxonomies for knowledge management tools, discussed in Sections 2.4.1, 2.4.2, and 2.4.3 of Chapter 2, were investigated in order to determine the current state of the art. This led to the finding that the existing taxonomies facilitated either the classification of tools or the functions, never both.

The second method of gathering the relevant information was conducting interviews. Further details about how the interviews were conducted and the numbers involved are specified in Chapter 4. The objective of the interviews was to identify the purpose of the knowledge management tool and details about how the tool performs its tasks. The

theory supporting this is that the former should indicate the types of categories that could exist within the taxonomy and the latter should provide an indication of the various kinds of functions. For instance, again using the example of a helpdesk, if the purpose of the tool is to store and provide information about previously solved queries then the categories for the taxonomy could include knowledge storage and sharing. Furthermore, if solutions to previously solved queries are retrieved using a search facility then this could be considered as one of the tool's functions falling under the storage category. Another example would be where the sender of the query is kept informed of its status using email. Therefore, email would be considered as another function that could be classified as part of the sharing category.

The final, and, most important, form of gathering data to create the taxonomy is the empirical investigation of knowledge management tools. However, in order to design a taxonomy that would be reflective of the wide range of knowledge management tools available on the software market it was necessary to include a large number of tools within the investigation. Ideally it would have been desirable to conduct a detailed investigation of each of the knowledge management tools. However, due to time constraints and the limited number of tools that could be investigated in this manner, this method was deemed unsuitable. Therefore, the picture comparison method described by Sharland (1991) and developed by Holloway and Bidgood (1991) was adapted since this is particularly suited for the evaluation of a large number of tools. Furthermore, the method is quick and performs a high level evaluation which is appropriate for this particular case. A description of the picture comparison method is provided in Section 2.6.1 of Chapter 2 (see page 43).

Therefore, four levels of investigation were carried out in order to gather the information to create the taxonomy using 44 knowledge management tools in total. 40 of the 44 knowledge management tools included in the investigation were selected by conducting a search on the Internet. The concept underpinning this is that one of the case studies used this method in the search for a suitable knowledge management tool. Therefore, the tools used within the investigation would be reflective of the tools that an organisation is likely to encounter. The first level of investigation involves a detailed investigation knowledge of management tools. As previously mentioned, this method would not be effective to evaluate all 44 tools because of the time required and the large number of tools involved. However, since a detailed evaluation of four knowledge management tools had already been conducted, as described in Chapter 3, as another part of this research the information was utilised.

The second level of investigation consisted of conducting a high-level investigation of the tools using evaluation copies where available. Surprisingly this turned out to be extremely low and consisted of only seven tools. Nevertheless, each of the seven tools was scanned to identify functions and possible categories for the taxonomy. The third level of investigation included tools that, instead of having an evaluation copy of the software, had a non-interactive demo of the tool. From the remaining 33 tools three had non-interactive demonstrations available that were viewed and functions and possible categories analysed. Therefore, the 30 remaining tools were investigated using brochures and reviews. The names of the knowledge management tools along with the functions and categories identified are displayed in Table 6.2. The tools are listed in an order according to the level of investigation carried out. Therefore, the first four tools

shaded the darkest represent tools where a detailed investigation was conducted. The following seven tools, shaded slightly lighter than the previous tools, indicate that a high-level investigation was employed using evaluation copies of the software. The three tools shaded the lightest are where a non-interactive demo of the tool was used for the evaluation. The remaining tools that are unshaded are where product brochures and reviews were used for the evaluation.

In addition to the names of the knowledge management tools and details about the type of investigation conducted, Table 6.2 illustrates the categories and functions present in each tool. In total, seven categories were identified that are representative of the characteristics present across the range of knowledge management tools including: capture; discovery; retrieval; storage; monitor; collaboration; and transfer. For instance, NetMeeting, the third tool listed in the table supports the collaboration and transfer of knowledge. The categories supported by each knowledge management tool are denoted using a solid black circle. Furthermore, the functions used in order to facilitate these characteristics are also specified. For example, NetMeeting collaborates and transfers knowledge via providing functions such as application sharing, central interface, chat, conferencing, file transfer, messaging, virtual teams, and whiteboard. The functions supported by each knowledge management tool are denoted using a cross. The results from the investigations were used to create a taxonomy for knowledge management tools and specify associated functions and knowledge management tools.

		WHITEBOARD	WEB SPIDER	VISUALISATION	VIRTUAL TEAMS	USER PROFILING	UNSTRUCTURED SEARCH	TEXT MINING	STRUCTURED SEARCH	NOTIFICATION	NATURAL LANG. PRO.	META DATA MANAG.	MESSAGING	MAN. CATEGORISATION	IMAGE/VIDEO SEARCH	FULL TEXT SEARCH	FILE TRANSFER	EXPERT PROFILING	DOC. MANAGEMENT	DATA MINING	CONFERENCING	COMMUNITIES	CLUSTERING	CHAT	CHANNELS	CENTRAL INTERFACE	BULLETIN BOARD	AUTO. CATEGORISATION	APP. SHARING	APP. INTEGRATION	AGENTS
FUNCTIONS	TRANSFER																													
	COLLABORATION																													
	MONITOR																													
	STORAGE																													
	RETRIEVAL																													
	DISCOVERY																													
	CAPTURE																													
KNOWLEDGE MANAGEMENT TOOLS	1. ARS Remedy																													
	2. Consultants KM Tool	●																												
	3. NetMeeting																													
	4. Synera																													
	5. 80-20 Product Suite																													
	6. Assistum																													
	7. Correlate K-Map																													
	8. Engenia																													
	9. Eureka																													
	10. Groove																													
	11. Orbis Intelliware	●																												
	12. C-business Server	●																												
	13. Hummingbird EIP	●																												
	14. Plumtree Portal	●																												
	15. Active Knowledge	●																												
	16. AskMe Enterprise	●																												
	17. Authorete																													
	18. Autonomy Update																													
	19. BackWeb																													
	20. Collectively Sharper																													
	21. Communispace	●																												
	22. Deskartes																													

		23. DocSmart	24. Docushare	25. Global Network	26. Hyperwave	27. InfoImage Freedom	28. ISYS:web	29. Kanisa	30. KM Studio	31. Knowledge XChanger	32. KnowledgeMail	33. myLivelink	34. Net Perceptions	35. Portal-in-a-Box	36. Practicity	37. RetrievalWare	38. SageMaker	39. Semio Map	40. Semio Taxonomy	41. STRATEGY!	42. Thinkmap	43. work2gether	44. ZyIMAGE
FUNCTIONS	WHITEBOARD																						
	WEB SPIDER																						
	VISUALISATION																						
	VIRTUAL TEAMS																						
	USER PROFILING																						
	UNSTRUCTURED SEARCH																						
	TEXT MINING																						
	STRUCTURED SEARCH																						
	NOTIFICATION																						
	NATURAL LANG. PRO.																						
	META DATA MANAG.																						
	MESSAGING																						
	MAN. CATEGORISATION																						
	IMAGE/VIDEO SEARCH																						
	FULL TEXT SEARCH																						
	FILE TRANSFER																						
	EXPERT PROFILING																						
	DOC. MANAGEMENT																						
	DATA MINING																						
	CONFERENCING																						
	COMMUNITIES																						
	CLUSTERING																						
	CHAT																						
	CHANNELS																						
	CENTRAL INTERFACE																						
	BULLETIN BOARD																						
	AUTO. CATEGORISATION																						
	APP. SHARING																						
	APP. INTEGRATION																						
	AGENTS																						
CATEGORIES	TRANSFER																						
	COLLABORATION																						
	MONITOR																						
	STORAGE																						
	RETRIEVAL																						
	DISCOVERY																						
	CAPTURE																						

Table 6.2: Categories and Functions for Knowledge Management Tools

6.4 The Taxonomy

The categories identified during the investigations of the knowledge management tools appear to be connected to one of the three knowledge management activities described in Section 2.3.1 of Chapter 2. Therefore, the two were combined in order to create the taxonomy for knowledge management tools illustrated in Figure 6.1. The taxonomy can be considered as a hierarchy of layers where the uppermost layer represents the whole range of knowledge management tools and subsequent layers reflect the various groups within this range. The hierarchy is represented in Figure 6.1 using structure and shading. Therefore, the darkest and top-most point is the top layer. The three boxes attached to this of a slightly lighter shade and positioned further down constitute the middle layer. The lightest boxes connected to each of these and located at the bottom make up the lowest layer of the taxonomy and consist of the categories identified during the investigation of knowledge management tools. The following sections discuss the three layers and provide a description for each category.

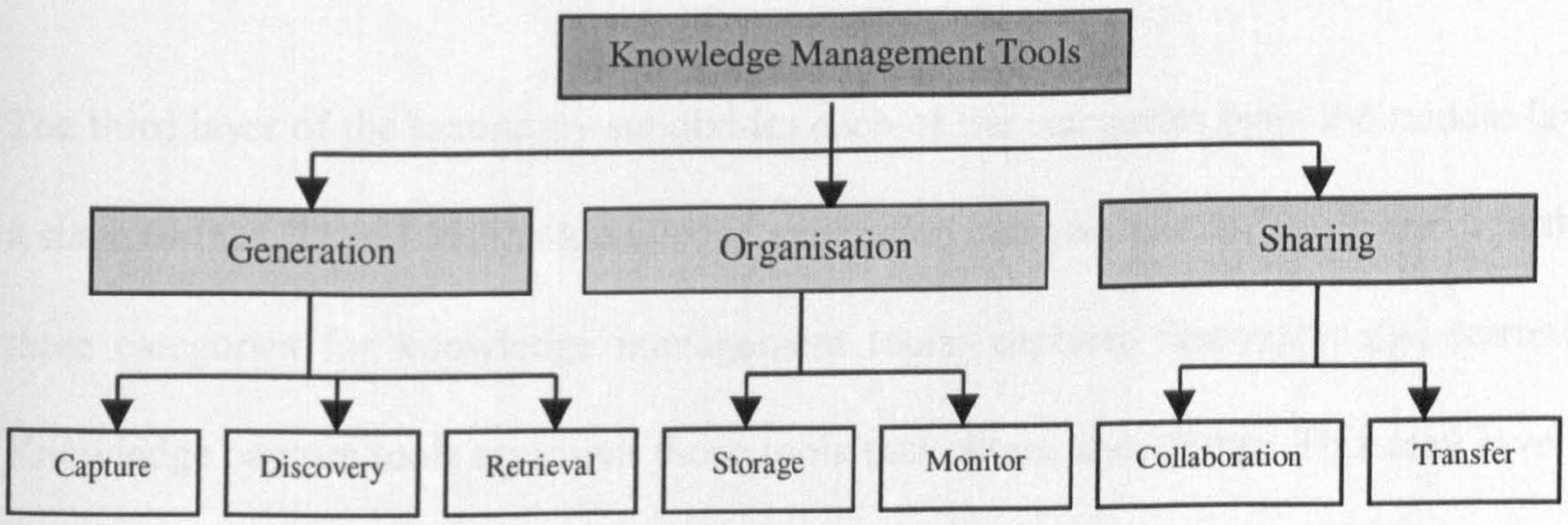


Figure 6.1: Taxonomy for Knowledge Management Tools

As previously mentioned, the top layer encompasses all knowledge management tools. Therefore, all 44 knowledge management tools listed in Table 6.2 would fall under this layer. The middle layer then divides knowledge management tools into three areas that are representative of the knowledge management activities: knowledge generation; organisation; and sharing. As the name suggests, the knowledge generation tools category is intended to represent knowledge management tools that generate knowledge. This could include tools such as those that obtain new knowledge by searching the Internet or one that creates new knowledge using information that already exists within the organisation. The second category within the middle layer is the knowledge organisation tools category. This is concerned with knowledge management tools that facilitate the creation and manipulation of knowledge repositories including the manner in which the knowledge is stored and whether or not it is monitored. The third and final category from the middle layer is the knowledge sharing tools category. This represents knowledge management tools that allow people to share knowledge in an easy and efficient manner.

The third layer of the taxonomy subdivides each of the categories from the middle layer a stage further. Therefore, the knowledge generation category is divided up into a further three categories for knowledge management tools: capture; discovery; and retrieval. Knowledge capture tools represent those tools that obtain knowledge. This may involve monitoring email and employee activity on systems and trawling the Internet to locate relevant information. The knowledge discovery category is associated with tools that are designed to uncover connections and relationships in data that an organisation may not be aware exists. The final category within knowledge generation is knowledge retrieval

tools. As opposed to the previous case where the organisation is unaware of the existence of such knowledge, retrieval tools are designed to search for specific knowledge that is known to exist.

The knowledge organisation category is divided into two further areas of knowledge management tools. The first is knowledge storage tools and as the name suggests is concerned with the manner in which knowledge is stored and presented. The second, knowledge monitoring, is related to tools that monitor the knowledge within the repository and may trigger an alert accordingly. The knowledge sharing category from the middle layer is also subdivided into two types of knowledge management tools including knowledge collaboration tools and knowledge transfer tools. The former category reflects the knowledge management tools that enable a group of people to work together in a collaborative manner. The latter concerns the transfer of knowledge within and outside of a collaborative environment.

Having established a taxonomy, it is possible to use this to classify the functions of knowledge management tools and the actual tools themselves. This was achieved to some extent in Table 6.2 where the categories and functions for each tool were identified. However, the table does not depict the functions that are associated with each of the categories. Therefore, Figure 6.2 illustrates the relationship between the functions and categories from the taxonomy.

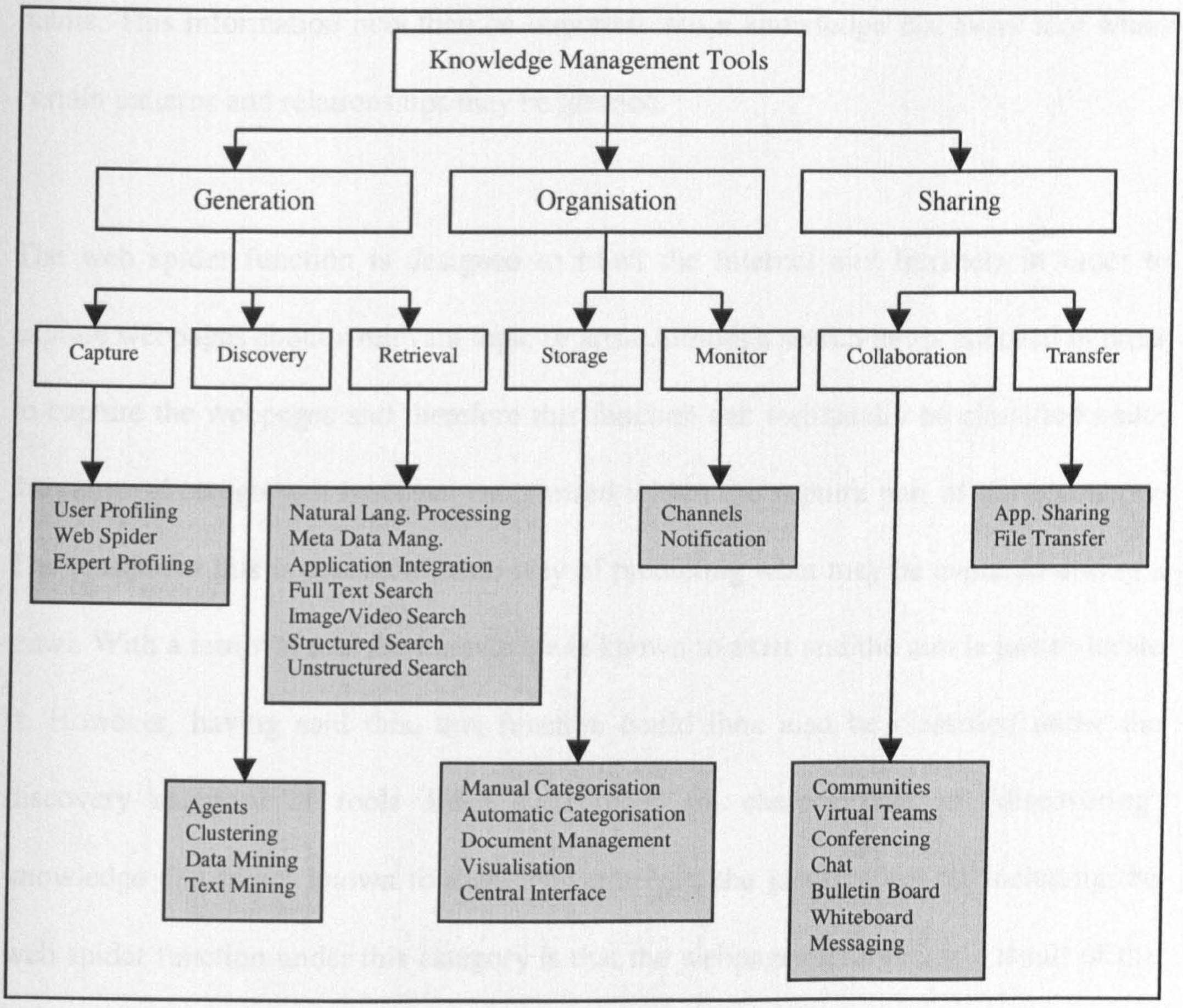


Figure 6.2: The Taxonomy Showing Associated Functions

6.4.1 Knowledge Capturing Tools

The functions associated with the first category, knowledge management tools that capture knowledge, include user profiling, web spiders, and expert location. User profiling was used as an example in Section 2.3.2 of Chapter 2 (see page 20) where a user profile is created according to the areas of a website that have been visited. Each time the website is visited, the user is presented with customised content according to their user profile. In addition to capturing user navigation routes, this function also includes the monitoring of work submitted by individuals, work reviewed, and querying

habits. This information may then be imported into a knowledge discovery tool where certain patterns and relationships may be gleaned.

The web spider function is designed to trawl the Internet and Intranets in order to capture webpages about a relevant topic or area. Although search terms are used in order to capture the webpages and therefore this function can technically be classified under the retrieval category, it has been categorised within the capture part of the taxonomy. The reason for this is that there is no way of predicting what may be captured during a trawl. With a retrieval tool the knowledge is known to exist and the aim is just to locate it. However, having said this, this function could then also be classified under the discovery category of tools since such tools are characteristic of 'discovering' knowledge that is not known to exist. Nevertheless, the justification for including the web spider function under this category is that the webpages returned as a result of the web trawl may not all be relevant and therefore cannot be utilised. In essence, the gathered information would need to be filtered and vetted before any knowledge discovery could take place.

The final function within the knowledge capture category is the expert profiling function. The purpose of this function is to capture as much information as possible about an employee's skills and expertise. There is some overlap with the user profile function in the way in which this knowledge is captured. In addition, employees are required to undertake various tests the results of which are used to assess their abilities in certain areas. The profiles that are created can then be searched in order to locate experts in the required area. Again, theoretically this function could be classified under

the retrieval category. However, since the primary aim of such a function is to capture the skills and expertise of individuals, it was considered most suitable to be placed under the capture category.

6.4.2 Knowledge Discovery Tools

The functions associated with the second category, knowledge discovery, include: agents; clustering; data mining; and text mining. The reasons for their inclusion within this category is that they discover knowledge that may not necessarily be known to exist. Agents are similar to web spiders in that they gather information about a topic specified by the user. However, the web spider will collect everything related to the topic regardless of whether it is relevant or not, whereas an agent performs a more intelligent search and therefore the results of a search are more likely to be applicable and avoid information overload.

The clustering function is used to identify common themes or patterns in a collection of text documents. However, this is achieved automatically and it is not necessary for search criteria to be predefined. The results of clustering are usually displayed using a graphical representation. Therefore, it is easy to view the connections between the various clusters and the numbers involved. This function is useful, especially where large volumes of material are involved and reading through it would be impossible. Clustering would group the material according to themes and topics derived from the content of each document. It would then be possible to view the areas of interest by cluster.

Data mining is similar to clustering in that its aim is to uncover trends and patterns in large volumes of data. However, in contrast to clustering that discovers patterns in a variety of text documents, data mining has a structured database as its source of information. Again, text mining is similar to data mining in its purpose. However, text mining identifies patterns and relationships in a collection of material of various different formats including documents, email, databases, and webpages. Moreover, the format of the collection of material is of an unstructured manner. Some people may argue that data mining and text mining belong in the retrieval category alongside the other search functions. However, this is not the case because the search criteria for data and text mining are not as specific as those required for the functions falling under the retrieval category.

6.4.3 Knowledge Retrieval Tools

The functions within the knowledge retrieval tools category consist predominantly of functions that search for and retrieve knowledge. However, these appear to focus on one of two areas: either the format of the search criteria; or the material being searched. The first function falls under the former and is that of natural language processing. This function enables search criterion to be entered in a format that is characteristic of language that is used in everyday life. Furthermore, as opposed to other search functions that only match keywords, natural language processing retrieves knowledge based on context. The other function that focuses on the format of the search criteria is the meta data management function. It is referred to as this because it enables documents to be retrieved using search criteria that are related more to the administrative side of

documents. Therefore, search criteria may include using the date of the document, its author, etc.

The remaining functions within this category focus on the content being searched. The application integration function enables searches to be conducted across a wide variety of applications including databases, emails, documents, and webpages. Whereas the full text search function scans all of the text contained within a document in order to ascertain its relevance. The contents of the next function consist of images and videos and use a pattern matching technique in order to locate suitable results. The structured search function enables the retrieval of knowledge from structured formats such as databases and data warehouses. Finally, the unstructured search function allows the content of the search to consist of a variety of text based documents including: email; webpages; presentation slides; text documents; and user profiles.

6.4.4 Knowledge Storage Tools

The functions classified under this category are concerned with the storage of knowledge, often referred to as a knowledge repository. The idea based around this type of tool is that if knowledge is organised in an appropriate manner then it can easily be located. The first function, manual categorisation, enables the knowledge within the repository to be organised manually by a human. The second function, automatic categorisation, is similar to this except that the knowledge management tool predominantly performs the organisation. The third function, document management, has been designed specifically for an environment that handles large volumes of text

based documents. This function facilitates features such as version control so that the history of a document as it evolves can be monitored.

The visualisation function is different in comparison to the retrieval functions mentioned so far. It uses graphical representation in order to depict the organisation and content of a knowledge repository. In this manner the relationships within the knowledge repository are easier to identify. The final function within this category, central interface, is also related to the visual aspect and is concerned with allowing the user to view numerous applications via one interface.

6.4.5 Knowledge Monitoring Tools

As the name suggests, knowledge monitoring tools monitor the knowledge within a knowledge repository and react accordingly. The first function, channels, consists of a series of links to data sources. As the data is updated and new data arrives the links are automatically updated. The second function, notification, works in exactly the same manner except the user is notified when any changes or updates have been made.

6.4.6 Knowledge Collaboration Tools

This group of tools consists of functions that enable a group of people to work in a collaborative manner. The communities function enables people with common interests to form groups and allows them to share knowledge. The next function, virtual teams, is aimed at groups working together but whose members are geographically separated. This differs from the previous function in that only invited people can participate and access the files. The remaining functions are often used within a virtual team to aid and

enhance their working environment. The first of these is the conferencing function that enables a meeting to be conducted by a virtual team. Conferencing enables the use of audio and video so that group members can view and hear one another. Another function is chat that enables real-time discussions to take place between a group of people. The bulletin board function is similar to the chat function except that the format of the discussion is asynchronous. The whiteboard function is similar to that of a drawing pad where documents can be loaded up and edited and at the same time group members can view the changes that are being made in real-time. The final function within this category is messaging. This is similar to the chat function except that messaging can be used to exchange files and receive an immediate response to a question.

6.4.7 Knowledge Transfer Tools

This category of knowledge management tools facilitates the transfer of knowledge. The first function within this category is the application sharing function. This is particularly useful where a team are working on a project in a virtual manner as described in the previous section. For instance, one of the team members has been working on an aspect of the project individually and would like to demonstrate their work to the other team members. However, the software that has been used to produce this piece of work is specialised and none of the other team members have it installed on their machines. The application sharing function would allow the person with the software to share it with the others so that the work could be viewed. Furthermore, control of the application could be passed between team members to allow them to make and demonstrate recommendations.

The second function within this category is file transfer. This function is concerned with the physical transfer of files. Therefore, referring back to the previous example of a virtual team sharing an application to produce some work. However, at the end of the session the updated version of the work would only be stored on the computer where the application is actually installed. The file transfer function would enable the relevant file to be transferred to the other team members.

Having established the functions that are related to each of the categories within the taxonomy the relationship between the knowledge management tools and the taxonomy can be investigated. In contrast with the functions Table 6.2 does illustrate the categories that are supported by each of the knowledge management tools. Furthermore, the functions could be divided using the categories relatively easily. However, it is not as clear cut as this with the knowledge management tools since there is a great deal of overlap. Table 6.3 demonstrates how the knowledge management tools are related to the categories within the taxonomy.

As is evident from Table 6.3 very few knowledge management tools can be classified under one category from the taxonomy. In fact three of four of the categories are likely to be applicable. Furthermore, it is apparent from Table 6.3 that the categories supported by the knowledge management tools are widely dispersed across the various knowledge management activities. For example, the knowledge management tool C-business Server facilitates knowledge capture and discovery from the generation category, storage from the organisation category, and collaboration and transfer from the sharing category.

KM TOOLS	KNOWLEDGE MANAGEMENT TOOLS						
	GENERATION			ORGANISATION		SHARING	
	Capture	**Discovery**	**Retrieval**	**Storage**	**Monitor**	**Collaboration**	**Transfer**
ARS Remedy			■	■	■		
Consultants KM Tool	■		■	■			
Netmeeting						■	■
Synera		■	■	■			
80-20 Product Suite		■	■				
Assistum		■					
Correlate K-Map		■	■				
Engenia			■			■	■
Eureka		■		■			
Groove						■	■
Orbis Intelliware	■		■		■		
C-business Server	■	■		■		■	■
Hummingbird EIP	■			■		■	
Plumtree Portal	■			■		■	
Active Knowledge	■	■	■		■		
AskMe Enterprise	■		■	■		■	
Authorete		■	■				
Autonomy Update		■			■		
BackWeb			■		■		
Collectively Sharper			■				
Communispace	■		■			■	■
Deskartes		■	■				
DocSmart			■	■			
Docushare		■	■	■			
Global Network	■		■			■	
Hyperwave	■		■	■		■	■
InfoImage Freedom		■				■	■
ISYS:web	■	■	■	■		■	
Kanisa		■	■				
KM Studio			■				
Knowledge XChanger	■		■			■	
KnowledgeMail		■			■		
myLivelink			■	■		■	
Net Perceptions		■	■				
Portal-in-a-Box	■	■	■		■	■	
Practicity			■	■		■	
RetrievalWare	■	■	■				
SageMaker			■				
Semio Map		■	■				■
Semio Taxonomy		■		■			
STRATEGY!			■				
Thinkmap		■					
work2gether			■	■			
ZyIMAGE		■	■				■

Table 6.3: Categories Supported by the Knowledge Management Tools

Overall, a taxonomy for knowledge management tools as displayed in Figure 6.1 was created using the information gathered during the investigation of knowledge management tools the results of which were demonstrated in Table 6.2. The connections between the functions commonly present in knowledge management tools were linked to the taxonomy as illustrated in Figure 6.2. The links between the taxonomy and knowledge management tools were displayed in Table 6.3. In essence, a taxonomy for knowledge management tools was created and its association with both functions and the tools themselves have been demonstrated. The remainder of this chapter discusses requirements for the future development of knowledge management tools.

6.5 Requirements for Further Tool Development

One of the objectives of this research was to identify requirements for future developments of knowledge management tools. These were obtained during the empirical investigation of knowledge management tools described in Chapter 3 and as a result of conducting the case studies described in Chapter 4. It is important to note that the requirements collated are specific to the knowledge management tools contained within this research. However, the findings are written in such a way that it is possible to apply the suggestions and recommendations to future developments of similar tools. The requirements identified are presented in Table 6.4.

REQUIREMENTS	DESCRIPTION
1. Improved interactivity	Increased interactivity would increase usability.
2. More intuitive	Using the tool needs to be made easier and more intuitive.
3. Consideration of user-friendliness	The constantly increasing functionality of a tool can compromise the user-friendliness and therefore this needs to be taken into consideration.
4. Archiving previous discussion threads	In a collaborative environment many issues are discussed using a chat facility and although these can be recorded it is time consuming to follow a certain thread within the discussion.

5. Searching previous discussion threads	If the previous requirement was supported then a search facility enabling the searching of discussion threads would also be useful.
6. Improved retrieval facilities	Current retrieval facilities are not sufficient.
7. Command search	Particularly applicable in programming. Enables information on how to use programming commands to be located.
8. Indication of related documents	The results from a search should also have links to related documents – similar to the way a search engine's results are presented.
9. Links to documents that were viewed by people who had also viewed this document	The results from a search should also have links to documents that were also viewed by people who viewed this document. This is similar to the Amazon on-line bookshop 'people who bought this book also bought these'.
10. Author search	It should be possible to locate a document within the knowledge repository searching using the name of the author of the document.
11. Date search	It should be possible to locate a document within the knowledge repository by using the date as the search criteria.
12. Identify complexity of document	Indicating the complexity of the document enables the user to immediately identify if the document is applicable to them.
13. Central interface	This would save having to open and navigate numerous windows to locate relevant information.
14. Task tracking for clients	This would enable clients to see the progress on their job.
15. Tool wide search	A search facility that searches everything as opposed to a select few areas.
16. Pattern matching	The ability to discover unknown patterns.
17. Improved output	Correctly and easily formatted reports for printing purposes.
18. Automatically updated contact information	A facility that automatically updates contact information of clients would be extremely useful.
19. Context search	The ability to perform a search based on context as opposed to simply keywords.
20. Multiple video conferencing	More than two people should be supported during video conferencing.
21. Editing meeting records	Should be possible to catalogue and annotate the details of meetings conducted in a collaborative environment.
22. Search engine	A facility similar to a search engine would be useful – current searching facilities can be restrictive.
23. Increased on-line help facilities	This would save the necessity to constantly refer back to guides.
24. Automatically generated 'what's new' area	This would save having to browse through large volumes of material trying to identify new additions.
25. Personalisation	The ability for the user to format the interface as they wish.
26. Issue tracking	The ability to track and trace issues through a system.
27. Time tracking	Enables the recording of time taken to complete task, etc.
28. Task tracking	Enables task to be tracked throughout system.
29. Team tracking	The ability to locate a team of people and their progress.
30. Improved searching	The increasing levels of data call for an efficient search tool.
31. Helpdesk	Someone to contact should there be a problem.
32. Cross reference facility	To connect related documents.
33. Tag facility	Enables user to 'tag' areas of interest so that relevant documents can be identified.
34. Most popular area	Links to most popular documents.
35. Important area	An area where important issues can be highlighted.

Table 6.4: Requirements for Further Development of Knowledge Management Tools

Having identified all of the requirements suggested for future developments of knowledge management tools it is possible to see how these may be incorporated. Theoretically, it is possible to include all of the suggested requirements in a newly developed knowledge management tool. However, this is unlikely to serve any useful purpose and could hinder the performance of the tool. Therefore, it is necessary to identify how these requirements could be taken into consideration during future developments of knowledge management tools. In order to achieve this, the requirements have been divided according to the type of knowledge management tool it would be most beneficial for. This is achieved by utilising the categories identified as a result of the taxonomy for knowledge management tools described in the previous section. Therefore, Table 6.5 illustrates how the requirements are linked to the various categories of knowledge management tools.

In addition to the categories from the knowledge management taxonomy, there is a 'general' category in Table 6.5. This has been included because the requirements contained within this section can be applied to any software tool and does not necessarily have to only be restricted to knowledge management tools. The requirements contained within this category are generally focused on improving the usability and providing better help facilities for the tool.

TAXONOMY CATEGORIES	REQUIREMENTS ACCORDING TO TYPE OF KNOWLEDGE MANAGEMENT TOOL
General	• Improved interactivity • More intuitive • Consideration for user-friendliness • Increased on-line help facilities • Helpdesk
Capture	• Indication of related documents • Links to documents that were viewed by people who had also viewed this document • Identify complexity of document • Most popular area • Important area
Discovery	• Pattern matching • Cross reference facility
Retrieval	• Improved retrieval facilities • Command search • Author search • Date search • Tool wide search • Context search • Search engine • Improved searching
Storage	• Central interface • Personalisation • Automatically updated contact information
Monitor	• Task tracking • Issue tracking • Time tracking • Team tracking • Automatically generated 'what's new' area • Tag facility
Collaboration	• Archiving previous discussion threads • Searching previous discussion threads • Multiple video conferencing • Editing meeting records
Transfer	• Task tracking for clients • Improved output

Table 6.5: Requirements Linked with the Categories from the Knowledge Management Tool Taxonomy

The second category, Capture, contains requirements that are related to the capturing and provision of certain information. These predominantly consist of providing additional information along with the results of a search. For instance, it was suggested that when the results from a search were displayed it would be useful to also identify

and provide links to related documents. This is similar to the facility provided by Internet search engines whereby the results of a search each have a 'Similar pages' option attached. Another requirement similar to this was where the results of a search also indicated the other documents that were viewed by those who had viewed this document. This is akin to a facility provided by Amazon the online bookshop. When further information about a particular book is obtained the customer is presented with an option to view other books that were purchased by people who also bought the book in question.

It was also proposed that specifying the complexity of a document within a knowledge repository would be a useful feature to have. The concept underlying this is that time and effort could be saved from having to trawl through numerous documents. The system would be far more efficient and user-friendly if the complexity of the document was indicated prior to the document being accessed. This would enable the user to decipher whether the document was suitable for them. The other two suggestions were to capture and provide an area where the most popular documents and important documents could be highlighted. Again, this would save having to browse or search through large volumes of data.

The third category, Discovery, contains requirements that are concerned with the discovery of knowledge. The first requirement suggested within this category is that of pattern matching. This would be useful for identifying relationships and trends in data that may not be obvious. Although this facility is already available in many knowledge management tools it is evident that there is an increasing need for such a feature. The

second requirement within this category is the provision of a cross-referencing facility. This involves discovering and displaying relationships between documents. This may appear similar to the 'indication of related documents' requirement in the previous category. However, the differentiating factor is that indication of related documents would be done manually and the cross-referencing would be achieved automatically by the tool. Hence, the reason for this requirement being included within the discovery category.

The Retrieval category contains the maximum number of requirements and these are predominantly focused on improving search options. Although the first of the requirements does not specify how retrieval facilities may be improved, it suggests that there is a need for improvement. The second requirement entails providing a search for commands. For instance, if searches are performed using a language similar to database querying, then commands for this may easily be forgotten. In such circumstances it would be necessary to refer to user manuals which would be time consuming and inefficient. However, if it were possible to conduct a search based on commands then the relevant information could be obtained instantly. This feature could also be useful in a programming environment.

Other suggestions include being able to perform searches using the name of the author of the document and the date when the document became available from the knowledge repository. Further requirements include being able to perform a search where all aspects are investigated as opposed to a few select areas. To further enhance search capabilities, it was suggested that searches should be able to be performed based on

context as opposed to simply keywords. This would enable search results to be more meaningful and would avoid information overload. Another suggestion was to provide search facilities similar to Internet search engines as opposed to rigid keyword searches that are currently used. The final requirement is to improve search facilities since increasing levels of data mean that a more efficient tool is necessary.

The Storage category consists only of three requirements and these are mainly related to presentation aspects. The first of these suggests that there is a need for a central interface where many windows can be viewed at the same time. Currently it is necessary to switch between several windows that can cause a great deal of confusion and has often led to mistakes being made. The second requirement is concerned with enabling the user to choose what they want to see and how they want to view it. Again, this is concerned with providing a user-friendlier environment and omitting unnecessary information. The final suggestion within this category is that of ensuring that contact information is automatically updated. For instance, if it is essential for a user to speak to the author of a particular document within the knowledge repository, it is often the case that although they are still with the organisation their contact details on the system are outdated. Therefore, it would be useful to have a facility whereby contact information is automatically updated and time would not be wasted trying to track a person down.

The Monitor category mainly consists of requirements that involve increasing monitoring options. For instance, the first four requirements propose that being able to track tasks, issues, time, and teams would be beneficial. The ability to track a task would enable the immediate identification of its progress. Furthermore, if a task was

being held-up somewhere in the system then it would be possible to identify where and who is responsible. The difference between task tracking and the following requirement, issue tracking, may appear blurred. However, the distinction is that the former is usually related to one task or job whereas the latter may spread across several tasks. For instance, if it has come to light that many tasks are not being completed, then issue tracking would enable the problem to be located and identified. The third requirement is that of time tracking and as the term suggests is concerned with being able to track the time taken to complete tasks. This would enable statistics such as the number of tasks being completed by day, week, etc to be derived. The fourth tracking requirement is related to the ability of tracking teams. For instance, if a group of people is working collaboratively on a project then this facility would enable the tracking of their progress.

The final two requirements within this category are related to the monitoring of the content of the knowledge repository. The first of these is concerned with monitoring the content in order to locate any new documents in the repository. Any new documents that are found are presented in a common area so that a user can go straight there. This saves individuals from having to browse through large volumes of material. Furthermore, there is no guarantee that all of the new documents would be located. The final requirement within this category is the tag facility. The concept underlying this is that users are able to 'tag' the areas and topics that they are interested in. The system then monitors the knowledge repository for documents that may be of relevance and highlights them for the user.

The collaboration category contains requirements that are related to the chat and conferencing facilities common in such tools. The first two requirements within this category are related to the former. Many collaboration tools provide a chat facility in which it is possible to save the conversation that has taken place. However, in order to follow a certain thread across one or more discussions that have taken place via a chat facility it is necessary to read through the whole document. If a particular thread spans across several chat sessions then it would be necessary to read the recordings from all of these. Therefore, the ability to archive previous discussion threads has been suggested. Moreover, if these were searchable then the feature would be further enhanced.

The final two requirements within this category are related to the actual meetings aspect of collaborative work. The first of these is the video conferencing facility that enables two people to view and hear one another during a meeting. However, it is suggested that this feature would be far more useful if more than two people could participate in video conferencing. The final requirement from this category suggests that although details from a meeting can be captured, it is difficult and complex to edit or annotate these and therefore such a facility would be found useful.

The final category is related to the transfer of knowledge and consists of two requirements. The first of these, task tracking for clients, is an extension of a requirement suggested in the monitoring category that is related to tracking a task. However, if the clients were able to track their own tasks then a great deal of time could be saved. Furthermore, this may increase the quality of service since clients are able to see for themselves the progress being made on the task.

6.6 Summary

In summary, although taxonomies currently exist for the classification of knowledge management tools, these are either tool or function based. The former refers to a taxonomy that specifies the knowledge management activities (generation, organisation, and sharing) that a tool supports. The latter type of taxonomy illustrates the knowledge management activities that a function supports. Therefore, it is only possible to identify the actual tool or the function that supports a particular knowledge management activity. In light of this, 44 knowledge management tools were evaluated with the aim of identifying the type of activities and the functions each support. The activities were used to create categories for the taxonomy, which was subsequently used to classify the knowledge management tools and functions.

The final contribution from this chapter was the gathering of requirements for further development of knowledge management tools. In essence, the requirements reflect the features that need to be included and improved for future versions of knowledge management tools from the viewpoint of the user. The requirements were organised according to the categories from the taxonomy to demonstrate where in the myriad of knowledge management tools the requirements would be most beneficial.

Chapter 7.

Summary and Conclusions

7.1 Introduction

The purpose of this chapter is to provide closure for this particular research and provide some thoughts with regards to how this research may be developed for future research projects. The chapter begins by providing a summary of the research that has been undertaken for this study. Following this conclusions that have arisen as a result of this research are identified along with the contributions from this research. This is followed by a discussion of the limitations of this research and details of areas for further research.

7.2 Summary of Dissertation

Chapter 1 of this dissertation provided an introduction to the research being undertaken for this study. The chapter began by discussing the increasing popularity of knowledge management despite the area being surrounded by vagueness and ambiguity. This was followed by a brief discussion of reasons why the area has failed to achieve a common definition or concept. Furthermore, it was suggested that software vendors have exploited this position by overwhelming the software market with a variety of knowledge management tools. This presents a problem when trying to find a tool that adequately meets a set of requirements particularly since no guidelines for evaluation and selection currently exist. Therefore, the aim of this research was to provide a set of guidelines for the evaluation and selection of knowledge management tools. In light of this a set of research objectives were identified and described along with a brief description of the contribution of this research. Following this, it was established that case studies would be adopted as the research strategy to carry out this research.

Chapter 2 presented literature relating to the research being undertaken with the aim of demonstrating the context of this research. The chapter began by describing the evolution of the knowledge age and as a result managing knowledge has become the key to an organisation's survival. This led to the discussion of knowledge management and in particular its activities and components. The chapter then demonstrated that this research is classified under the technology component of knowledge management. Following this a discussion of knowledge management tools was provided along with a description of three studies related to this area. The purpose of including the three studies was to demonstrate the research that has already been undertaken in this area.

Therefore, each of the studies was critically analysed and directions for further research were identified. The second part of Chapter 2 investigated guidelines that already exist for tool evaluation and selection. Firstly, generic guidelines that can be applied to any software tool were described. This was followed by the analysis of guidelines that have been developed with the aim of being used on a particular type of tool designed for a specific discipline. The chapter concluded with a critical analysis of the existing guidelines along with a description of what the results of this research should strive for in light of this.

Chapter 3 described the empirical investigation of four knowledge management tools. Justifications for adopting this approach were provided along with a brief illustration of how the tools investigated relate to the knowledge management activities. Following this a description of the empirical investigations of the four knowledge management tools carried out by the researcher was described. This included identifying the main features of the tool and a critique of the tool illustrating its weaknesses.

Chapter 4 presented four case studies in order to support and enhance the findings that were achieved as a result of Chapter 3. The chapter began by describing the research strategy that was used in order to undertake this research. In addition to describing the case study strategy, this involved describing the data collection and data analysis techniques that would be adopted. Following on from this, a description of the four case studies was provided. Each consisted of a brief introduction to the case followed by an account of how the knowledge management tool was acquired or developed. The case studies concluded with a description of how the knowledge management tool was used

and the main features identified by its users. The positive and negative aspects of the features were identified along with suggestions for requirements for future developments of knowledge management tools.

Chapter 5 demonstrated an evaluation framework and frame of reference that was created as a result of undertaking this research. Firstly, the chapter described the techniques that were used in order to design the evaluation framework. Following on from this, the evaluation framework was presented and described according to section and category. This part of the chapter concluded by outlining the various ways in which the evaluation framework could be applied. The second part of the chapter then focused on the frame of reference. This began by describing how the frame of reference was designed. Following this the actual frame of reference was illustrated along with a description of how the frame of reference may be applied.

Chapter 6 presented a taxonomy for the classification of knowledge management tools along with requirements for the future development of knowledge management tools. The chapter began by introducing the work that has already been carried out in relation to taxonomies for knowledge management tools. Furthermore, the shortcomings of these were identified. Following on from this, the design of the taxonomy was discussed including a description of how 44 knowledge management tools were evaluated in order to create the taxonomy. The chapter then demonstrated the taxonomy and provided a description of the categories within the taxonomy. The taxonomy part of the chapter concluded by illustrating how the taxonomy can be used to classify knowledge management tools. The second part of the chapter shifted focus to the requirements for

future developments of knowledge management tools. This involved identifying and describing the requirements specified by the various participants in this research. The requirements identified were then related back to the categories contained within the taxonomy in order to identify the type of knowledge management tool that would benefit most from such a requirement. The chapter concluded with a description of each of the requirements in relation to the respective category from the taxonomy.

7.3 Conclusions

As a result of conducting this research a number of conclusions were drawn. The first conclusion was that the literature suggests that the area of knowledge management has no clear definition or concept. It was also concluded that in order for a knowledge management deployment to be successful it is necessary to consider all of the knowledge management components of culture, business processes, and technology, in combination, across the entire organisation. This also leads onto the third conclusion that knowledge management is an organisation-wide deployment. The fourth conclusion is that the existing research that has been undertaken in the area of knowledge management focuses almost entirely on the organisational and human aspects of knowledge management, not the technical aspects. The fifth conclusion is that very little research has been undertaken in the area of knowledge management tools. The sixth conclusion states that no guidelines currently exist for the purposes of evaluating and selecting knowledge management tools. The seventh conclusion came about due to the practical aspects of the research and suggests that the empirical investigation of a knowledge management tool by a third party is unsuitable to enable a true picture of the knowledge management tool to be obtained. The eighth conclusion is that the empirical

investigation of a knowledge management tool by a third party often results in a high-level perspective of the tool. A summary of the conclusions are demonstrated in Table 7.1.

CONCLUSIONS	
i.	The subject of knowledge management is vague and ambiguous
ii.	The components of knowledge management must all be addressed in combination across the whole organisation
iii.	Knowledge management is an organisation-wide strategy
iv.	Existing literature on knowledge management focuses on the organisational and human aspects
v.	Very little research has been carried out in the area of knowledge management tools
vi.	No guidelines currently exist for the evaluation and selection of knowledge management tools
vii.	Empirical investigation of knowledge management tools by a third party does not enable a true picture of the knowledge management tool to be obtained
viii.	Empirical investigation of a knowledge management tool by a third party often results in a high-level perspective

Table 7.1: Summary of Conclusions

As a result of this research there are four main contributions to the area of knowledge management and in particular the technical aspects of knowledge management. Firstly, a framework was designed for the purposes of evaluating commercial knowledge management tools. Secondly, a frame of reference was developed to enable the selection of commercial knowledge management tools. Thirdly, a taxonomy was created in order to provide a classification system for knowledge management tools. Finally, requirements for the future development of commercial knowledge management tools were also proposed. The following four sub-sections describe the contributions from this research in further detail for the reader who is reading this chapter before Chapters 5 and 6.

7.3.1 A Framework for the Evaluation of Knowledge Management Tools

The first contribution from this research is a framework for the evaluation of knowledge management tools. The framework consists of numerous categories and criteria that can be used to capture and evaluate the features of a knowledge management tool. Furthermore, the framework can be used to evaluate all aspects, general and knowledge management specific, of a knowledge management tool. One of the shortcomings of the discipline specific evaluation frameworks was that the general aspects of purchasing a tool such as costs and training were not addressed. Therefore, the framework designed for this research enables all aspects of a knowledge management tool to be evaluated including the general aspects.

In light of this, the evaluation framework consists of two main sections: general and knowledge management tool specific. The general section consists of categories and criteria that can be used to evaluate the more general aspects of purchasing a knowledge management tool. Categories within this section include: financial aspects; training; support; documentation; usability; technical aspects; vendor; and client view of vendor. The categories and criteria within the second section are related specifically to the features commonly found in knowledge management tools. This section is divided into four main categories. The first contains general criteria that can be applied to any type of knowledge management tool. The remaining three categories are reflective of the knowledge management activities described in Section 2.3.1 of Chapter 2. These include a category for knowledge generation tools, another for knowledge organisation tools, and the final for knowledge sharing tools. In turn, each of these are divided into

further categories that are representative of the categories identified for the taxonomy for knowledge management tools described in Section 6.4 of Chapter 6.

The evaluation framework can be used in conjunction with the other contributions from this research. However, it can also be applied independent of the other guidelines. The framework can be applied in three ways and for three different purposes. Firstly, the entire evaluation framework can be used as an aid for capturing information about knowledge management tools. Secondly, the evaluation framework can be used as a template as a basis for which to conduct a comparison of the knowledge management tools. Finally, the ordering of categories and criteria may be altered according to importance in order to create a hierarchical, customised evaluation framework. Each of these was discussed in detail in Sections 5.5.1, 5.5.2, and 5.5.3 of Chapter 5.

7.3.2 A Frame of Reference for the Selection of Knowledge Management Tools

The frame of reference was developed in order to provide guidance for the issues and factors that may be taken into consideration during the selection of a commercial knowledge management tool. The frame of reference consists of five main phases each with a number of intermediate steps. In summary, the frame of reference consists of identifying the requirements, creating a short-list of knowledge management tools, conducting empirical evaluation of the knowledge management tools, pilot testing the tools, and purchasing the knowledge management tool. The differentiating factor between this frame of reference and other general tool selection methodologies is that this frame of reference has been designed specifically for the selection of knowledge

management tools. This was achieved predominantly by incorporating issues prevalent to knowledge management within this frame of reference.

Firstly, a great deal of the literature strongly emphases that all three components (organisational, human, and technology) must be considered within a knowledge management strategy. Therefore, although the frame of reference is primarily for the purpose of knowledge management tools, it acknowledges that the other two components (organisational and human aspects) must also be considered. Secondly, during the formation of the selection team people that have been employed specifically to support a knowledge management strategy must be included. These may include a Chief Knowledge Officer and a Knowledge Librarian.

Thirdly, the frame of reference considers the knowledge management activities one or more of which should be supported by any knowledge management tool . Finally, embedded within the frame of reference is a framework that has been designed specifically for the evaluation of knowledge management tools. An evaluation framework is another contribution from this research and was briefly described in the previous section and in further detail in Chapter 5. However, it must also be highlighted that it is not necessary to use the evaluation framework designed as a result of this research in conjunction with the frame of reference. It is possible for the evaluator to create their own framework in order to evaluate knowledge management tools.

7.3.3 A Taxonomy for Knowledge Management Tools

The third contribution from this research is that of a taxonomy for knowledge management tools. The purpose of the taxonomy is to provide a classification of knowledge management tools. Although taxonomies for this purpose do already exist these are either tool based or function based. This issue was presented in detail in Section 6.2 of Chapter 6. Therefore, the differentiating factor between the existing taxonomies and the taxonomy designed as a result of this research is that the latter combines the two, tools and functions, to provide a novel taxonomy. To re-iterate, the taxonomy developed as a part of this research enables the classification of functions commonly present in knowledge management tools as was illustrated in Figure 6.2 of Chapter 6 (see page 185). In addition, the taxonomy also enables the classification of knowledge management tools as demonstrated in Table 6.3 of Chapter 6 (see page 193).

7.3.4 Requirements for Further Development of KM Tools

The final contribution from this research is a set of requirements for the future development of knowledge management tools. As was previously established there are numerous knowledge management tools available on the software market. Furthermore, these are appearing at a rapid rate that it is difficult to keep track of and monitor all of the tools. Therefore, this appears to indicate that developers are attempting to create knowledge management tools. Furthermore, in the haste to get the tools on the market as quickly as possible there is a chance that user requirements are not considered in great detail. Therefore, the requirements from this research could provide some guidance as to the features required by the actual users of the tool.

7.4 Limitations of the Research

As with most research projects, there are a number of associated limitations. This research is no different and contains many limitations. The first set of limitations is associated with the literature of knowledge management, and in particular knowledge management tools. Although the volume of literature related to the area of knowledge management is vast, the opposite is true for knowledge management tools. Therefore, it was difficult to conduct an extensive literature review of knowledge management tools. However, this was overcome by drawing from the broader area of knowledge management and other disciplines for the tool evaluation and selection literature. Furthermore, a great deal of the little literature for knowledge management tools that does exist does so in magazines and general articles. Although these are ideal for obtaining general knowledge these tend not to be peer reviewed and therefore there is a chance that these are biased and subject to the authors interpretation. However, if journal articles and conference proceedings in this area are limited then it is necessary to utilise the information that is available. Therefore, the study by Ruggles (1997) described in Section 2.4.1 of Chapter 2 is taken from a white paper that, as of yet, has not been published. The third study by Angus *et al.*, (1998) was published in a weekly magazine.

The second area of limitations is related to the empirical evaluation of knowledge management tools conducted by the researcher. The limited period of this research enforced that it was only possible to conduct the empirical evaluation of a small number of tools. It is of the assumption that the more knowledge management tools that are empirically investigated the more exhaustive the resultant guidelines would be. Ideally

this research would be on-going and therefore would allow the empirical evaluation, where possible, of knowledge management tools as they appear on the software market. Another problem associated with the empirical aspect of this research is that the levels of access granted for some of the tools was restricted. For instance, AR System described in Section 3.5 of Chapter 3 had a 30-day evaluation period. This led to a further limitation in that the constrained evaluation period meant that it was impossible to evaluate the tool using the researcher's own knowledge base. Therefore, the evaluation was based solely on the knowledge base that was provided with the tool.

The final area of research limitations is related to the case studies. Firstly, the difficulty in obtaining a case study where an institution is willing to participate in the research means that the overall number of studies conducted is limited. In relation to this particular research the more case studies that could have been conducted the more extensive the resultant guidelines would be. Furthermore, it was found that the write-up of the case study is only as good as the information obtained from the institution during the case study period. Therefore, in some parts the case studies abruptly ends where in fact more information is required. Due to the limited time available from the case studies it was only possible to conduct one round of interviews although two would have been ideal. This was overcome by utilising questionnaires prior to the round of interviews. However, the questions on the questionnaire were predominantly of an open-ended nature and therefore many of the participants were discouraged by this.

7.5 Research Reflections

Although this research has achieved the objectives set out in Section 1.3 of Chapter 1, there are many areas that could be investigated outside the scope of the PhD. The first of these would be to ascertain whether the guidelines produced as a result of this research benefit the evaluation and selection process. Throughout this dissertation, the rapidly evolving knowledge management software market has been constantly brought to the attention of the researcher. Furthermore, the guidelines developed within this research can only be enhanced through the investigation of new knowledge management tools as they appear on the software market. Consequently, it is likely that the guidelines will remain a step behind the current knowledge management software market. A faster way of collecting more data to contribute to the guidelines may be to conduct a survey where a positivist approach is adopted as opposed to the interpretivist approach used for this research.

In order to identify the usefulness of these guidelines it would be necessary to use them in an actual evaluation and selection exercise within an institution. Although feedback for the guidelines was obtained from the case studies involved in this research, the guidelines were not tested in an actual knowledge management tool selection exercise. In order to achieve this, it would be necessary to get in contact with one or more institutions who are intending to undertake this task. Ideally, it would be advantageous if the guidelines developed as a result of this research were adopted by the institution to select a knowledge management tool. However, an institution may not be willing to discard their procedures in favour of these guidelines. In this instance, the guidelines from this research could be used in parallel to the institution's procedure. In this

manner, the guidelines could be further developed incorporating the experience of this exercise. Furthermore, if the guidelines did prove to be beneficial during the evaluation and selection of knowledge management tools then it would be possible to develop theory from this, and add it to the field of knowledge management.

Due to the constant introduction of new knowledge management tools on the software market, the guidelines developed as a part of this research are likely to be outdated extremely quickly. Therefore, to ensure that the guidelines are up-to-date it will be necessary to constantly update them. This will mean that as new knowledge management tools appear on the software market, they need to be evaluated and their features incorporated into the evaluation framework and their details added onto the taxonomy.

Furthermore, the guidelines could be automated in order to improve the usability. It is envisioned that the guidelines could be incorporated into a software tool that would enable the guidelines to be used in a more efficient manner. For instance, the taxonomy could be converted into a database consisting of details of all of the tools that have been evaluated and their associated functions. This would enable an evaluator to enter the functions required by the knowledge management tool and the database could return all of the tools that match these functions. Alternatively, the evaluator may already have some tools in mind and may wish to obtain further information. In this instance the automated taxonomy would display the various functions supported by the tools.

The evaluation framework may be automated in order for customised evaluation frameworks to be obtained. This may be achieved by producing a piece of software that will ask the evaluator to answer a set of questions. The purpose of this series of questions will be to identify information about what aspects of the tool are most important for their requirements. After each question has been answered, the responses may be analysed and a weighting may be allocated to each of the categories. The result could be an evaluation framework that has been produced according to the weighting assigned to each of the questions.

During the initial feedback for the guidelines that was obtained from the case studies participating within this research, it was suggested that the frame of reference could include various sectors that exist in industry. In order to achieve this, it would be necessary to contact institutions from as many different sectors as possible that have been through or are currently going through the process of evaluating and selecting a knowledge management tool. The experiences of the selection of a knowledge management tool for each sector should be collated and compared. If there are major differences in the way that one sector selects a knowledge management tool to another sector, for example financial institutes and hospitals, then these should be incorporated into the guidelines. Furthermore, initial feedback from the case studies also indicated that a frame of reference for the development of knowledge management tools would be beneficial. Therefore, this could also be an area for further investigation.

As a final point, although the aim of this research was to investigate an area of the technology component of knowledge management in isolation it appears that the other

components and knowledge management activities have had an influence on this research. For instance, the knowledge management tools selected for empirical investigation in Chapter 3 all support one or more of the knowledge management activities. Furthermore, the knowledge management section of the evaluation framework described in Chapter 5 is divided up according to the knowledge management activities. Initially, the frame of reference for knowledge management tool selection described in the second half of Chapter 5, was designed without the other components of knowledge management being included. However, the feedback from the case study companies suggested that these should configure even if their only purpose is to demonstrate the importance of addressing all of the components. The knowledge management activities also exist within the frame of reference since it is important for the evaluating organisation to identify the knowledge management activities that must be supported by the tool.

Finally, the taxonomy that was designed for the classification of knowledge management tools described in Chapter 6 is also based around the knowledge management activities. In essence, this suggests that although the technology component of knowledge management was examined in isolation the other knowledge management components and activities do have an impact and are important as part of an overall knowledge management strategy.

References

Alvesson, M. and Kärreman, D. (2001) Odd Couple: Making Sense of the Curious Concept of Knowledge Management. *Journal of Management Studies*. Vol. 38, No. 7, pp. 995-1018.

Anderson, E. E. (1990) Choice Models for the Evaluation and Selection of Software Packages. *Journal of Management Information Systems*. Vol. 6, No. 4, pp. 123-138.

Angus, J. and Patel, J. (1998) Knowledge Management Cosmology. *Informationweek*. March 16, pp. 59.

Angus, J., Patel, J. and Harty, J. (1998) Knowledge Management: Great Concept...But What Is It? *Informationweek*. March 16, pp. 58-70.

Applehams, W., Globe, A. and Laugero, G. (1999) Managing Knowledge: A Practical Web-Based Approach. Addison Wesley. Reading.

Berryman, R., Clark, G. and Ho, A. (1994) An Exploration into Practices and Theories of Software Evaluation for Educational Use. *Computers in New Zealand Schools*. November, Vol. 4, No.1, pp. 14-19.

Bicknell, D. (1999) Knowledge Manager's Don't Work. *Computer Weekly*. May 27 1999, pp. 26.

Bonner, D. (2000) Enter the Chief Knowledge Officer. *Training and Development*. Vol. 54, Iss. 2, pp. 36-40.

Borghoff, U.M. and Pareschi, R. (1997) Information Technology for Knowledge Management. *Journal of Universal Computer Science*. Special Issue on Information Technology for Knowledge Management, August 28 1997, Vol. 3, Iss. 8, pp. 835-842.

Breslin, J. (1986) Selecting and Installing Software Packages: New Methodology for Corporate Implementation. Quorum Books, USA.

Buckleitner, W. (1999) The State of Children's Software Evaluation: Yesterday, Today and in the 21st Century. *Information Technology in Childhood Education*. Vol. 1, pp. 211-220.

Creswell, J. (1998) Qualitative Inquiry and Research Design. SAGE Publications, Thousand Oaks, California.

Curry, J.W. and Bonner, D.M. (1983) How to Find and Buy Good Software: A Guide for Business and Professional People. Prentice-Hall, New Jersey.

Czaja, R. and Blair, J. (1996) Designing Surveys: A Guide to Decisions and Procedures. The Pine Forge Press, California.

Davenport, T.H. (1993) Process Innovation: Reengineering Work through Information Technology. Harvard Business School Press, Boston, Massachusetts.

Davenport, T.H. (1997) Information Ecology: Mastering the Information and Knowledge Environment. Oxford University Press, New York.

Davenport, T.H. and Prusak, L. (1998) Working Knowledge: How Organisations Manage What They Know. Harvard Business School Press, Boston, Massachusetts.

Denzin, N.K. and Lincoln, Y. (1998) Collecting and Interpreting Qualitative Materials. SAGE Publications, London.

Dillman, D.A. (1978) Mail and Telephone Surveys: The Total Design Method. John Wiley & Sons, New York.

Drucker, P.F. (1993) Post-Capitalist Society. Butterworth-Heinemann, London.

Duffy, J. (2001) The Tools and Technologies Needed for Knowledge Management. *Information Management Journal*. Vol. 35, Iss. 1, pp. 64-67.

Dupuy, A. and Leveson, N. (2000) An Empirical Evaluation of the MC/DC Coverage Criterion on the HETE-2 Satellite Software. *Proceedings from DASC (Digital Aviation Systems Conference)* in Philadelphia, October.

Eisenhardt, K.M. (1989) Building Theories from Case Study Research. *Academy of Management Review*, Vol. 14, No. 4, pp.532-550

Ferran-Urdaneta, C. (1999) Teams or Communities? Organisational Structures for Knowledge Management. *Proceedings of the 1999 ACM SIGCPR Conference on Computer Personnel Research*, pp. 128-134.

Foddy, W. (1993) Constructing Questions for Interviews and Questionnaires. Cambridge University Press, Cambridge.

Forte, G. (1992) Tools Fair: Out of the Lab, onto the Shelf. *IEEE Software*. May 1992, pp. 70-79.

Galliers, R.D. (1990) Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy. *Proceedings of the IFIP TCB/WG 8.2 Working Conference on the Information Systems Research Arena of the 90's*. Challenges, Perceptions, and Alternative Approaches. Copenhagen, Denmark, 14-16 December, Nissen, H.E., Klein, H.K. and Hirschheim, R. (eds).

Galliers, R.D. (1992) Choosing Information Systems Research Approaches. In Galliers, R.D. (ed) Information Systems Research: Issues, Methods, and Practical Guidelines, Blackwell Scientific Publications, Oxford, pp. 144-166.

Hammer, M. and Champy, J. (1993) Re-engineering the Corporation: A Manifesto for Business Revolution. Nicholas Brearley, London.

Hibbard, J. and Carillo, K.M. (1998) Knowledge Revolution: Getting Employees to Share What They Know is no Longer a Technology Challenge: it's a Corporate Culture Challenge. *Informationweek*. January 05 1998, Iss. 663.

Hlupic, V. (1997) Simulation Software Selection Using SimSelect. *Simulation*. October, Vol. 69, No. 4, pp. 231-239.

Hlupic, V. and Paul, R.J. (1996) Methodological Approach to Manufacturing Simulation Software Selection. *Computer Integrated Manufacturing Systems*. Vol. 9, No. 1, pp. 49-55.

Holloway, S. and Bidgood, T. (1991) CASE Handbook for Information Managers: Selecting and Implementing CASE Tools. Avebury Technical, Aldershot.

Horgan, J.R. and Mathur, A.P. (1992) Assessing Testing Tools in Research and Education. *IEEE Software*. May 1992, pp. 61-69.

Insch, G.S., Moore, J.E. and Murphy, L.D. (1997) Content Analysis in Leadership Research: Examples, Procedures, and Suggestions for Future Use. *Leadership Quarterly*. Vol. 8, No. 1, pp. 1-25.

Jackson, C. (1999) Process to Product: Creating Tools for Knowledge Management. [WWW document] URL http://www.brint.com/members/online/120205/jackson/

Klamma, R. and Schlaphof, S. (2000) Rapid Knowledge Deployment in an Organisational-Memory-Based Workflow Environment. *Proceedings of the 8th European Conference on Information Systems (ECIS 2000: A Cyberspace Odyssey)*. Vol. 1, pp. 364-371. Hansen, H.R., Bichler, M. and Mahrer, H. (eds).

Klein, G. and Beck, P.O. (1987) A Decision Aid for Selecting Among Information System Alternatives. *MIS Quarterley*. June, Vol. 11, Iss. 2, pp. 177-185.

Kogut, B. and Zander, U. (1997) Knowledge of the Firm. Combinative Capabilities, and the Replication of Technology. In Prusak, L. (ed) Knowledge in Organisations, Butterworth-Heinemann, Oxford.

Kramer, M. (1998) Knowledge Management Becomes Catch Phrase but Eludes Easy Definition. *PC Week*. Dec 7, pp. 95.

Le Blanc, L.A. and Jelassi, T. (1991) An Empirical Assessment of Choice Models for Software Evaluation and Selection. Working Paper, INSEAD No.91/24/TM

Leonard-Barton, D. (1995) Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation. Harvard Business School Press, Boston.

Lynch, R.K. (1985) Nine Pitfalls in Implementing Packaged Applications Software. *Journal of Information Systems Management*. Vol. 2, No. 2, pp. 88-92.

Macintosh, A. (1999) Knowledge Management.
[WWW document] URL http://aiai.ed.ac.uk/~alm/kamlnks.html

Malhotra, Y. (1997) Current Business Concerns and Knowledge Management.
[WWW document] URL http://www.brint.com/interview/times.htm

Martin, J. and McClure, C. (1983) Buying Software off the Rack. *Harvard Business Review*. Vol. 61, No. 6, pp. 32-47.

McDermott, R. and O'Dell, C. (2001) Overcoming Cultural Barriers to Sharing Knowledge. *Journal of Knowledge Management*. Vol. 5, No. 1, pp. 76-85.

McDonald, T. (1996) Evaluating Primary Health Care Software Packages. ITCH '96 (A Conference Addressing Information Technology Issues In Community Health), Victoria Conference Centre, Victoria, Canada, November 3-6.

McNeese-Smith, D. (1999) A Content Analysis of Staff Nurse Descriptions of Job Satisfaction and Dissatisfaction. *Journal of Advanced Nursing.* Vol. 29, No. 6, pp. 1332-1341.

Microsoft (2001) NetMeeting Home Page.
[WWW document] URL http://www.microsoft.com/windows/netmeeting/

Miles, M.B. and Huberman, A.M. (1994) Qualitative Data Analysis. (2nd Edition). SAGE Publications, London.

Miles, R.E., Snow, C.C., Mathews, J.A., Miles, G. and Coleman H.J. (1997) Organising in the Knowledge Age: Anticipating the Cellular Form. *The Academy of Management Executive.* Nov 1997, Vol. 11, No. 4, pp. 7-18.

Milton, N., Shadbolt, N., Cottam, H. and Hammersley, M (1999) Towards a Knowledge Technology for Knowledge Management. *International Journal of Human-Computer Studies.* Vol. 51 Iss. 3, pp. 615-641.

Montazemi, A.R., Cameron, D.A. and Gupta, K.M. (1996) An Empirical Study of Factors Affecting Software Package Selection. *Journal of Management Information Systems.* Summer, Vol. 13, No. 1, pp. 89-105.

Mosley, V. (1992) How to Assess Tools Efficiently and Quantitatively. *IEEE Software.* May 1992, pp. 29-32.

Nandy, B.R. and Sarvela, P.D. (1997) Content Analysis Re-examined: A Relevant Research Method for Health Education. *American Journal of Health Behaviour.* Vol. 21, No. 3, pp. 222-234.

Nikoukaran, J., Hlupic, V. and Paul, R.J. (1998) Criteria for Simulation Software Evaluation. *Proceedings of the 1998 Winter Simulation Conference.* Washington, USA, pp. 399-406 Medeiros, D.J., Watson, E.F., Carson, J.S. and Manivannan, M.S. (eds).

Nonaka, I. and Takeuchi, H. (1995) The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford University Press, Oxford.

Nonaka, I. (1998) The Knowledge-Creating Company. Harvard Business Review on Knowledge Management, Harvard Business Review Press, USA.

Onge, A. (2001) Knowledge Management and Warehousing. *Modern Materials Handling*. Vol. 56, Iss. 3, pp. 33.

Oppenheim, A.N. (1996) Questionnaire Design, Interviewing and Attitude Measurement. Pinter Publishers Ltd, London.

Parnas, D.L., John van Schouwen, A. and Po Kwan, S. (1990) Evaluation of Safety-Critical Software. *Communications of the ACM*. June, Vol. 33, No. 6, pp. 636-648.

Patton, M.Q. (1990) Qualitative Evaluation and Research Methods. (2nd Edition) SAGE Publications, London.

Poston, R.M. and Sexton, M.P. (1992) Evaluating and Selecting Testing Tools. *IEEE Software*. May 1992, pp. 33-42.

Preece, A.D., Talbot, S. and Vignollet, L. (1997) Evaluation of Verification Tools for Knowledge-Based Systems. *International Journal of Human Computer Studies*. Vol. 47, No. 5, pp. 629-658.

Prusak, L. (1998) Why Knowledge, Why Now? In Klein, D.A. (ed) The Strategic Management of Intellectual Capital, Butterworth-Heinemann, Boston.

Reilly, M., Matarazzo, T. and Ives, W. (1999) Once Upon a Corporate Time: The Role of Stories in Organisational Learning. *Knowledge Management*. Vol. 2 Iss. 4, December 1998/January 1999, pp. 7-12.

Robson, M. and Ullah, P. (1996) A Practical Guide to Business Process Re-engineering. Gower, Hampshire.

Ruggles, R. (1997) Knowledge Tools: Using Technology to Manage Knowledge Better. [WWW document] URL: http://www.cbi.cgey.com/pub/docs/KnowledgeTools.PDF

Rutkoski, M.L. and Stasko, S.R. (2000) Data, Information, Knowledge – Understanding the difference. The Knowledge Chronicle.
[WWW document] URL http://www.walshcol.edu/~mrutkow/article1A.htm

Setzer, V.W. (1999) Data, Information, Knowledge and Competency.
[WWW document] URL http://www.ime.usp.br/~vwsetzer/data-info.html

Sharland, R. (1991) Package Evaluation: A Practical Guide to Selecting Applications and Systems Software. Avery Technical Academic Publishing Group, Aldershot.

Silver, C.A. (2000) Where Technology and Knowledge Meet. *The Journal of Business Strategy.* Vol. 21, Iss. 6, pp. 28-33.

Silverman, D. (2000) Doing Qualitative Research: A Practical Handbook. SAGE Publications. London.

Silverman, D. (2001) Interpreting Qualitative Data: Methods for Analysing Talk, Text and Interaction. SAGE Publications, London.

Sterling, B. (1997) The Digital Revolution in Retrospect. *Communications of the ACM.* February 1997, Vol. 40, No. 2, pp. 79.

Stewart, T.A. (2000) Software Preserves Knowledge, People Pass it On. *Fortune.* New York, September 4, Vol. 142, Iss. 5, pp. 390-391.

Stewart, T.A. (2002) The Wealth of Knowledge: Intellectual Capital and the 21st Century Organisation. Currency Doubleday, New York.

Sveiby, K. (2001) What is Knowledge Management? [WWW document] URL http://sveiby.konverge.com/articles/KnowledgeManagement.html

Svensen, N. (1998) Knowledge Sharing. *Knowledge Management.* Vol. 1 Iss. 6, pp. 21-24.

Teece, D.J. (1998) Capturing Value from knowledge Assets: The New Economy, Markets for Know-How, and Intangible Assets. *California Management Review* (Special Issue on Knowledge and the Firm). Spring 1998, Vol. 40, No. 3, pp. 55-80.

Toffler, A. (1980) The Third Wave. Collins, London.

Toffler, A. (1990) Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century. Bantam, London.

Tolen, F.A.L. (1999) Knowledge Management: A Practical Approach. *Information Services and Use.* Vol. 19, No. 1, pp. 57-61.

Trauth, E.M. (1999) Who Owns my Soul? The Paradox of Pursuing Organisational Knowledge in a Work Culture of Individualism. *Proceedings of the 1999 ACM SIGCPR Conference on Computer Personnel Research.* April 8-10, 1999, New Orleans, LA USA.

Vaas, L. (1999) Brainstorming: Before Opening the Floodgates to New KM Technologies, IT Managers Should Make Sure Users are Ready, Willing and Able to Share What They Know. *PC Week.* May 31 1999, Vol. 16, Iss. 22, pp. 65.

Wang, W.L. (1999) Information in the Information Age. *Communications of the ACM.* Vol. 42, No. 6, pp. 23-24.

Wiig, K.M. (1999) What Future Knowledge Management Users May Expect. *Journal of Knowledge Management.* Vol. 3, No. 2, pp. 155-165.

Yin, R.K. (1994) Case Study Research: Design and Methods. (2nd Edition) SAGE Publications, California.

Youngman, M.B. (1982) Designing and Analysing Questionnaires. University of Nottingham School of Education, Nottingham.

Zolingen, S.J. van, Streumer, J.N. and Stooker, M. (2001) Problems in Knowledge Management: A Case Study of a Knowledge-Intensive Company. *International Journal of Training and Development.* Vol. 5, No. 3, pp. 168-184.

Appendix A: Questionnaires

This appendix demonstrates the three questionnaires used during the initial stages of data collection. However, prior to the presentation of the questionnaires Table A1 demonstrates the base questions and where in each of the questionnaires the question is positioned. For instance, Table A1 illustrates that base question Q11 is question 11 in the questionnaire for where a commercial knowledge management tool was purchased, question 13 in the questionnaire were a knowledge management tool was developed, and question 4 in the questionnaire for the users of knowledge management tools.

		Questionnaires		
ID	Base Question	Commercial	Developed	User
	Name	A1	A1	A1
	Company	A2	A2	A2
	Job Title	A3	A3	A3
	Email Address	A4	A4	A4
	Company Web Address (If applicable)	A5	A5	A5
	Briefly describe the main activities of your company	A6	A6	A6
	Briefly describe your role within the company	A7	A7	A7
Q1	What made you decide they required a KM tool?	B1	B2	B2
Q2	List the features that were required of the KM tool to be purchased and briefly explain why for each.	B2	B4	
Q3	List the names of the KM tools that were considered for purchase	B3	B5	
Q4	Describe the process used for arriving at the short-list of the KM tools.	B4	B6	
Q5	Explain why each of the tools was considered unsuitable.	B5	B7	
Q6	What is the name of the Knowledge Management tool?	B6	B1	B1
Q7	What are the reasons for selecting this particular KM tool?	B7		
Q8	What business objectives was the tool intended to achieve?	B8	B10	
Q9	In your opinion did the tool meet the business objectives?	B9	B11	
Q10	Are you satisfied with the KM tool?	B10	B12	B3
Q11	List what you feel are the main features of the tool and briefly describe each.	B11	B13	B4
Q12	List the features of the KM tool that you like in particular and briefly explain why for each.	B12	B14	B5
Q13	List the features of the KM tool that you do not like and briefly explain why for each.	B13	B15	B6
Q14	List any features that the tool does not currently have but you believe would benefit from having and briefly explain why for each.	B14	B16	B7
Q15	Was the price of the tool a major factor?	B15		

Q16	Cost of tool?	B16		
Q17	Items included in cost of tool? E.g. training, support, etc	B17		
Q18	Additional costs on top of cost of tool? E.g. training	B18		
Q19	If the whole process were to be repeated, which of the following would be most applicable?	B19	B17	
Q20	Was it necessary to adapt the tool in order to meet your requirements?	B20		
Q21	Describe the alterations that were made to the tool	B21		
Q22	Was it easy to make the alterations?	B22		
Q23	Were any commercial KM tools considered?		B3	
Q24	After considering one or more commercial KM tools explain why it was decided that a commercial KM tool was unsuitable.		B8	
Q25	What steps were taken in order to develop your own KM tool?		B9	
Q26	If you experience any difficulties using the tool what methods of assistance are available?			B8
Q27	What is your opinion about the interface of the KM tool?			B9
Q28	Was training provided in order to learn how to use the KM tool?			B10
Q29	Did you find the training useful?			B11
Q30	Do you feel that training should have been provided?			B12
Q31	Do you feel you should have been involved in selection/development process?			B17
Q32	What is your opinion about the KM tool that you are using?			B18
Q33	Were the users involved during the selection/development of the tool?	C1	C1	B13
Q34	What was the users role during the selection/development of the KM tool?	C2	C2	B14
Q35	Was it useful to have the users involved in the selection/development process?	C3	C3	B15
Q36	Do you feel that involving the users in the selection/development of the KM tool has resulted in greater user acceptance?	C4	C4	B16
Q37	Explain why users were not involved in the selection/development of the tool.	C5	C5	
Q38	If the process of selecting/developing a KM tool were to be repeated would you involve the users?	C6	C6	
Q39	What advice would you give to anyone intending to purchase/develop a KM tool?	C7	C7	

Table A1: Questions for Questionnaire

QUESTIONNAIRE FOR THE PURCHASE OF A COMMERCIAL KNOWLEDGE MANAGEMENT TOOL

The following questionnaire was used for cases where a commercial knowledge management tool was purchased.

Section A – Personal Information

1. Name

2. Company

3. Job Title

4. Email Address

5. Company Web Address (If applicable).

6. Briefly describe the main activities of your company.

7. Briefly describe your role within the company.

Section B – Information about the Knowledge Management Tool

1. What made the company decide they required a Knowledge Management tool?

2. Please list the names of the Knowledge Management tools that were considered for purchase?

3. Please describe the process used for arriving at the short-list of the Knowledge Management tools specified in Q.B3.

4. Apart from the tool that was purchased, please explain why each of the tools specified in Q.B3 was considered unsuitable.

5. What is the name of the Knowledge Management tool that was purchased?

6. What are the reasons for selecting this particular Knowledge Management tool?

7. What business objectives was the tool intended to achieve? (e.g. improving customer services by reducing call times at a call centre).

8. In your opinion did the tool meet the business objectives specified in Q.B8?

[ ] Yes
[ ] No

Please give your reasons.

9. Are you satisfied with the Knowledge Management tool that was purchased?

[ ] Yes
[ ] No

Please give your reasons.

10. Please list what you feel are the main features of the tool and briefly describe each.

11. Please list the features of the Knowledge Management tool that you like in particular and briefly explain why for each.

12. Please list the features of the Knowledge Management tool that you do not like and briefly explain why for each.

13. Please list any features that the tool does not currently have but you believe would benefit from having and briefly explain why for each.

14. Was the price of the tool a major factor during the evaluation and selection process?

[ ] Yes
[ ] No

Please give your reasons.

15. Approximately how much did the tool cost?

16. What was included in the cost of the tool? (e.g. installation, training, support, etc)

17. Please specify any additional costs, with regards to the tool, that were incurred. (e.g. consultancy, training, manuals, support, etc.) For each item listed please specify the approximate price.

18. If the whole process of evaluating and selecting a Knowledge Management tool were to be repeated, which of the following would be most applicable? (select one only).

[ ] Keep the selection process exactly the same
[ ] Make minor amendments to the selection process
[ ] Make major amendments to the selection process
[ ] Use an alternative approach

Please give your reasons.

19. Was it necessary to adapt the tool in order to meet your requirements?

[ ] Yes
[ ] No

Please give your reasons. If you answered 'No' please go to Section C

20. Briefly describe the alterations that were made to the tool?

21. Was it easy to make the alterations?

[ ] Yes
[ ] No

Please give your reasons.

Section C – Information about the users

1. Were the intended users of the Knowledge Management tool involved at any stage of the evaluation and selection of the tool?

   [ ] Yes
   [ ] No

If you answered 'No' please go to Q.C5

2. What was the users role during the evaluation and selection of the Knowledge Management tool?

3. Was it useful to have the users involved in the evaluation and selection process?

   [ ] Yes
   [ ] No

Please give your reasons.

4. Do you feel that involving the users in the evaluation and selection of the Knowledge Management tool has resulted in greater user acceptance?

   [ ] Yes
   [ ] No

Please give your reasons. Please go to Q.C6

5. Explain why the users were not involved in the evaluation and selection of the tool?

6. If the exercise were to be repeated would you involve the users?

   [ ] Yes
   [ ] No

Please give your reasons.

7. What advice would you give to anyone intending to purchase a Knowledge Management tool?

QUESTIONNAIRE FOR THE DEVELOPMENT OF A KNOWLEDGE MANAGEMENT TOOL

The following questionnaire was used for cases where a knowledge management tool was developed.

Section A – Personal Information

1. Name

2. Company

3. Job Title

4. Email Address

5. Company Web Address (If applicable).

6. Briefly describe the main activities of your company.

7. Briefly describe your role within the company.

Section B – Information about the Knowledge Management Tool

1. What is the name of the Knowledge Management tool that was developed?

2. What made the company decide they required a Knowledge Management tool?

3. Were any commercial Knowledge Management tools considered?

[ ] Yes
[ ] No

Please give your reasons. If you answered 'No' please go to Q.B9

4. Please list the features that were required of the Knowledge Management tool to be purchased and briefly explain why for each.

5. Please list the names of the Knowledge Management tools that were considered for purchase.

6. Please describe the process used for arriving at the short-list of Knowledge Management tools specified in Q.B5.

7. Please explain why each of the tools specified in Q.B5 was considered unsuitable.

8. After considering one or more commercial Knowledge Management tools explain why it was decided that commercial Knowledge Management tools in general were unsuitable.

9. What steps were taken in order to develop your own Knowledge Management tool?

10. What business objectives was the developed Knowledge Management tool intended to achieve? (e.g. improving customer services by reducing call times at a call centre).

11. In your opinion did the developed Knowledge Management tool meet the business objectives specified in Q.B10?

[ ] Yes
[ ] No

Please give your reasons.

12. Are you satisfied with the Knowledge Management tool that was developed?

[ ] Yes
[ ] No

Please give your reasons.

13. Please list what you feel are the main features of the Knowledge Management tool that was developed and briefly describe each.

14. Please list the features of the Knowledge Management tool that you like in particular and briefly explain why for each.

15. Please list the features of the Knowledge Management tool that you do not like and briefly explain why for each.

16. Please list any features that the developed tool does not currently have but you believe would benefit from having and say why for each.

17. If the whole process of evaluating commercially available tools and deciding to develop your own Knowledge Management tool internally were to be repeated, which of the following would be most applicable? (select one only)

[ ] Keep the process exactly the same
[ ] Make minor amendments to the process
[ ] Make major amendments to the process
[ ] Use an alternative approach

Please give your reasons.

Section C – Information about the users

1. Were the intended users of the Knowledge Management tool involved at any stage during the evaluation and development of the tool?

[ ] Yes
[ ] No

Please give your reasons.

If you answered 'No' please go to Q.C5

2. What was the users role during the evaluation and development of the Knowledge Management tool?

3. Was it useful to have the users involved in the evaluation and development process?

   [ ] Yes
   [ ] No

Please give your reasons.

4. Do you feel that involving the users during the evaluation and development of the Knowledge Management tool has resulted in greater user acceptance?

   [ ] Yes
   [ ] No

Please give your reasons.

5. Explain why the users were not involved in the evaluation and development process?

6. If you were to repeat the process of evaluating and developing a Knowledge Management tool would you involve the users?

   [ ] Yes
   [ ] No

Please give your reasons.

7. What advice would you give to anyone intending to develop a Knowledge Management tool?

QUESTIONNAIRE FOR THE USERS OF KNOWLEDGE MANAGEMENT TOOLS

The following questionnaire was used to obtain information from the users of knowledge management tools.

Section A – Personal Information

1. Name

2. Company

3. Job Title

4. Email Address

5. Company Web Address (If applicable).

6. Briefly describe the main activities of your company.

7. Briefly describe your role within the company.

Section B – Information about the Knowledge Management Tool

1. What is the name of the Knowledge Management tool that you are using?

2. What do you use the tool for?

3. Are you satisfied with the tool?

[ ] Yes
[ ] No

Please give you reasons.

4. Please list what you feel are the main features of the tool and briefly describe each.

5. Please list the features of the Knowledge Management tool that you like in particular and briefly explain why for each.

6. Please list the features of the Knowledge Management tool that you do not like and briefly explain why for each.

7. Please list any features that the tool does not currently have but you believe would benefit from having and briefly explain why for each.

8. If you experience any difficulties using the tool what methods of assistance are available? (Select all that apply and for each item selected put them in order of increasing usefulness, using 1 to indicate the most useful).

	Level of Usefulness
[ ] User manuals	.....
[ ] Help Line/Help desk	.....
[ ] On-line (i.e. within the tool)	.....
[ ] Internet web site	.....
[ ] Email	.....
[ ] Other (Please specify)	.....

9. What is your opinion about the interface of the Knowledge Management tool that you are using?

10. Was training provided in order to learn how to use the Knowledge Management tool?

[ ] Yes
[ ] No

If you answered 'No' please go to Q.B12

11. Did you find the training useful?

[ ] Yes
[ ] No

Please give your reasons. Please go to Q.B13

12. Do you feel that training should have been provided?

[ ] Yes
[ ] No

Please give your reasons.

13. Prior to the Knowledge Management tool being installed were you given the opportunity to evaluate any Knowledge Management tool(s) that were being considered?

[ ] Yes
[ ] No

If you answered 'No' please go to Q.B17

14. Please describe your role during the evaluation process.

15. Do you feel that it was beneficial for you to be involved in the evaluation of the Knowledge Management tool(s) prior to one being installed within the organisation?

[ ] Yes
[ ] No

Please give your reasons.

16. Do you feel that by being involved in the evaluation and selection of a Knowledge Management tool has resulted in greater user acceptance?

[ ] Yes
[ ] No

Please give your reasons. Please go to Q.B18

17. Do you feel you should have been involved in the evaluation of any Knowledge Management tools?

[ ] Yes
[ ] No

Please give your reasons.

18. What is your opinion about the Knowledge Management tool that you are using?

Appendix B: Evaluation Framework

This Appendix contains the framework that can be used for the evaluation of knowledge management tools.

SECTION 1 – GENERIC CRITERIA			
Financial Aspects			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Cost	❑ Within budget ❑ Exceeds budget		Does the cost of the tool fall within the allocated budget?
Additional features	❑ Installation ❑ Training ❑ Documentation	❑ Support ❑ Other Details:	Are any additional features included in the cost of the tool?
Bulk discount	❑ Yes ❑ No	Details:	Is there a discount if multiple copies of the tool are purchased?
Number of licences	❑ 1 – 50 ❑ 51 – 100	❑ 101 – 150 ❑ 150 +	How many licences are included in the cost of the tool?
Additional Licences	❑ Available ❑ Not Available	Cost:	Are additional licences available? If so, at what cost?
Training			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Required	❑ Yes ❑ No		Is training required in order to be able to use the tool?
Provided	❑ Yes ❑ No		Does the tool vendor provide training?
Cost	❑ Included ❑ Additional	Cost:	Is training included in cost of tool ? If additional, what is the cost?
Location	❑ On site ❑ Vendor site	❑ Training Centre	What are the options for the location of the training?
Duration	❑ 1 Day ❑ 2 Days	❑ Upto 1 Week ❑ Upto 2 Weeks	What is the duration of the training required?
Session Size	❑ Upto 5 people ❑ 6 – 10 people ❑ 11-15 people	❑ 16 – 20 people ❑ 21 – 25 people ❑ 25 +	How many people can be accommodated during a training session?
Support			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Required	❑ Yes ❑ No		Is support required for the tool?
Provided	❑ Yes ❑ No		Does the tool vendor provide support?
Cost	❑ Included ❑ Additional	Cost:	Is support included in cost of tool? If additional, what is the cost?
Duration	❑ 1 Year ❑ 2 Years	❑ 3 Years ❑ 5+ Years	What is the duration for the provision of support?
Formats	❑ Telephone ❑ Email	❑ Internet Website ❑ On-line in tool	In what format(s) is support available?
Availability	❑ 24 X 7 ❑ Local Office Hours ❑ International Office Hours		When is direct support available?
Extension	❑ Yes ❑ No	Cost:	Can the support period be extended if required? If so, what is the cost?

Documentation			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Provided	❑ Yes ❑ No		Is documentation for the tool available?
Cost	❑ Included ❑ Additional Cost:		Is documentation included in cost of tool? If additional, what is cost?
Content	❑ Yes ❑ No		Is the content of the documentation sufficient?
Standard	❑ Basic ❑ Medium	❑ Difficult ❑ Too Complex	What is the standard of the documentation?
Target Audience	❑ Users ❑ Managers ❑ Technical		What group(s) is the documentation suitable for?
Examples	❑ Yes ❑ No		Are sufficient examples provided within the documentation?
Copies	❑ 1 Copy ❑ According to number of licences ❑ Other Details:		How many copies of the documentation are provided?
Availability	❑ Yes ❑ No		Would the documentation be easily available to everyone?

Usability			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Learning	❑ Easy ❑ Average	❑ Difficult ❑ Too Difficult	How easy is the tool to learn?
User Interface	❑ Yes ❑ No		Is the format of the interface familiar to any other?
Visual	❑ Yes ❑ No		Is the interface of the tool visually appealing?
Navigation	❑ Yes ❑ No		Is the tool easy to navigate?
Ease of use	❑ Yes ❑ No		Is the tool easy to use?
Crashes	❑ Yes Details: ..... ❑ No		Did the tool crash at any point? If so, provide details.
Personalisation	❑ Yes ❑ No		Does the tool enable the user to design their own interface?

Technical Aspects			
CRITERIA	**OPTIONS**		**DESCRIPTION**
Functionality	❑ Yes ❑ No		Does the tool do what you want it to do?
Tailorability	❑ Yes ❑ No		Can the tool be adapted if necessary?
Feasibility of Tailorability	❑ Yes ❑ No		Is it feasible to tailor the tool?
Compatibility	❑ Windows 95 ❑ Windows 98 ❑ Windows 2000 ❑ Windows XP	❑ Windows NT ❑ Mac OS ❑ Unix	What Operating Systems is the tool compatible with?
OS Problems	❑ Yes Details: ..... ❑ No		Are there any known problems with specific Operating Systems?
Performance	❑ Windows 95 ❑ Windows 98 ❑ Windows 2000 ❑ Windows XP	❑ Windows NT ❑ Mac OS ❑ Unix	On which Operating System(s), if any, does that tool perform best?
Cost	❑ Yes Details: ..... ❑ No		Are there any differences in cost depending on the OS?

Integration	❑ Yes ❑ No	Can the tool be integrated with other software tools?
Development	❑ Yes Details: ..... ❑ No	Is any development of the tool planed for the near future?
Upgrades	❑ Yes ❑ No	Will free upgrades be provided with new versions of the tool?
Macros	❑ Yes ❑ No	Does the tool facilitate macros?
Security	❑ Yes Details: ..... ❑ No	Are there any known security issues with the tool?
	❑	

Vendor

CRITERIA	OPTIONS			DESCRIPTION
Reputation	❑ Unknown ❑ Bad	❑ Good ❑ Excellent		What kind of reputation does the tool vendor have?
Stability	❑ Stable ❑ Unstable ❑ Unknown			Is the tool vendor stable?
No. of Clients	❑ 1–10 ❑ 11–20	❑ 21–30 ❑ 31–40	❑ 41–50 ❑ 50 +	How many clients does the tool vendor have?
Client Companies	❑ Small Companies ❑ Medium Companies ❑ Large Companies ❑ Unknown			What term is most reflective for the majority of the vendor's clients?
Service	❑ Bad ❑ Low	❑ Medium ❑ High		How would you rate the quality of the service provided by the vendor?
Installation	❑ Yes ❑ No			Will vendor help to install tool?
Modifications	❑ Yes ❑ No			Is vendor willing to make modifications to the tool?

Client View of Vendor

CRITERIA	OPTIONS		DESCRIPTION
Vendor Service	❑ Bad ❑ Low	❑ Medium ❑ High	What is the general opinion of the service provided by the vendor?
Delays	❑ Yes Details: ..... ❑ No		Were any delays encountered?
Bugs	❑ Yes Details: ..... ❑ No		Were any bugs discovered within the tool?
Response Time	❑ No Response ❑ Slow	❑ Average ❑ Fast	What is the general opinion for the response time to queries?
Improvements	❑ Yes Details: ..... ❑ No		Do the clients suggest any improvements for the tool?

SECTION 2 – CRITERIA SPECIFIC TO KM TOOLS			
CRITERIA	**OPTIONS**		**DESCRIPTION**
General Criteria for Knowledge Management Tools			
Type	❑ Generate knowledge ❑ Organise knowledge ❑ Share knowledge		Which of the knowledge management activities does the tool accommodate?
Purpose	❑ General ❑ Specific Details:		Has the tool been designed for a specific area? E.g. Helpdesk
Type of knowledge	❑ Structured ❑ Unstructured		What type of knowledge does the tool facilitate?
Format of data	❑ Numeric ❑ Text ❑ Graphics	❑ Audio ❑ Visual	What format(s) of data does the tool facilitate?
Reward Scheme	❑ Yes ❑ No		Does the tool accommodate the deployment of a reward scheme?
Criteria for Knowledge Generation Tools			
General			
Generation	❑ Capture ❑ Discovery ❑ Retrieval		What aspect(s) of knowledge generation does the tool facilitate?
Display Format	❑ Text ❑ Graph ❑ Table	❑ Database ❑ Graphic	In what format(s) can the generated knowledge be displayed?
Knowledge Capture			
Functions	❑ User Profiling ❑ Web Spider ❑ Expert Profiling		What functions are used in order to capture knowledge?
Performance Indicators	❑ Yes ❑ No		Are details about an individual's performance captured?
Time Scheduling	❑ Yes ❑ No		Does the tool enable individual schedules to be captured?
Log Caller Details	❑ Yes ❑ No		Does the tool capture contact details about caller?
Time Logging	❑ Yes ❑ No		Does the tool capture the time taken to complete a task?
User Input	❑ Yes ❑ No		Is there a facility for an average user to submit to the repository?
Input Wizard	❑ Yes ❑ No		Does the tool guide the user when they are submitting to repository?
Ease of Input	❑ Yes ❑ No		Is it easy for the user to submit to the knowledge repository?
Knowledge Discovery			
Functions	❑ Agents ❑ Clustering ❑ Data Mining ❑ Text Mining		What functions are used in order to discover knowledge?
Discovery Data	❑ Numeric ❑ Structured Text ❑ Unstructured Text	❑ Audio ❑ Visual ❑ Graphics	Is knowledge discovery based on particular type of data?
Output	❑ Patterns ❑ Rules		In what format(s) is the discovered knowledge displayed?

Knowledge Retrieval			
Functions	❑ Natural Language Processing ❑ Meta Data Management ❑ Application Integration ❑ Full Text Search ❑ Image/Video Search ❑ Structured Search ❑ Unstructured Search		What functions are used in order to retrieve knowledge?
Database Querying	❑ Yes ❑ No		Can database queries be used to locate knowledge?
Browsing	❑ Yes ❑ No		Does the tool provide a browsing facility?
Similar Documents	❑ Yes ❑ No		Does the tool suggest others documents that may be relevant?
Ease of Search	❑ Yes ❑ No		Is it easy to search for what you want?
Results of Search	❑ Yes ❑ No		Are the results of the search as you expected?
Criteria for Knowledge Organisation Tools			
General			
Organisation	❑ Storage ❑ Monitor		What aspect(s) of knowledge organisation does the tool facilitate?
Knowledge Storage			
Functions	❑ Manual Categorisation ❑ Automatic Categorisation ❑ Document Management ❑ Visualisation ❑ Central Interface		What functions are used in order to store knowledge?
Display Format	❑ Text ❑ Graph ❑ Table	❑ Database ❑ Graphic	In what format(s) can the knowledge repository be displayed?
Import Facility	❑ Yes ❑ No		Is it possible to import an already existing knowledge repository?
Import Formats	❑ Text Files ❑ MS Access ❑ MS Excel ❑ Dbase ❑ Fox Pro	❑ Paradox ❑ Lotus 1-2-3 ❑ HTML ❑ ODBC ❑ Other Details.....	If an import facility is provided what formats can data be imported in?
Creation of Repository	❑ Yes ❑ No		Can the knowledge repository be created from within the tool?
Optimised Storage	❑ Yes ❑ No		Does the tool store data in an optimised manner?
Size of Repository	❑ Yes ❑ No	Size:.....	Is there a limit to the size of the knowledge repository?
Cost	❑ Yes ❑ No		Is cost dependent on the size of the knowledge repository?
Task Logging	❑ Yes ❑ No		Does the tool facilitate the storage of tasks currently being carried out?
Task Knowledge Base	❑ Yes ❑ No		Does the tool facilitate the storage of details of previous tasks?
Update	❑ Yes ❑ No		Is the tool easy to update and add information to?
File Management	❑ Yes ❑ No		Is it easy to manage files within the knowledge repository?

Directory Structure	❑ Yes ❑ No	Is a directory structure used to organise content of repository?
Knowledge Monitoring		
Functions	❑ Channels ❑ Notification	What functions are used in order to monitor knowledge?
Tracking	❑ Yes ❑ No	Is it possible to perform tracking?
Automatic Progress Report	❑ Yes ❑ No	Does the tool automatically inform on progress of a task?
User Navigation	❑ Yes ❑ No	Is it possible to track a user's navigation through a website?
Criteria for Knowledge Sharing Tools		
General		
Sharing	❑ Collaboration ❑ Transfer	What aspect(s) of knowledge sharing does the tool facilitate?
Knowledge Collaboration		
Functions	❑ Communities ❑ Virtual Teams ❑ Conferencing ❑ Chat ❑ Bulleting Board ❑ Whiteboard ❑ Messaging	What functions are used in order to support knowledge collaboration?
Records	❑ Yes ❑ No	Are records of collaborative work automatically created?
Quality of Collaboration	❑ Bad ❑ Medium ❑ Low ❑ High	How would you rate the quality of the collaborative environment?
Video Conferencing	❑ Yes Details: ..... ❑ No	Can more than two people participate in video conferencing?
Knowledge Transfer		
Functions	❑ Application Sharing ❑ File Transfer	What functions are used in order to transfer knowledge?
Upload Facility	❑ Yes ❑ No	Does the tool provide an upload facility?
Download Facility	❑ Yes ❑ No	Does the tool provide a download facility?
Knowledge Sharing	❑ Yes ❑ No	Does the tool allow knowledge to be shared easily?