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ON..... 9 October 2002

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Knowledge management in evidence based practice: study of a community of practice

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Addendum

1.10 Outline of thesis

This thesis consists of ten chapters; a brief description of these is as follows:

Chapter 1 outline the research questions and the theoretical stance taken in relation to the research questions. The main concepts discussed and researched in the thesis, knowledge management, knowledge work, knowledge management systems are defined. Evidence-based practice (EBP) is a way of informing health care decision-making is outlined, and how knowledge management can be linked to it. A historical explanation of how knowledge work compares with information work in the context of health care is given to highlight this as a new area of research and an original contribution to knowledge.

Chapter 2 provides a review of the literature in relation to action research, locating it within the context of information systems research. Through this I describe the range of research methodologies that can be used within research, from a philosophical stance, an interpretive approach is taken. Action research is one framework for interpretive enquiry and is used to reflect the participant's world views and why

Chapter 3 Discusses the specific research approach used in relation to this research project. This includes a description methods and techniques used to investigate the research questions, and an overview of how data analysis is tackled in the research. To underpin this the chapter outlines action research cycles, giving a broad outline of the steps taken during the research, providing the context, flow and course that the research took. By explicitly mapping action research cycles I aim to clarify how a range data collection and analysis approaches can be used within the one project. This reflects the complexity of researching knowledge management within the context of EBP. In addressing these complexities the research uses multiple cycles of action research to explore the differing perspectives of stakeholders in looking at KM issues.

Chapter 4 provides a background to the researcher's worldview, their standing with action research and the impetus for carrying out the research. In this first action research cycle, I describe the basis for exploring the research situation and data collection. This chapter provides a background to the research, to me, the researcher and to some initial questions that created the impetus for carrying out this research. A rich description of background and worldview adds context and meaning to the research emphasizing the need for an interpretive approach. Findings from this initial cycle are that the knowledge of the researcher within action research and understanding of the environment creates a useful background where questions are raised about the current state of the EBP field. This sets the scene for future cycles and action planning within the research context.

Chapter 5 is a description of the community of practice, the role of the intermediary, and an introduction to knowledge management issues. An exploration the individual's perspective on knowledge innovation and knowledge management sharing are made while working within the community of practice. By this stage I had a good understanding of KM, and how

the research might progress using an action research approach. Data collected in this initial phase is used to explore these concepts through interviews and diaries. Findings from the data collected are fed back to participants for validation, clarification and further discussion. This was conducted through a group interview, which was semi-structured in order to develop the contribution of new ideas around knowledge management. Findings from this cycle were that the participants had a broad set of problems relating to their own understanding of their role, to knowledge work and to knowledge innovation. Through this cycle I saw the emergence of knowledge storage and sharing as major issues, stifled and constrained by organisational culture and support.

Chapter 6 describes an analysis of the community of practice in order to understand their work as purposeful human activity. The richness and complexity of the EBP environment creates a backdrop to this activity. Part of understanding what was happening was to carry out systems analysis of the community of practice. Through using SSM (soft systems analysis), a rich picture is used as a way of explaining graphically what takes place when a health practitioner interacts with an intermediary in order to find evidence about effective health care. This work lays the foundation for the next cycle where there is an integration of conceptual modelling and knowledge management, illustrating knowledge sharing within the community of practice.

Chapter 7 seeks external validation of concepts and models of knowledge management. To explore this I sought peers working in the same area that could understand the conceptualisation of KM in EBP. To achieve this I took the project to an international conference, using this as an opportunity for external validation of rich pictures and models, and giving experts in the area the opportunity to add their perspective to the research situation. This cycle builds on the SSM activities in cycle three, creating a second iteration of SSM linking the initial conceptual model of activities to knowledge sharing and innovation. This culminates in the development of another CATWOE, root definition and conceptual model for KM within the community of practice.

Chapter 8 explores the role of intermediaries through the end users' perspective. While external validation had taken place, this had been mainly achieved through similar individuals as those within the community of practice. By finding end users of the unit I wanted to gain a different perspective and insight into what intermediaries contribute to their decision-making. Looking beyond the small community of practice, to the wider environment added greater depth in understanding the issues and challenges faced when working within a large and complex organisation. Data from health care practitioners was collected through text analysis of questionnaire feedback and through semi-structured interviews with a representative group of health practitioners. The outcome was mixed, their views of intermediaries differed, although there was convergence on many themes, including the view of an intermediary being an methodological expert and of saving the precious time that practitioners had.

Chapter 9 describes the development of knowledge management systems selection through the development of selection criteria for the community of practice. Developing these is set against an organisational understanding and articulated need for some specific IT in helping

facilitate KM processes. Conceptual modelling from chapter 7 creates a useful understanding of the KM steps that must be supported through the selection of any KMS. Rather than being the sole solution this is only one strand of a wider problem-solving strategy. The aim of this cycle is to discuss issues concerned with selecting such a system to support intermediaries. SISTeM (Cycle 1) is used as a problem-solving approach within an action research framework to analyse KMS issues, human computer interaction and developing criteria for selecting a system.

Finally, Chapter 10 provides a summary discussion on the findings in relation to the research questions with a discussion of proposed future research that can follow this specific research. This chapter brings together information generated from the analysis of six action research cycles. Strands and themes that emerged are tied to the research questions defining which ones have contributed to new knowledge. This includes:

- the development of a conceptual model of knowledge management for intermediaries
- identifying the role of intermediaries in knowledge management for EBP
- development of knowledge innovation and sharing activities and KMS selection criteria for the community of practice
- methodological extensions to the study of knowledge management focusing on social, political and cultural factors and the social construction of problems and solutions
- a new approach to applying action research

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Abstract

This research explored issues of knowledge management and the role of intermediaries within a small community of practice. The community is a group of knowledge workers who answer questions of clinical effectiveness on behalf of health care practitioners within a network of metropolitan hospitals. The theme under investigation was knowledge management within the context of evidence based health care information provision.

Action research was used to explore three research questions:

- In what ways are knowledge management processes of identification, collection, storage, sharing and dissemination, access, use and exploitation manifested in the community of practice?
- What is the role of the intermediary in providing knowledge for health care decision making?
- Can a knowledge management system be identified that will match the requirements of the intermediaries within the project?

Six action research cycles were carried out utilising a range of data collection and analysis approaches. Action research within this project was applied in a new way. Each cycle explored different participant viewpoints relating to the research. The personal experiences of the researcher were compared and triangulated with these. Within this project both improvement in practice and theory generation were sought. The issues investigated were multifaceted and have brought together a variety of 'worldviews' about the research environment and the role of intermediaries.

This research explored indepth issues of culture, politics and perception that are important in interpreting what is happening in terms of knowledge management before technological solutions are introduced into organisations. Issues identified were verified and confirmed by research participants and professionals acting as peers who worked in the area of evidence based practice.

Key findings were: a) that knowledge management concepts are relevant and applicable to this community b) that selecting KM systems to support their work is nevertheless a complex process and c) that the role of the intermediary as an 'expert' in issues of research methodology and searching saves the health practitioner time and the organisation scarce resources in training all end users to carry out sophisticated and demanding knowledge work.

Papers published from this research

Fennessy, G. (2002,). *Understanding and selecting knowledge management systems for a health information provider*. Proceedings of the 34th Hawaii International Conference on System Sciences HICSS, 2-5th January 2002, Big Island, Hawaii.

Fennessy, G. (2002 In press). *Collaboration in information seeking: a case of knowledge work in evidence based health care*. Proceedings of the International Systems Design ISD 2001, Wednesday 5th - Friday 7th September 2001, Royal Holloway University of London.

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Papers presented from this research

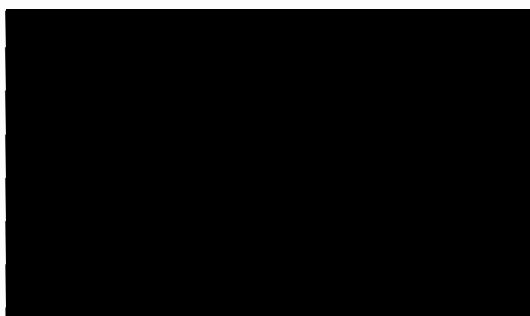
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Fennessy, G. (2000). *Evolution of the knowledge worker in evidence based health care*. Paper presented at the International Congress of Medical Librarianship, 2-5 July 2000, London, UK.

Fennessy, G. (2000). *Developing a model for knowledge management within the context of evidence based health care*. Paper presented at the SHIMR 2000 Fifth International Symposium on Health Information Management Research 12-13 June 2000, Sheffield, UK.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other institution and affirms that to the best of my knowledge, the thesis contains no material previously published or written by another person, except where due reference is made in the text of thesis.



Gabrielle Ann Fennessy
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Chapter 1

1. Introduction

This chapter introduces the main concepts discussed and researched in the thesis. Knowledge management, knowledge work, knowledge management systems are defined. Evidence-based practice (EBP) is a way of informing health care decision-making is outlined, and how knowledge management can be linked to it. A historical explanation of how knowledge work compares with information work in the context of health care is given to highlight this as a new area of research and an original contribution to knowledge.

1.1 Knowledge management

Knowledge management (KM) has been defined in many ways, some definitions focus on information technology and some on the culture of the organisation. Perhaps before defining 'knowledge management' it is useful to define 'knowledge'. Rather than entering a philosophical discussion about the difference between data, information and knowledge, I have taken the definition of knowledge from Polanyi (1966) who distinguishes between tacit and explicit knowledge. Within this definition, 'explicit' knowledge is that which is captured and codified, 'tacit' knowledge is that which cannot be articulated easily and therefore only exists in people's heads, manifested through their actions.

So what is it to 'manage' knowledge? Many definitions revolve around formal activities, although Nonaka & Takeuchi (1995) define informal mechanisms and unstructured systems such as open meetings and free access to information as appropriate knowledge management endeavours.

Davenport and Prusak (1998) state that, "knowledge management" implies formalised transfer, one of its essential elements is developing specific strategies to encourage such spontaneous exchanges" (p. 89).

Management of knowledge will generally aim to "build and exploit intellectual capital effectively and gainfully" (Wiig, 1999 p. 3.3). Making sense of what specific activities are considered to be knowledge management activities is vague in the literature. There has been a range of approaches to explaining or conceptualising KM, the range of frameworks and ways of conceptualising the KM phenomenon (Leonard-Barton, 1995; Van der Spek & Spijkevert, 1997; Wiig, 1993).

Good quality overviews are available within the field (Holsapple & Joshi, 1999a), although the findings from such reviews conclude that each framework covers many aspects of KM, and are different ways of saying many of the same things. As there are so many frameworks and models to choose from, for the purposes of this research I have used Skyrme's (Skyrme, 1999) conceptualisation of KM. This is simple to understand and represents KM in two different ways, one cycle of knowledge innovation and another of knowledge sharing. These two cycles operate together and simultaneously within an environment that is knowledge rich. It is represented in figure 1.

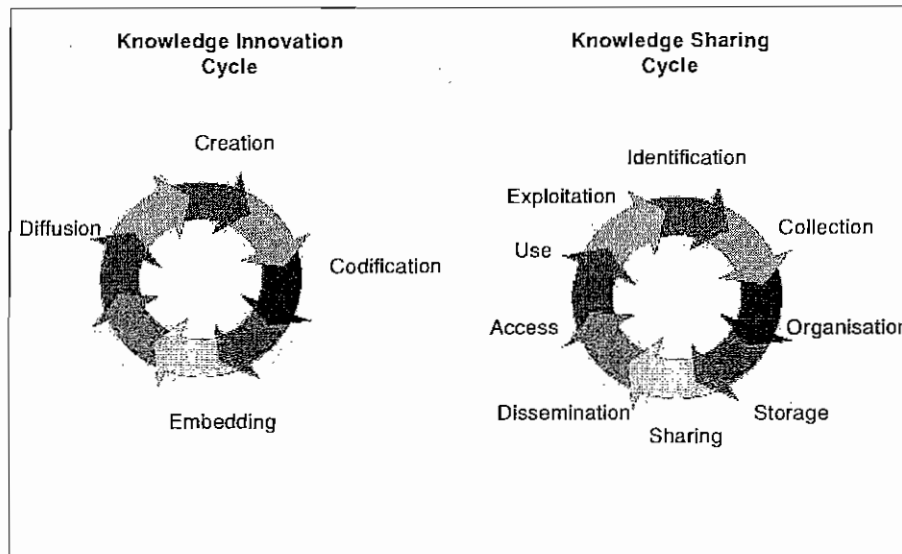


Figure 1 Skyrme's knowledge innovation and sharing cycle

These cycles are used throughout the research as a way of conceptualising and understanding KM issues.

1.2 Evidence-based health care

Managing knowledge to support decision-making in health care is one of the main tenets of evidence-based health care or evidence-based practice (EBP) in health care. This can be defined as

“the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research” (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996, p. 71).

This inclusive definition covers all areas of health care, not just medicine, including nursing, allied health, and the management of health services. Knowledge contributing to health care decision-making is complex. While both tacit and explicit in nature, the concept of knowledge and how it is updated and shared with health practitioners can mean that no health practitioner is completely up to date with innovation, and changes in health practice. It would also be unreasonable to expect health practitioners to retain knowledge about all health problems, interventions and diagnosis, especially when less routine work does not present often. The complexity of current health knowledge and the amount of new information available to health practitioners can be overwhelming. The current situation of drowning in information but thirsting for knowledge has created a move towards filtering out the irrelevant, and communicating the important and relevant. EBP is one way of helping practitioners distil this information overload and turn it into useable knowledge.

There are several steps in being evidence-based, including:

- asking an answerable question
- searching for the evidence

- appraising what is found
- deciding if it is relevant to the local health care situation
- applying it and implementing the evidence into practice
- evaluating the situation to see if there has been a change and improvement

Each of these steps takes a range of special skills, intellectual input and understanding of the local health care situation and also of research methodologies and sources of information.

EBP can be seen as a way of helping practitioners to update their knowledge, to reflect on current knowledge that is being translated into health care practice, and to challenge others with the idea that health care should be based on up-to-date knowledge rather than ritual.

1.3 Knowledge work

The environment in which EBP takes place is the antithesis of knowledge work within a health care context. Health practitioners act as knowledge workers, making sense of information, turning it into knowledge and applying it to clinical practice.

Knowledge work has been described by Drucker (1993) as nonrepetitive, nonroutine work that entails substantial levels of cognitive activity. It includes professional and specialist work. Knowledge workers must acquire and use theoretical and analytical knowledge in highly sophisticated ways as well as to develop significant physical manual skills (Drucker, 1992).

We can usefully apply the label of knowledge worker to health care professionals; they bring unique knowledge that is essential to carry out health care. Knowledge work, however, has its problems in health care; practitioners' lack of skills, time and understanding of what to look for when making decisions hamper the effective utilisation of resources for decision-making (Davidoff & Florance, 2000).

This in turn means that health practitioners may be unable to carry out their role of knowledge work. Because of this, a range of support workers has emerged, acting as intermediaries in the evidence-based process. This includes the intermediary acting as knowledge seeker. Intermediaries have been described in the decision support literature as

“a person who helps the users, perhaps merely as a clerical assistant...or perhaps as a more substantial staff assistant, to interact and make suggestions. Role assignment depends on the following factors: the nature of the problem, particularly how narrow or broad; the nature of the person, particularly how comfortable he or she is with the computer, language and concepts; and the strength of the technology, particularly how user oriented it is” (Sprague & Carlson, 1982).

Knowledge workers within the context of EBP have their own body of knowledge, which has not been researched previously. Much of this relates to an understanding of:

- research methodology
- sources of information
- issues of validity and rigour
- credibility of information resources

- searching methods and techniques for retrieval

Part of this research is to investigate this role and see what input these knowledge workers have in EBP.

1.4 Knowledge workers versus information providers

The role carried out by knowledge workers or intermediaries differs in many ways from traditional information or library work. With intermediaries there is an emphasis on working within the organisation rather than acting as a source of information on external sources and passive dissemination. Much health librarianship work focuses on information seeking which has a range of characteristics described by Ellis (1989) as starting, chaining, browsing, differentiating, monitoring, extracting, verifying, and ending. This has also been developed into a general model of what might be called "information behaviour" including concepts of information need, information seeking, information exchange, and information use (Wilson, 1981). These components add up to fulfil some of the needs of health care practitioners, but often fail to add substantially to their body of knowledge as interpretation, appraisal and validation have not taken place. Despite this perceived lack of adding value, the contribution of health librarianship to the rise of EBP cannot be underestimated. This includes projects such as the National Library of Medicine's Medline, which has transformed the environment in which knowledge workers find themselves. Resources such as Medline have created a springboard for knowledge workers, to progress and enhance their work with tools that would once have left them wading through print indexes, these can now be accessed in a virtual environment.

By contrast the role of knowledge worker demands that workers utilise their 'know-how', requiring interpretation and presentation of what has been digested and its application to the clinical area. In practical terms, knowledge workers are adding to knowledge that can be assumed to increase the capacity for action (Stehr, 1992).

Traditional librarians have been responsible for text-based sources and external sources of information. Knowledge workers within the context of health care decision-making 'need to transcend tribal boundaries' (Urquhart, 1998), perhaps something that has not been done to any great success by health librarians. Even where this has been the case, such as the clinical librarian project (Lamb, 1982) the function of such a role has been confined to formulating questions and literature searching.

Information management has been concerned with dissemination of information rather than transformation into knowledge with the application of personal tacit knowledge. This differs from traditional information workers in a range of ways. Intermediaries place their own interpretation and tacit knowledge on top of the questions being asked of them by health practitioners. Their worldview will differ from that of the practitioner, but will include knowledge and understanding of the context of health care delivery and the role in decision-making that health practitioners play. This understanding of context creates added value, which is perhaps not required by health librarians working in traditional roles.

1.5 Intermediaries

The concept of 'intermediaries' can be compared to those of a "chauffeur-decision-maker" (Ahituv & Getz, 1986), "a person who helps the users, perhaps merely as a clerical assistant, to push the buttons of the terminal, or perhaps as a more substantial staff assistant, to interact and make suggestions" (Sprague & Carlson, 1982). This is often designed to meet busy work requirements of chief executive officers, however advances in decision support technologies are often driven by the aim of making decision support systems more accessible and usable to the immediate decision-makers. The field of EBP shows that the role of intermediaries may be needed regardless of the progress of technical systems.

1.6 Communities of practice

Within this study, the group of research participants that I worked with was based within a community of practice. Communities of practice are

"groups that emerge around a discipline or problem: a work related subject... they are defined by the subject that engages them, not by project, rank, department or even corporate affiliation. They are where learning and innovation occur... learning is social, we have learned. Managers who focus on communities and teams can improve performance... bosses used to try to break up the gang by the water cooler. Now they support them with web sites" (Stewart, 2001).

Like the community described in this definition, the intermediaries described in this research are defined by their department and physical location. All of them worked in the same department in the same health care organisation, in close proximity with regular face-to-face interaction.

1.7 Knowledge management systems

Knowledge management systems (KMS) are tools to effect the management of knowledge and are manifested in a variety of implementations (Davenport, De Long, & Beer, 1998). Alavi and Leidner (1999) describe these as

"Target (ing) professional and managerial activities by focusing on creating, gathering, organizing, and disseminating an organization's 'knowledge' as opposed to 'information' or 'data'" (p. 1).

While these are adequate explanations for a KMS, a more holistic approach would be to describe a KMS as "the intersection of business practice, organisational culture, and technology" (Frappaolo & Capshaw, 1999). The ultimate aim of the KMS is to provide necessary knowledge to support decision-making. This includes the people and processes involved in the systems. In many knowledge management contexts, these understandings and definitions are used interchangeably, for the purposes of this thesis the second broader definition will be used.

1.8 Research scope

The objective of this research was to make a methodological and theoretical contribution to understanding knowledge work and management within the context of EBP, and the role that intermediaries had to play in decision-making. This was done through exploring the nature of knowledge management within a group of intermediaries in EBP, describing their role and whether a KMS could be selected for them.

1.8.1 Choice of research topics

Before carrying out this research I had worked in a range of information management roles within health care organisations, the research questions arose from the idea of the 'chief knowledge officer' as proposed by Muir Gray (1998). He contended that there was a need for such a role within the scope of managing knowledge within the health care sector. My interpretation of this idea and the thrust of Muir Gray's argument is, that there is a major role for knowledge management in an environment that is suffering from 'information overload', where streamlining processes could make the life of the health care practitioner easier. To date there has been little exploration or discussion of such ideas, part of the challenge of Muir Gray's work therefore is to further explore the idea of knowledge management and what components of this concepts can be applied to health care

From this central concept, I wanted to test whether a chief knowledge officer acting as an intermediary was useful and relevant to scope of practice I had experience in. Muir Gray's background and interest fell into the same area as mine, the field of evidence based practice. This approach to decision making is knowledge rich and knowledge intensive process, and in fact creates its own niche or discrete field in health care, that would help define the scope of the research covered in this research. Tackling knowledge management as applied to the whole of health care was a daunting and potentially impossible task, so that refining the questions to EBP, made the task more realistic.

More information about my experience and worldview that brought me to selecting the topics of EBP, KM and intermediaries is explored in chapter 4. There I highlight that my experience of knowledge management in EBP was mixed, sometimes negative, I questioned the use or misuse of this term, and wanted to demonstrate that an in-depth understanding of the concept as applied to EBP could be done in a systematic way.

Research in the area of knowledge management has so far been criticised for lacking empirical evidence to support proposed theories, being localised and difficult to generalise, and for being too strongly linked to specific technologies (de Hoog et al., 1999). This research aims to provide some empirical data to support the development of theory behind knowledge management and to avoid concentrating on specific solutions that are based on technology.

Ideas of knowledge management while not being new, often focus on the end user or main beneficiary. This study aims to look at the intermediary as the main focus for study. Knowledge work and management applied to health care is not new either (Sorrells-Jones & Weaver, 1999), what is novel about this research, is looking at knowledge work and management as applied to the paradigm of EBP, which is more specific than that of KM in general health care.

The EBP movement has been geared towards end users doing searching, appraising and assimilation of knowledge themselves (Ghali et al., 2000; Grimes, 1995). This research

looks at intermediaries as an alternative way for developing knowledge in the area and poses the question:

In what ways are knowledge management processes of identification, collection, storage, sharing and dissemination, access, use and exploitation manifested in the community of practice?

By asking this question I explored whether all of these steps in the knowledge sharing cycle were present within the community of practice. If they were present to what how are they being performed and what is the impact of such performance. Through articulating and understanding these parts of KM within the research, I as researcher and the research participants can evaluate the current state of knowledge management. This will help us gaps in current activities and what types of improvement could be made to move the participants into a more effective state of managing their knowledge work. The scope of this research concentrated on knowledge management within the context of this specific community of practice, rather than the wider organisation. Once identified, the ways of investigating the following question could be raised:

What is the role of the intermediary in providing knowledge for health care decision-making?

The aim of this question was to tease out whether the intermediary had a role in contributing to health care practitioner or the organisational decision-making. By exploring this question I aimed to find out whether they had an impact on decision-making through knowledge creation and sharing, and whether health practitioners recognised this contribution. Part of this question was to understand the relationship between the intermediary and evidence, how intermediaries approached the incredibly wide range of resources, made sense of them and interpreted them to give an answer to the end user. The relationship with health care practitioners was also explored to understand whether interpretation, feedback and understanding of the organisational context were important in turning information needs into explicit questions that could be answered by searching and appraising a wide range of sources.

Operating in a knowledge management context created the potential for using systems that could help in improving the effectiveness and delivery of knowledge management initiatives. Before embarking on this research I had seen many KM systems demonstrated, but did not have the requisite knowledge or criteria to judge such systems. The KM environment has been dominated by the use of IT as an approach to problem solving, so that I wanted to explore which knowledge needs or parts of the KM process such systems addressed. Despite the publicity and literature generated about KM systems, I wanted to explore whether this was a discrete part of the KM picture or overriding driver to successful KM. This helped in developing the following question:

How can a knowledge management system be identified that will match the requirements of the intermediaries within the project?

From the literature, there were many broad statements about the potential and use of KM systems. Despite these broad statements, the choice of the right technology is commonly recognised as a nontrivial stage of building a true knowledge management system (Frappaolo & Capshaw, 1999).

If this was nontrivial, it was difficult to understand how an organisation could make the leap between product information and system selection. This question aimed to address the challenge of selecting a system that was appropriate and useful to the community of

practice being researched. The choice depended on a number of factors, such as complexity of knowledge to be manipulated, a level of flexibility required from communication, and the level of technical competence of the users. Any such technology would need to fit into organisational structures. These factors relate to the issues of business practice and organisational culture

In understanding these requirements, the participants and I could clarify our understanding of KM systems before making costly decisions about technology. Beyond understanding requirements was an implicit need to understand the context into which one brings such technology and what climate is conducive to introduction of a system.

Findings from the research created new knowledge in the area

1. development of conceptual model of knowledge management for intermediaries
2. identifying the role of intermediaries in knowledge management for EBP
3. development of KM processes and KMS selection criteria
4. methodological extensions to the study of knowledge management focusing on social, political and cultural factors and the social construction of problems and solutions

1.8.2 Theoretical stance

Central to most research is the development or testing of theory (Popper, 1959). Theory serves two purposes; one purpose is to act as a source of guidance on how to develop multiple data sets by helping the researcher focus on types of data needed. The second is as a way of different types of data sets by providing common concepts that help structure data collection efforts (Sawyer, 2001). The following describes and sets the scene for theory development, and acts as a way of uniting both the research questions outlined above and the many data sets generated through the action research cycles.

The questions raised for this research come from a theoretical stance that recognises the role and opportunities that KM presents to the organisation (Liebowitz & Beckman, 1998). This stance supposes that people are willing participants in knowledge creation and each have a unique contribution to make to organisational knowledge and memory. It also supposes that most individuals work as part of a team that works towards the achievement of organisational goals. Personal and professional experiences are crucial factors in collaboration and the way in which individuals contribute to the organisational goals. Consequently, participants in KM need to be engaged and encouraged to share their knowledge and populate KM initiatives, this needs to be done in a range of ways and cannot rely on passive use of systems and technology.

Using a holistic view, KM includes more than technology in facilitating knowledge sharing. People, context and culture are the underpinning causes of KM success or failure. The above assumptions arise from the fact that successful KM is the interplay between different parts of the knowledge sharing cycle, where the relationship between individuals, the organisation, culture, context and technology must all be considered. To facilitate this understanding a range of tools for systems thinking can be used (Checkland, 1981). Such tools are used at several points throughout the research to illustrate the complex interplay between processes and KM within the community of practice. Using systems thinking also tackles the perception of a lack of overarching strategy or frameworks in organisations that provides a sense of direction when researching or discussing KM (Tsoukas, 1996).

This theoretical stance has been developed through extensive research of the KM literature, and through my own knowledge and observation of KM in practice. The connection between an interpretive approach to knowledge and the ways in which organisations use such knowledge has been under explored. This research demonstrates that the theoretical stance outlined can be used to articulate the application of KM within an organisation and that the three research questions can be used to test specific constructs of this theory. This exploration is congruent with an interpretive approach where the individual constructs their own meaning of the world and their contribution to that world. This epistemology is further discussed in section 2.3.

1.9 Overview of thesis

This thesis is structured in three parts

1. part one locates the work in its research tradition, formulates the research problem and objectives, discusses the research approaches available in the field and justifies the research design.
2. part two describes the process of investigation, and answering the research questions through action research. To reflect this cyclical process, there are six separate cycles; each represented by a separate chapter (chp. 4-9). This includes data analysis and meeting the objectives set out at the beginning of each chapter.
3. part three includes a discussion of all the cycles brought together through the research questions. This part looks at implications of the research and new contributions to knowledge.

The structure of the thesis is given in figure 2.

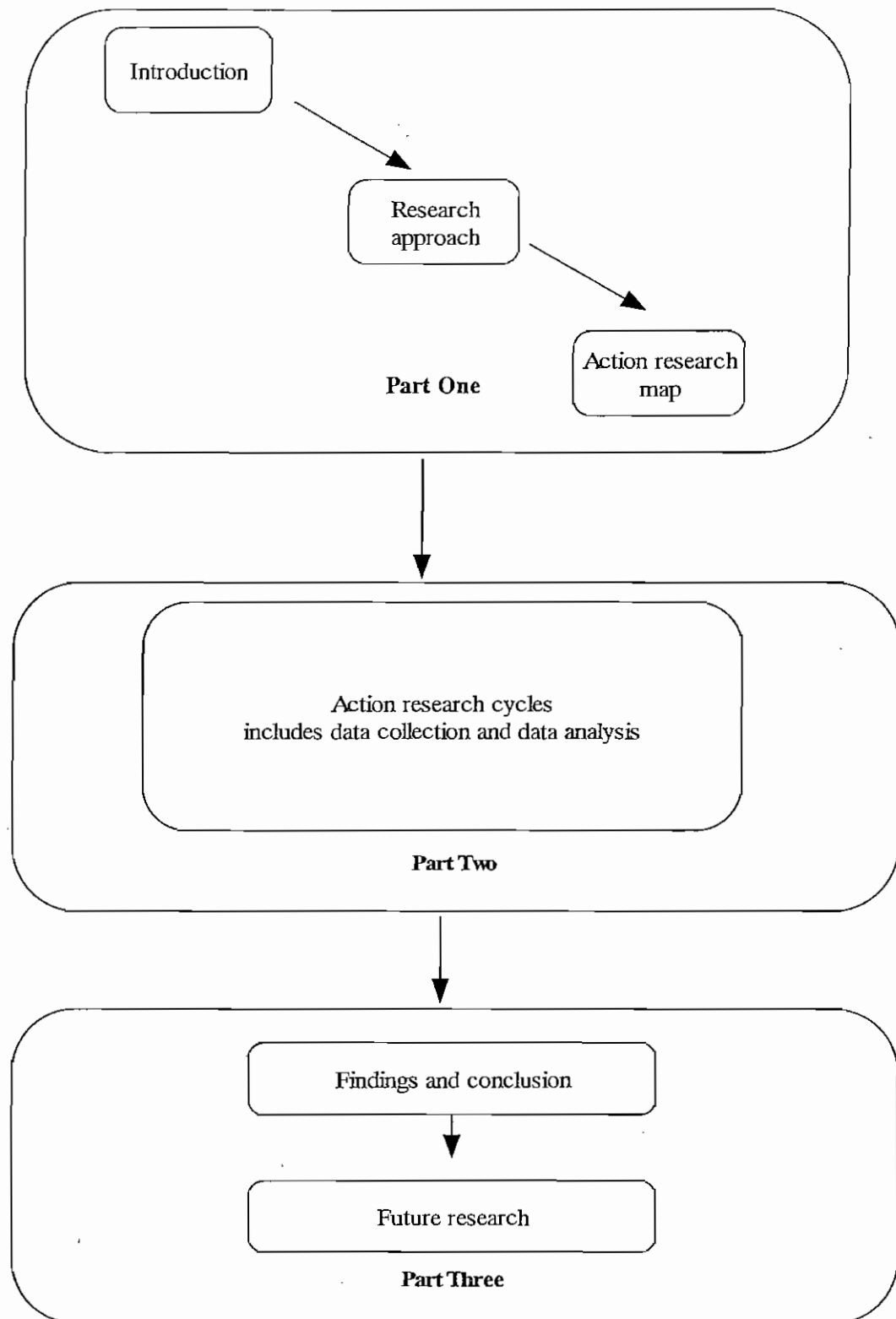


Figure 2 Diagrammatic representation of thesis structure

1.10 Outline of thesis

This thesis consists of ten chapters; a brief description of these is as follows:

Chapter 2 provides a review of the literature in relation to action research, locating it within the context of information systems research.

Chapter 3 Discusses the specific research approach used in relation to this research project. This includes a description methods and techniques used to investigate the research questions, and an overview of how data analysis is tackled in the research.

Chapter 4 provides a background to the researcher's worldview, their standing with action research and the impetus for carrying out the research.

Chapter 5 is a description of the community of practice, the role of the intermediary, and an introduction to the knowledge management problems

Chapter 6 describes an analysis of the community of practice in order understand their work as purposeful human activity

Chapter 7 seeks external validation of concepts and models of knowledge management

Chapter 8 explores the role of intermediaries through the end users' perspective

Chapter 9 describes the development of knowledge management systems selection through the development of selection criteria for the community of practice

Finally, Chapter 10 provides a summary discussion on the findings in relation to the research questions with a discussion of proposed future research that can follow this specific research.

Chapter 2

2. Research methodology

In this chapter I will describe the research methodology used to investigate the research objectives. Within the field of information systems (IS) there are a number of legitimate research approaches. In ontological and epistemological terms, a broad variety of assumptions are accepted, ranging from positivist to interpretivist positions. I justify this research as interpretivist within this chapter.

This research focuses on the social aspects of knowledge management, where values, beliefs and social construction of meaning are the focus, so that the research adopts an interpretivist approach. This choice is consistent with the theoretical focus of interpretive research and the research framework of action research and is mirrored in the data collection methods used.

The research design is as follows: an action research project in knowledge management in a health information provider is conducted using a range of qualitative research techniques. Analysis of the data leads to theoretical development focussing on knowledge management and the role of intermediaries.

Action research was chosen as an overarching framework. Within this there was a range of cycles exploring knowledge management within the community of practice, looking at the problem through different lenses and using key stakeholders to investigate the research questions. Within each action research cycle a range of data collection techniques were used. Those chosen reflect the complexities and challenges of working within an interpretive paradigm. A description of action research cycles and the role of the researcher is provided in greater depth in the next chapter.

2.1 Methodology, methods or techniques?

Before starting on an explanation of methodology and techniques, it is useful to define these terms. Within qualitative research there are a range of interconnected activities, where often terms are used interchangeably, "including theory, method, analysis, and ontology, epistemology and methodology" (Denzin & Lincoln, 1994b, p. 11). Strauss and Corbin (1990) define the difference as methodology being "a way of thinking about and studying social reality". Methods are defined as a set of procedures and techniques for gathering and analyzing data" (p. 3). These practices "produce empirical materials as well as theoretical interpretations of the world" (Denzin & Lincoln, 1994a, p. 353).

Within the context of this thesis, I use the term methodology to define the overall strategy for inquiry, a road map showing me how to approach the research area. I have used the term 'techniques' to refer to specific data collection techniques along the way. I have used this term to differentiate them from the methodology. Methodology is sometimes used interchangeably with methods, which is sometimes another word for techniques.

2.3 Philosophical stance

The definition of ontology is the 'science or study of being', for the purposes of this thesis ontology refers to the assumptions that an approach to social inquiry makes about the nature of social reality (Blaikie, 1993).

Within research there are a range of perspectives about the ways to study the world and assumptions attached to what reflects reality. A short explanation of these perspectives creates a background against which I set my own stance and choice of ontology. Describing choice and perspective is supported by Clark (1975), who states

"the personality of the researcher helps to determine his or her selection of topics, his or her intellectual approach and his or her ability in the field" (p. 104).

The ontological question can be posed as "what is the form and nature of reality, and therefore, what is there that can be known about?" (Guba & Lincoln, 1994, p. 108).

I believe that realities can take multiple forms that are socially and experientially based. My background of health information and knowledge work influences the course and nature of this research. I have worked in the field for nearly ten years, both in hospital and research settings. During my career I have developed and refined my ideas about knowledge work, knowledge management and the role of intermediaries within a health context. Initially I started from a position of thinking that there were defined and specific roles between developing knowledge and using information. I have gone through a process of reassessing my ideas. My current beliefs could be described as constructivist relativism, where those working in health construct their own individual understandings of knowledge about health and the work they do; that environment factors play a part in how they see their roles in relation to information seeking and knowledge creation. Within the health context, there are "sometimes conflicting social realities that are the products of human intellects, but that may change as their constructors become more informed and sophisticated" (Guba & Lincoln, 1994, p. 108).

Beliefs about ontology, or what is the nature of reality, need to be set against those of epistemology, "what is the relationship between the inquirer and known?" (Denzin & Lincoln, 1994b, p. 13) "The answer to this question is constrained by answers to the ontological question; that is, not just any relationship can now be postulated" (Guba & Lincoln, 1994, p. 108). An overview of different basic beliefs of inquiry paradigms is useful in setting the scene for this research.

The use of positivism encompasses both the positivist and postpositivist approach. These two research perspectives provide specific contentions concerning reality and its perception. "In the positivist version it is contended that there is a reality out there to be studied, captured and understood, whereas postpositivists argue that reality can never be fully apprehended, only approximately" (Guba, 1990, p. 22).

In contrast to this way of discovering 'reality', the constructivists and interpretivists understand the world of meaning as one that must be interpreted. "The enquirer must elucidate the process of meaning construction and clarify what and how meanings are embodied in the language and actions of social actors" (Schwandt, 1994, p. 118).

Interpretivism has its origins in hermeneutics and phenomenology, here the central tenet is one of studying social phenomena. This requires an understanding of the social world that people construct. The behaviour of people depends on the way they interpret the

conditions in which they find themselves. Social reality therefore may be interpreted in different ways. Giddens (1974) describes this reality as "produced by its component actors precisely in terms of their active constitution and reconstitution of frames of meaning whereby they organise their experiences" (p. 79).

This knowledge can be gained from following the hermeneutic circle (Gadamer, 1975). Susman (1983) describes this as a circle of interpretation, while

"attempting an initially holistic understanding of a social system and then using this understanding as a basis for interpreting the parts of the system" (p. 99).

The philosophy of interpretivist research can be linked to method.

"Interpretive methods of research start from the position of our knowledge of reality, including the domain of human action, is a social construction by human actors and this applies equally to researchers. Thus there is no objective reality which can be discovered by researchers and replicated by others in contrast to the assumptions of positivist science. Our theories concerning reality are ways of making sense of the world and shared meanings are a form of intersubjectivity rather than objectivity" (Walsham, 1993, p. 5).

From this epistemology, knowledge is derived from everyday concepts and meanings. As a researcher I immerse myself in the social world in order to make sense of socially constructed meaning. My background in the area of knowledge management and EBP help to play a role that Giddens (1976) described as one where

"the social scientist of necessity draws upon the same sorts of skills as those whose conduct he seeks to analyse in order to describe it" (p. 155).

One is able to bring these together in the "net that contains the researchers epistemological, ontological and methodological premises may be termed a paradigm" (Guba, 1990, p. 18), this is also a "basic set of beliefs that guides action" (Guba, 1990, p. 17). The specific research approach and action are described in the following chapter.

2.4 Research approaches for IS

The field of knowledge management covers a broad range of reference disciplines, from human resources, to management, to information systems (IS). Within this research, knowledge management is aligned to IS, this reflects my research background and consequently the research questions posed.

IS is a multidisciplinary area, often with 'conflicting definitions' (Checkland & Holwell, 1998), and is described as

"the effective design, delivery, use and impact of information technology in organisations and society...it is clear the subject is interdisciplinary...seeks to integrate technological disciplines with management and other disciplines, for example, psychology and sociology" (Mingers & Stowell, 1997, p. 14).

This broad and inclusive definition has offered the scope and flexibility to research knowledge management within this discipline. It also provides a suitable philosophical background and research methodology that are needed to explore the research questions.

A range of research approaches have been described in the field of IS. Klein and Myers (1999) classify these into three different areas, "positivist, interpretive and critical".

Positivist research assumes that there are formal propositions, variables that can be measured, here inferences can be drawn about phenomena from a sample population. This paradigm is based on the assumptions of a belief in objective reality and that knowledge is gained from data that can be directly experienced and verified between independent observers. It is unlikely that using positivist methods would identify roles of knowledge work, the complexities of working as an intermediary, and the appropriateness of knowledge management within the research environment.

In contrast, critical research is where the main aim is one of social critique, where problematic and restrictive conditions within the status quo are highlighted. This philosophical framework grew from critical theory (Habermas, 1971). One aim is to encourage those who are normally excluded from the process of research, to become involved and therefore informing it. Linked to this is the desire for social improvement, focusing on enhancing the opportunities for realising human potential (Alvesson & Willmott, 1992). This research approach seeks to critique dominant conceptualisations of society that may serve to disadvantage certain sections of society.

Critical research was not chosen as an appropriate method, neither participants nor I view themselves as alienated or dominated within their place of work. Social, cultural and political dominance is not the focus of knowledge management within the research topic. Some have criticised critical research as being idealistic, that the analysis of power, with the desire to create more equitable systems, is naïve and optimistic. Others claim that it provides a vehicle by which individuals import 'radical' ideas into social settings (Kemmis & McTaggart, 2000).

From the range of approaches, interpretive research was chosen as a way of gaining insight into the rich and diverse world of the participants.

Ideas of roles, knowledge work and the function of a community of practice are complex. Interpretive research gives more explanatory power to explore the richness of this situation. Gaining insight in the context of IS, is described by Walsham (1993) as being "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (p. 4-5).

I have defined the research in the following chapters as interpretive. This is explained by Gaulliers (1992)

"as the study of the interpretation and understanding not only of text but also human actions and customs and social practices" (p. 158).

2.5 The choice of action research as a methodology

Through the typologies used to explore research questions in information systems (section 2.4), we can see that a range of approaches are used within the field to investigate research questions. Using an interpretive approach there are a range of methodologies that can also be used. Collections of typologies have been explored in the literature by Denzin and Lincoln (1994) and more specifically in the IS literature by Myers (1997) and Galliers (1985). I have used Denzin and Lincoln's typology to provide an overview of different

methodologies as it is comprehensive and can be applied to areas of investigation such as knowledge management. This includes:

- Case studies
- Ethnography or participant observation
- Phenomenology, ethnomethodology, and interpretive practice
- Grounded theory
- The biographical model
- The historical model
- Clinical models
- Action research

Following an overview of these, I finish with a justification of why action research has been used as the framework for this research.

2.5.1 Case studies

Case studies are perhaps not a methodological choice, but a way of choosing the object to be studied (Stake, 1994). Yin (1994) defines them as,

“an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 13)

Like many other forms of interpretive research, case studies aim to collect and analyse empirical evidence as a way of understanding phenomena in its natural environment. This provides useful insight into context

2.5.2 Ethnography

Ethnography or participant observation relies on the collection of unstructured empirical materials, using analysis that is primarily interpretive, involving descriptions of phenomena (Atkinson & Hammersley, 1994). Unlike case studies, findings are not linked to generalisable theory, do not test hypotheses but aim to uncover the meanings and functions of human actions.

2.5.3 Phenomenology and ethnomethodology

This grouping of methodologies focuses on the reality constitution of interpretive practices. In essence these approaches examine how humans construct and give meanings to their actions in social situation. Holstein and Gubrium (1994) emphasis that knowledge is always local, situated in a local culture and embedded in organisational sites, embracing cultural ideologies. Ethnomethodology similarly brings together interpretive resources and local cultures to produce meaning, focusing on the situated practices that define the research environment. The emphasis of this research is through interpretive resources and local cultures where situated practice constitutes the research.

2.5.4 Grounded theory

Grounded theory is a “general methodology for developing theory that is grounded in data systematically gathered and analyzed” (Denzin & Lincoln, 1994, p.204). Strauss and Corbin

(1990) viewed this as a way of generating theory during the actual research, through the interplay between analysis and data collection, with the central analytical approach being one of constant comparative analysis.

2.5.5 The biographical model

Using a biographical model seeks to report on and document the history of a person life. Smith sees this as a methodology that cuts across many social science disciplines and can take many forms ranging from historical, narrative, personal and institutional. Within an interpretive contest this type of study often involves the intersection of the public and private lives of those being studied

2.5.5 The Historical Model

By using a historical model, the researcher focuses on social phenomena being studied within a historical context. Tachman (1994) emphasis that this mode of investigation requires a point of view, "that implicitly contains some notion of the meaning of history" (p. 306). Through using this mode of enquiry, the use of historical documents and written records such as diaries, letters and newspapers becomes the main focus of interpretive analysis.

2.5.6 Clinical models

This method is pragmatic in some ways like action research, this methodology reflects a commitment to change. Traditionally this methodology has been the realm of the positivist and postpositivist paradigm, but can also be used to encompass an experienced based, interpretive view of clinical practice. Miller and Crabtree (1994) classify this mode of enquiry as applied anthropology; questions emerge from the clinical experience and determine research design.

2.5.7 Action research

Action research is a broad research framework that encompasses a range of research methods. Action research can be defined as

"a cognitive process that depends on social interaction between the observers and those in their surroundings" (Baskerville & Wood-Harper, 1998, p. 92).

The essential components of any action research are viewed as a two-stage process, the diagnostic stage that analyses the social situation, and then the therapeutic stage involving change. In this stage change is introduced and the impact or outcomes are examined (Blum, 1955). There has been a large amount of work in the area, carried out since Lewin's original work (Lewin, 1946). Definitions of action research vary, despite this some consensus on the characteristics of action research does exist, this includes the collective, self-reflective inquiry of participants in a situation to improve the rationality of their practices, while developing understanding of both the situation and their practices. Rolfe (1996) suggests that rather than a single definition, action research is best seen as a continuum of methodologies. In this research a traditional approach that follows Lewin (1946) has been chosen, where the researcher as professional expert enter the situation to facilitate and evaluate change. These steps are explained in further detail in the following chapter.

Key characteristics of action research can be identified, including a cyclic process that involves some kind of action intervention. The second is that of research partnership, in which there is a degree of involvement of the researcher. This may range from co-operation, when priorities are being determined to direct involvement, to collective action (Hart & Bond, 1996).

Action research has had a long and varied reputation in IS, this is reflected through the amount of debate and published papers in the past 25 years (Avison et al., 2001; Lau, 1997), this includes disagreements over the paradigm and differentiating it from consulting (Baskerville & Wood-Harper, 1988). Unlike other research approaches in IS, action researchers have had to justify and substantiate that action research is indeed a valid approach to investigating both theory and action within organisations. By not action researches has reached a maturity and respectability through publication and debate that justifying its use for research such as this is clear. IS is an applied field, so that placing researchers in an enabling role helps them to merge research and practice, creating extremely relevant research findings that can be understood and applied by those involved.

The research presented here aims to refine our understanding of the potential of action research, through reinterpretation and application of cycles in a new way. Reinterpretation of action research has been acceptable within the field of IS, and can be demonstrated through the development of new problem solving approaches within action research. Some examples include Soft Systems Methodology (SSM) (Checkland & Scholes, 1990), Multiview (Wood-Harper, Antill & Avison, 1985) and Effective Technical and Human Implementation of Computer Systems (ETHICS) (Mumford, 1983; Mumford & Weir, 1979). These developments have been made possible through a long and dynamic history in the field of IS, where fragmentation and diffusion have taken place over 25 years (Baskerville & Wood-Harper, 1998).

Just as a range of research approaches can be used in IS, action research also encompasses a range of research approaches. These in many ways reflect what has just been outlined in the previous section, each 'mode' of action research having a different set of structures and goals. Grundy (1988) has described the different modes of action research as falling into three categories; technical, practical and emancipatory. Another way of describing categories is by McKernan (1991) who lists the types of action research in the following three ways,

Type 1: the scientific technical view, the underlying goal is testing a particular intervention, based on a theoretical framework. This can be defined as positivist, putting forward a scientific method for problem solving. Within this mode the researcher aims to implement an intervention. An example of this is the work by John Dewey, "who applied the inductive scientific method of problem solving as a logic for the solution of problems in the field as aesthetics, philosophy, psychology and education" (McKernan, 1991).

Type 2: practical deliberative action research. In this mode of action research the practitioner and researcher come together to identify problems, their causes and possible interventions. This mode of action research offers a flexible approach, not available in the positivist paradigm. "Indicative of the flexibility is the frequent use of 'interpretive' as an umbrella term that comfortably accommodates interactive and phenomenological perspectives" (McCutcheon & Jurg, 1990). This mode trades some measurement and control for human interpretation and rich description (McKernan, 1991).

Indeed, Baskerville and Wood-Harper (1996) have described this mode of action research as the "paragon of the post-positivist research methods" (p. 236).

Type 3: Critical emancipatory action research: there are two reasons to use this approach, to increase the link between actual problems and theory used to explain and resolve the problem. The second is to help practitioners identify and make explicit fundamental problems by raising their collective consciousness (Holter & Schwartz-Barcott, 1993). Grundy (1987) described this mode of action research as one of promoting “emancipatory praxis in the participating practitioner, that is, it promotes a critical consciousness which exhibits itself in political as well as practical action to promote change” (p. 154).

This overview gives a range of approaches to action research; it can be suggested that these range from interpretive to positive approaches.

In this research I have used practical deliberative action research. Through this mode I engaged with the participants to help identify and resolve real world problems in knowledge management. This also afforded me the flexibility to direction and data collection techniques as I learned and progressed through the research. The richness and extent of interpretation of what took place during the research made it impossible for me to use positivist action research. Instead I was immersed in the process and influenced the outcomes.

2.6 Justification for using action research

From the research approaches outlined in the previous sections, it would be possible to use case studies, ethnography or phenomenology to explore KM within a community of practice. While all of these help to gain insight into the world of the research participant and the research context, none of them involve the researcher in helping participants with problem solving as an action research approach does.

Within the one project both improvement in practice and theory generation were sought, the ways of teasing out such issues were multifaceted thus warranting the use of a range of tools and techniques across the life of the project. Compared to any other methodology, action research helped me and the participants achieve our aims of both generating knowledge about the research environment, generating theory and change. While using a case study approach may have been relevant to some extent, it would not have fitted with the notion of me enabling and stepping in to the research environment to take constructive action with the participants.

Action research as an approach was selected as being the best method for investigating a problem where participants sought improvement in their work situation. Positivist approaches by comparison, do not provide the researcher with the context and richness of the social world in which knowledge is also socially constructed and interpreted by the participants. Positivist criteria of statistical rigour and generalisability offer little insight into how people view knowledge, and why participants do what they do.

Action research provides a flexible approach to investigating knowledge management. Feedback and continual input from stakeholders can allow the researcher to stimulate, guide, encourage reflection and stimulate improvement throughout the journey of the project. This iterative methodology could be useful in generating proposals for knowledge management, testing them and then moving on. Baskerville and Wood-Harper (1996) sum up this position:

“we cannot study a newly invented technique without intervening in some way to inject the new technique into the practitioner environment. This leads us to

conclude that action research is one of the few valid research approaches that the researcher can legitimately employ to the study of specific alterations in systems development methodologies. It is both relevant and rigorous" (p. 243).

The applicability and relevance to using action research to investigate knowledge management has been discussed by Probst et al. (2000) creating the basis for their textbook on managing knowledge. A traditional approach that follows Lewin (1946) has been chosen where the researcher as professional expert enters the situation to facilitate and evaluate change.

The range of issues and problems presented through this research has been explored in an evolutionary way. The format of action research used within this research is that described by Susman (1983). He recommends initially the establishment of a client-system infrastructure or research environment. Steps in each cycle include diagnosing; action planning; action taking; evaluating and learning.

Rather than using action research cycles to explore and improve the same issue with the same group of participants over and over again, cycles were used to explore different perspectives of the same research problem. This is a new interpretation of using cycles, and is described more fully in the following chapter. Using different forms of data collection and different stakeholders within the scope of the research problem, has contributed to a deep and rich investigation of the research questions and provided a new contribution to knowledge in the application of action research.

2.7 Summary

This chapter has outlined my research approach, philosophical underpinnings and technique used within the research. The methodology I have chosen and justified action research within an interpretive approach. This is the most appropriate methodology to investigate knowledge management issues within the rich and diverse group of participants, and within a complex organisation. This sets the scene for my background and worldview as researcher and ways of gaining knowledge in this project. It also lays the framework and boundaries within which the research has taken place.

Chapter 3

3. Specific research approach

This chapter outlines action research cycles, giving a broad outline of the steps taken during the research. This chapter does not give an indepth description or analysis of the data. This information is explored in more depth in the following chapter. This chapter puts into context the flow and course that the research took. Action research cycles are outlined in this chapter to clarify how a range data collection and analysis approaches can be used within the one project. This reflects the complexity of researching knowledge management within the context of EBP. In addressing these complexities this research proposed using multiple cycles of action research to explore the differing perspectives of stakeholders in looking at KM issues.

3.1 Research design

The research design provides the connections between three different activities

“the articulation of the researcher’s individual worldview or basic belief system; decisions on the theoretical perspective and strategies of enquiry, and decisions on methods of data collection and analysis” (Denzin & Lincoln, 1994b, p. 14).

Denzin and Lincoln (1994a) sum up some essential elements of research design

“Four basic questions structure the issue of design: (a) How will the design be connected with the paradigm used? This is, how will empirical materials be informed by and interact with the paradigm in question? (b) Who or what will be studied? (c) What strategies of inquiry will be used? (d) What methods or research tools will be used for collecting and analyzing empirical materials?” (p. 200)

The design of this research is general and deliberately loose, this provided flexibility, as it was iterative research. This flexibility reflects an interpretive research paradigm, where the data was collected from the field, then given meaning by research participants and myself as researcher.

Knowledge management is a concept that is best researched in organisations. Through studying an organisation, I was able to collect data on the complex and messy nature of knowledge, and investigate a range of knowledge management sharing and innovation. Part of this research also required me to look at the intermediary, so that I researched a group who have a role as knowledge workers and also acted as intermediaries within the organisation. A definition of intermediaries is given in the introductory chapter of this thesis in section 1.5.

The strategy used to answer research questions posed was through action research. As discussed in the previous chapter, this is widely used in information systems research as an interpretive methodology that can be used to help generate theory and action, in helping the research participants.

Action research is cyclical, and through this research, each cycle reflects a new form of inquiry. At the end of each cycle I have written my own reflections. Within the 'lessons learned' section of each cycle, I have used these experiences and insights as a way of informing future chapters. This reflection has been a way of developing the next steps of inquiry and selecting the most appropriate data collection techniques. This approach set the scene for establishing a pathway through the research where specific data collection techniques were not put into place at the beginning of the research. This is because the research was iterative; findings of one cycle informed the next. By doing this, I left the research design flexible and responsive to the needs of the participants and myself as we progressed through the research.

Methods or techniques for data collection in the field are wide and varied; these are described in depth later in this chapter. Data analysis followed that set out by Miles and Huberman (1994), of three sub-processes, data reduction, data display and conclusion drawing.

"These processes take place before data collection, during study design and planning; during data collection as interim and early analyses are carried out; and after data collection as final products are approached and completed" (Huberman & Miles, 1994, p. 429).

These are continual through the life of the project, they are integrated into every cycle. With these guiding principles, data has been reduced as I moved through the research, answering the different research questions and looking at the different perspectives of the stakeholders. Through the different cycles I have found themes, coded, clustered the data, and condensed them into a form that made data display possible.

Through data display I was able to draw conclusions and pursue further avenues of inquiry. This and the conclusion drawn from the data are discussed in chapter 10, after the different action research cycles have been concluded.

3.2 Data analysis

This thesis takes the unorthodox approach to data analysis by carrying it out during each action research cycle rather than waiting until the end of the research. This made understanding more immediate and enabled me to keep methods and data collection techniques flexible and change in the light of findings. This means that analysis takes place at a range of points throughout the research. There is no final data analysis chapter, instead the separate threads of analysis are united in the discussion chapter.

An interpretive approach to analysing what has taken place within the research was used. Blaikie (2000) has described this as abductive research, where the researcher is involved in investigating the social work and the conceptualisation and giving meaning to that world. This does not mean that the analysis is without structure or a framework. Unlike grounded theory where themes emerge from the data, this research focussed on more explicit research. These were not hypotheses to be tested but discrete issues that I sought to explain through investigation. I have followed the data analysis path that is recommended by Miles and Huberman (1994), that of data reduction, data display, conclusion drawing and verification. This way of analysing data fits well with the nature of action research, compared to grounded theory, as the research is tight and bounded by a range of specific questions. I did not use grounded theory, as its underpinning message is one of themes emerging from the data, this was not the case in my research, as I had already chosen the topics to be investigated. So this was not an inductive or exploratory piece of research, but

one where explanation was sought through the data. The design of this research has in many ways been a form of data analysis.

3.2.1 NUD*IST Vivo (NVivo™) Non-numerical unstructured data indexing, searching and theorising

Computer software was used to speed up the process of data analysis and facilitate the organisation of text information. Before analysis began, data, for example interview transcripts, were word processed and saved as text files. This data was then imported into NVivo™ and reading of the text line by line then began. The coding of the text was not simply a mechanical process of labelling but itself forms part of the analysis process, with interpretation and thinking about theoretical perspectives as the analysis progresses. During this process the researcher read over the text and coding many times so as not to fragment or decontextualise the data. During this, it has been suggested that “the researcher brings with them their own lenses and conceptual networks” (Webb, 1999, p. 325), and it is acknowledged that such analysis cannot take place in a ‘value free’ environment.

The term ‘code’ has a range of meanings, for analysis in this project it means “to identify a passage of text which the research interprets as having a particular meaning” (Webb, 1999). This is referred as to ‘referential’ by Richards and Richards (1995), as opposed to a factual code. Factual codes would denote facts such as age, gender or profession, for this research, such facts were determined prior to data collection.

Using computer software to help with this process is sometimes controversial, I have acknowledged the arguments for and against using such tools in analysis. Such reservations (Buston, 1997) relate to the issue of the computer controlling the analysis process, forcing the researcher to adopt certain processes, perhaps alienating them from the data. This can be countered by the ability of NUD*IST to help with the analysis workload, save time and enhance the power of qualitative analysis.

As suggested by Buston (1997), analysis for this project subscribes to the idea that “the researcher should have a clear idea of this process (analysis) and then use the software to benefit it”. This sentiment is echoed by NUD*IST creators that “NUD*IST requires nothing, but invites a lot” (Richards & Richards, 1995, p. 92).

3.3 Action research as a framework

Information systems research has an established tradition of using action research to explore practical and research problems (Baskerville & Wood-Harper, 1996; Mansell, 1991). It is part of a wide repertoire of methodologies that are used within the field (Galliers, 1992) and has been chosen because it embraces both theory and practice. Action research fulfils my needs as a researcher to answer research questions and generate theory, but also helps potential research participants to improve things that are of relevance to them. Action research is an often used and well-understood methodology within health care (Coghlan & Casey, 2001; Hart & Bond, 1995), this made it more acceptable and easy to explain to participants in this research.

3.4 Understanding the research problem using action research

The range of issues and problems presented through this research were explored in an evolutionary way. The format of action research used within this research was that

described by Susman and Evered (1978), this five-phase cycle is described as necessary for comprehensive definition of action research. The five phases include: diagnosing, action planning, action taking, evaluating and specifying learning. These five phases of action research have been described and cited many times within the IS literature, and have been highlighted as an appropriate form of action research within the discipline (Baskerville & Wood-Harper, 1998; Stowell & Stansfield, 1997). Initially, Susman and Evered (1978) recommend the establishment of a client-system infrastructure or research environment. In the case of this research, I was given the authority to specify actions and provide legitimacy in taking action to help the participants. The numbers of action research cycles that can be worked on within the life of a project are finite. After five iterations I had gained enough data and understanding of the issues to make an impact on participants, to initiate some change, to complete data collection and generate theory.

What follows is a description of what takes place within each phase of the action research cycle.

3.4.1 Diagnosing

This is the phase where the primary problems of the participants are identified and the underlying causes of which the organisation wants to change. This includes the interpretation of complex organisational issues, aiming at taking a holistic view of what is occurring rather than simplifying them. When diagnosing takes place, a working hypothesis of the organisation is developed; this focuses on the nature of the organisation and its problem domain. I have also applied this phase to understanding and defining my own research and theory issues.

3.4.2 Action planning

From this phase, the researcher and participants collaborate in specifying the action that can be taken to improve the problems that have been identified. The discussion of planned action will be guided by the theoretical assumptions or working hypotheses about the organisation, aiming at the intended situation or state that participants would like to move towards. This plan will include actions that need to be taken to meet the goal situation, this will include both approaches and targets of the intended change.

3.4.3 Action taking

This is the implementation of the action plan where there is collaborative action within the participant organisation. A range of intervention strategies can be used, both directive and non-directive. Directive intervention creates a situation where the research drives that change, a contrast to a non-directive approach where change is more indirect. This phase borrows strategies from psychology and management, where there is a strong tradition of change. This can include processes such as those described by Lewin and Roger's Diffusion Model (Lewin, 1951; Rogers, 1995).

3.4.4 Evaluating

This phase requires reflection on the outcomes of the process. This reflects on whether actions have relieved the problems and moved the organisation to a desired state. Success and failure may not be attributable to the intervention. This critical analysis may illustrate that through organisational activity the change would have taken place anyway. Where failure has taken place, the next iteration of the cycle may address the problem once more; such failure is an important part of the process and needs to be documented.

3.4.5 Specifying learning

Learning will take place throughout the cycle, but can be summarised through the last stage of the cycle. Knowledge gained throughout the process of successful and unsuccessful change can be used to inform a range of stakeholders. The purposes of this research will lead to theory development after the final analysis and will provide a new range of knowledge in relation to intermediaries and knowledge management within the subject area.

'Double loop learning' as described by Argyris and Schon, looks at restructuring organisational norms to reflect new knowledge gained during the research (Argyris & Schon, 1978). Failure to change can usefully inform future cycles, may in turn be beyond the scope of this project.

3.5 Overview of cycles

By using action research I have used several research cycles to explore a range of discrete research questions, while testing and generating theory. The multifaceted nature of these questions and the complex nature of the organisation being researched have led me to develop a new interpretation and use of action research and its cycles. Rather than using action research cycles to explore and re-explore the same issue again and again, I have explored the issues under investigation from a range of different perspectives, using a range of research methods and lenses. A contrasting approach to this is one tested by Kock et al. (1997) where two types of investigation are made with two separate cycle iterations during the life of the project. In contrast, I have used six cycles to illustrate the rich and diverse nature of the questions under investigation and the challenging world of the research participants.

By doing this I have triangulated my investigation through different data collection methods and viewpoints, by looking at the same problems and issues through the eyes or perspectives of a range of stakeholders. This is illustrated in figure 3. The cycle metaphor has been used in the past to describe action research (Baskerville & Wood-Harper, 1998; Susman, 1983). Cycles create a discipline for the journey of the research. This research reinterprets the use of cycles and application provides new knowledge and application within the field of action research. Rather than using action research cycles to revisit the same issue, I have explored a range of issues from a range of stakeholder perspectives. Each perspective co-evolved during the research to assist in answering the research questions. Cycles within the context of this research still create direction, the direction in this case is complex and multidimensional, these dimensions change throughout the life of the project. In the following chapters I describe in detail the investigation of the research question through these action research cycles. Table 1 provides a summary of the research progress through each cycle. It aims to give an overview of how each piece of data collected informs the next cycle and analysis.

The cycles and stages of each cycle have been mapped out below to provide an overview of what has taken place within the research.

Cycle One is where I explore and declare my own worldview on the topic. Here I describe my background and what I bring to the research. This includes experience and interest in the area of EBP, and my concerns about the application of knowledge management to the subject area.

Cycle Two is used to gain an introductory understanding to the community of practice being studied. Within this cycle I explore if knowledge management is a concept that can be applied to the community and what aspects currently exist within the organisation.

Cycle Three explores how an EBP information provision can be modelled and also explores the role of the intermediary acting between the evidence and the health care practitioner as end user.

Cycle Four validates the findings of the two previous cycles by testing ideas and models with peers who work in the same field of EBP information provision.

Cycle Five gains the views of health care practitioners as users of the evidence, and their views of intermediaries in this process.

Cycle Six explores how the research participants could go about defining and selecting a knowledge management system in order to help them with their knowledge work.

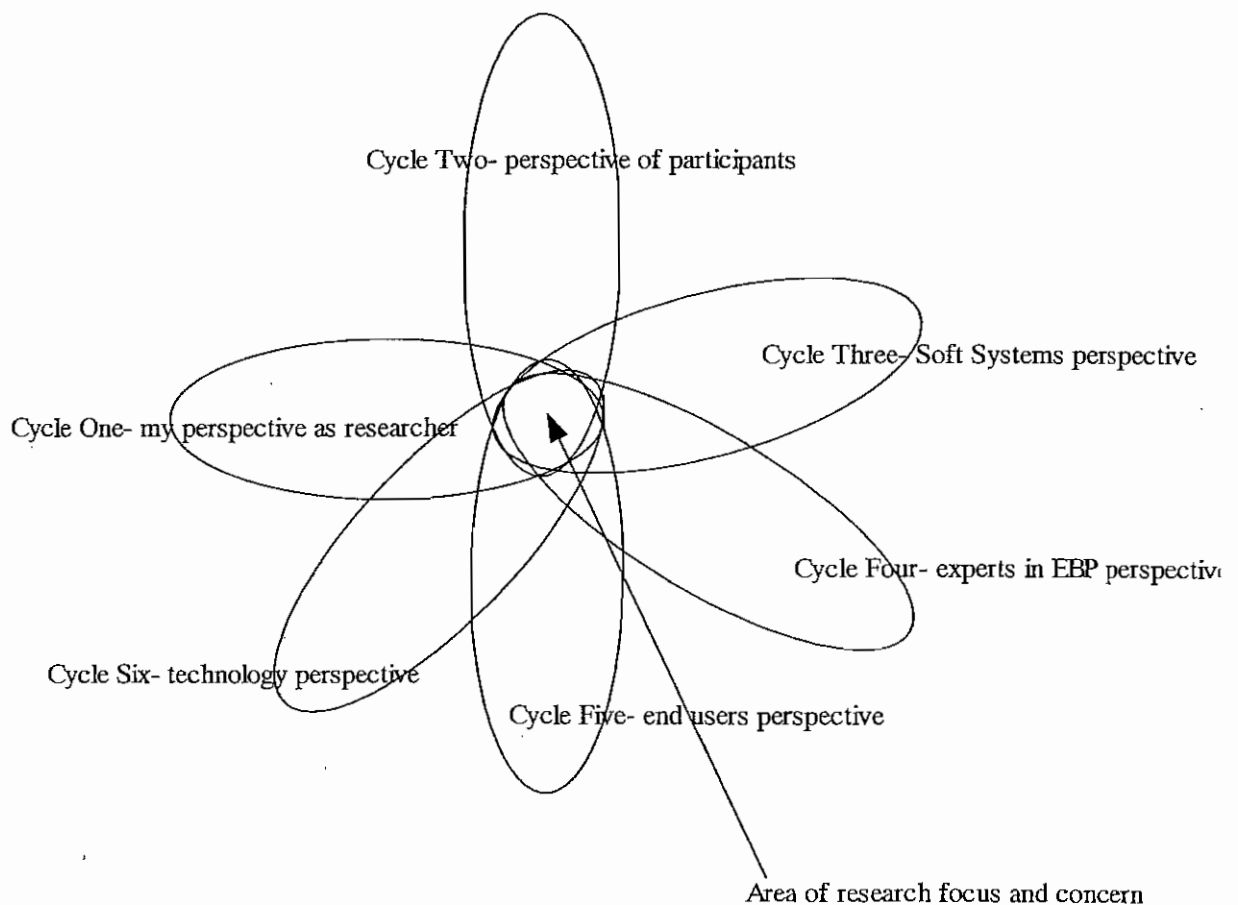


Figure 3 Action research cycles of the research

3.6 Action research as a way of exploring theory and problem-solving

Action research has been described as a way of generating theory or answering research questions and as a way of problem-solving (McKay & Marshall, 2001). These can be described as dual cycles, one as the research method (MR) and the other as a problem-solving method (MP). Using this perspective, during the research I aimed to answer a range of research questions but also helped solve some practical issues. Different iterations of the action research cycles focused on either MP or MR or both. These letters represent cycles as theoretical or practical problem-solving are described in table 1. There are a range of problem-solving methods that are used within the life of the research, these are both explicit such as Soft Systems Methodology (SSM) and Soft Information Systems and Technologies Methodology (SISTeM) (Atkinson, 1997) and more general methods such as facilitation as a way of enabling change within the organisation.

3.7 The role of researcher

A defining factor for action research which makes it stand apart from other research methodologies is the active involvement of the researcher within the research context. To achieve this, I was fortunate to secure a post within the organisation, working as an educator, becoming a key participant in the research. Becoming part of the organisation enabled me to get to know and understand the research participants, the world in which they worked, including the politics, systems and constraints under which they worked. Being in this position defined me as an 'insider action researcher' as distinguished from external action research approach (Webb, Turton, & Pontin, 1999; Coughlan & Brannick, 2001). This approach differs from many other research approaches where the researcher joins the organisation for a short amount of time specifically for the purpose of carrying out research. As a researcher I was part of the organisation, and was able to build up trust and rapport with the participants. While this approach has many advantages it also creates challenges. Preunderstanding is a way of describing the knowledge, everyday jargon of the organisation lending itself to the researcher having "insights and experience before they engage in a research programme" (Gummerson, 2000, p. 57).

While being immersed in the subject and organisation, this has the disadvantage of the researcher being too close to the subjects and data. There is the danger of assuming too much, and not probing participants as much as an outside researcher. I may think that I know the answers and not uncover the perceptions of participants. Such challenges require reflection and examination in order to expose unreflected action and underlying assumptions to testing (Argyris, Putman & Smith, 1985). These criticisms of the research can be countered by using triangulation and validation of the research data. This was done by exploring the issues under investigation as suggested by Denzin (1978) through a range of data sources, by method and by theory. I also verified my analysis and conclusions with both research participants and colleagues within the project.

3.8 Research methods and techniques

As described there in section 2.1, there is a difference in the interpretation and use of the terms methodology, methods and techniques. In this section I describe how methods and techniques are used to gain multiple perspectives and to generate a range of data sources that can be triangulated. A range of methods and techniques have been used throughout the project, these differed between cycles and were used to explore multiple problems and perspectives relating to knowledge management and intermediaries. Each method or technique was chosen to elicit views, perspectives and information that would inform that problem-solving function of the action research cycles. As I moved through the action research cycles with the participants, I needed to change techniques according to what issues and solutions were raised, informing future cycles. An example of this was collecting individual views of the research situation, but needing to feed back this information in a group context and gain further feedback within the context of a group interview. Two of these methods are described by their authors as methodologies (Checkland & Scholes, 1990; Atkinson, 1997). I have placed them within this section because I have used them in specific and discrete ways of investigating issues within the research, rather than as overarching research methodologies.

Data collection activities were closely linked to data analysis. These were interwoven activities, all of which are brought together in the discussion chapter. This section puts into context the methods and course that the research took. The range of methods used reflects the complexity of researching knowledge management with the context of EBP. Within the one project both improvement in practice and theory generation are sought, the ways of teasing out such issues are multifaceted thus warranting the use of a range of tools and techniques across the life of the project.

3.8.1 Soft Systems Methodology

Within action research, Soft Systems Methodology (SSM) (Checkland, 1981; Checkland & Scholes, 1990) can be used as a technique that explores the notion of 'purposeful human activity'. SSM not only enhances our knowledge of the problem and situation but also comes up with a useful intervention for such situations. The action research tradition recognises that the priority is one of reaching practical solutions to the problem at hand instead of only testing and generating theory (Susman and Evered, 1978). Checkland's SSM methodology (Checkland, 1981) lies firmly within the tradition of action research which

"aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework" (Rapport, 1970, p. 500).

The philosophical underpinnings of this 'methodology' are essentially interpretive, aligning well with others used within the research (Susman, 1983). This differs significantly from experimental techniques; data collected is only relevant to the social situation being studied, and the same problem in a different setting may provide many different responses because of the nature of human interaction.

In fact using explicit definitions of the 'Weltanschauung', or worldview, validates and affirms an interpreted view of reality. SSM has been described as a stand-alone research technique within the context of action research (Baskerville & Wood-Harper, 1998). I however, used it as a technique within a wider action research framework rather than an overarching research methodology in its own right. This is because SSM has a range of shortcomings including an emphasis on groups and gaining consensus about problems.

This makes it a useful, but also sometimes inappropriate technique to be applied to all of the questions under investigation within this research. Such hybridisation of research techniques can be justified on the grounds that I sought to explore and explain a range of complex problems from different perspectives. SSM seeks to explore the world from a systems perspective, but is perhaps less useful in eliciting individual's experiences of what takes place within their worlds.

3.8.2 Soft Information Systems and Technologies Methodology (SISTeM)

This technique concentrates on the use of information technology and human-machine activities. Development of this method was in response to some of the constraints of SSM (Atkinson, 1997; Atkinson, 2000b) providing a more practical approach to promote

“operational decision-making and bringing about the integration of organisational, information and technological changes within the situation” (Atkinson, 2000a).

SISTeM is used within one research cycle to help identify KMS selection criteria. This approach has also been used within a variety of health care settings by the developer of SISTeM (Atkinson, 1997; Atkinson, 2000b) and is relevant to the participants within my research. The methodology contains two cycles, the first focuses on strategic decision-making and broad principles, and the second cycle covers operational issues, with decisions for action and processes for decision-making

Using this technique was a way to articulate what was needed from a KMS in order to aid action planning. I have used part of the SISTeM methodology rather than the whole, and as with SSM it has been used as a problem solving approach. The emphasis is on Cycle 1 of the methodology, at strategic level, which is where decisions of principle were used to guide decision-making in KMS before practical decisions for action were made.

Exploring the situation at hand provided a focus on developing information systems and is described by Atkinson (2000a). This helped with challenging the community of practice, in its current form and future guises, but also explored the impact that these might have had on how intermediaries did their job. A political and social analysis also helped to explore the role that IT staff had to play within the research, and the experiences and attitudes to KMS and IT by potential users of a system.

The following sections speak more specifically about data collection techniques used within an action research framework.

3.8.3 Interviews

There are a range of interview styles, ranging from structured to group to unstructured. The style of interviewing was applied according to the theoretical framework that has been used within the research (Miller & Glassner, 1997). Because of this, I have chosen unstructured interviews where participants had the opportunity to tell their story.

Interviewing is a way of asking questions and getting answers, it has a wide variety of forms and range of uses. It has been described as “one of the most common and most powerful ways we have of understanding human beings” (Fontana & Frey, 1994). From a constructivist perspective the interview is a social conversation in which the participants actively construct versions of reality. My use of interviews has been as a dynamic, meaning creating encounter, where those involved were shaping and influencing meaning.

3.8.4 Group interviews

Group interviews were a way of bringing together participants, in order to encourage discussion and the expression of differing opinions and points of view (Marshall & Rossman, 1995). Often referred to as 'focus groups' especially in marketing, the purpose is to gather consumers' opinions. This term was used by Merton et al. (1956), to apply to a situation where the interviewer asked specific questions about a topic, after conducting research. Unlike them, I do not focus on specific questions, but on themes. Through this technique, I identified trends in the perceptions and opinions expressed, which were revealed through careful, systematic analysis (Kreuger, 1988). In this way participants were not responding in a vacuum, but were gaining the opportunity to listen to others' responses and understanding of knowledge management issues in order to form their own views.

This format gave participants an opportunity to talk in a natural environment, in this case with their work colleagues, allowing me as researcher to explore unanticipated issues which arose in the discussion: the results have high face validity, the technique is readily understood, the findings appear believable (Kreuger, 1988). Participants knowing and feeling comfortable with the researcher, but also the researcher understanding the subject specific jargon and 'shorthand' with which the participants spoke, helped the ease of this particular focus group.

3.8.5 Diaries

Diaries are a way of providing access into the personal intimate world of the participants. Burgess (1990) suggests that diaries provide a first-hand account of the situations that might arise. Within the context of the research I have looked for knowledge management as it happened from the perspective of the participant. Using this data collection technique enabled research participants to make sense of their work, and to reflect on their practice, without the pressures and constraints of an interview situation. The aim was to gain a candid picture of how individuals make sense of their world and the knowledge work that they perform. This mode of data collection provides intimate data that is meaningful and accurate descriptions of how participants view their world. Diaries have been advocated as a way of eliciting information that may otherwise be difficult to collect such as through observation, which can be time-consuming. Also data collected through diaries can be confirmed and investigated for inconsistencies through interviews with the same group of participants (Zimmerman & Wider, 1977).

Diaries have been used to gain insights into the past, but more recently have been used as academic tools. Platt (1981) highlights the growing trend of using them as documents in social research. They can be in the form of solicited or pre-existing diaries, where they are produced with the research in mind. Diaries do have limitations and a range of authors have questioned the accuracy of diaries (Conrath, 1983). I acknowledge that participants bring their own biases, background and interpretation of events to this type of data collection. Within hermeneutics, the meaning individuals attach to what is happening to them and their own experiences of the world is a valid and important part of understanding knowledge management and the research environment.

Modes of collecting diaries have often been in a manual, pen and paper format. For the purposes of this research the Internet was used as a mode of data collection, using web diaries delivered to the participant's desktop. The use of technology for this purpose can be paralleled with the use of web surveys (Wyatt, 2000). As with all web-based tools, data is easy to collect as it has been keyed in by informants, saving time, and moving it into analysis more quickly.

3.8.6 Participant observation

Observation has often been cited as “the fundamental base of all research methods in the social sciences” (Adler & Adler, 1994, p. 389). Within this research I focused on the group of participants within their work environment, and thus observed their behaviour. Such placement within the research environment is what Gold (1958) classifies as an ‘active membership role’. The researcher becomes more involved in the setting’s central activities, assuming responsibilities that advance the group, but without fully committing to the members’ values and goals. This enabled me to make meaningful bonds with the research participants, while not necessarily conforming to their views about EBP, intermediaries or knowledge management.

Lofland suggests that this technique can be closely linked to data gathered from informal interviewing in the field (Lofland, 1971). Like unstructured interviews, observation “attempts to understand the complex behavior of members of the group without imposing any *a priori* categorization that may limit the field of inquiry” (Fontana & Frey, 2000, p. 653). The final products of observed data collection can vary from recorded written text following a free association form, to standardised predefined formats. One of the main criticisms of observation is its validity. Observers rely on their own perceptions, this has been addressed through the use of other techniques of data collection, and the use of participant’s validation to confirm my own analysis.

One of the great strengths of observation is that it is an unobtrusive technique, which can be conducted inconspicuously. In this way participants can carry on as normal, uninfluenced nor generating observer effects. Another advantage is that observation lies with its emergence. Unlike working with predefined categories, the researcher has the flexibility to construct theories, generate categories, altering questions and problems, as knowledge of the participants becomes greater (Adler & Adler, 1994). This fits well with the notion of iterative research, where the focus and investigation of issues will change focus with each action research cycle.

3.8.7 Document analysis

This is concerned with an analysis of written texts. This can range from looking at documents prepared for official reasons to documents prepared for personal communication (Lincoln & Guba, 1985). Meaning about text does not lie within it, instead text can take on a range of meanings that lie with the writing and reading of it (Derrida, 1978). Through this medium I collected data that was not normally available through participants, offering an alternative voice and perspective to other data collection techniques. Sources of documents within the research environment were varied, when they were re-read in different contexts they take on different meanings, which are “socially embedded” (Hodder, 1994, p. 394). Text interpretation depends on whether it is solicited or, whether it is edited, anonymous or attributed (Webb, Campbell, Schwartz, & Sechrest, 1966), all of these forms were available for me to analyse.

3.8.8 Reflective diary by researcher

As a participant in the research, I kept a diary about the experience and process of carrying out action research. This was a way of creating analysis of what was happening in the research and to report on my own practice (Cherry, 2000). This was a combination of participant observation, as previously described, but also of my own reflections and interpretations of events that occurred throughout the research.

This reflection and analysis was kept the form of a journal, documenting what was happening in and around the research, especially as the researcher, where and how I felt.

As in the previous discussion of diaries, the same rationale can be applied. With a reflective diary the researcher records immediate and intimate data of meetings, events, visits, thoughts and feelings of what has taken place during the life of the project.

3.9 Summary

This chapter has discussed the research design that I have used within this thesis. I have used action research within an interpretive context. Within an action research framework I have used a range of approaches to investigate the research questions including Soft Systems Methodology (SSM) and Soft Information Systems and Technologies Methodology (SISTeM). More specifically I have used a broad range of data collection techniques that fit with an interpretive form of research. There are six-action research cycle iterations covering the scope of this research project. This is a break from the traditional action research cycle approach as different lenses are used to explore a range of stakeholders and issues relevant to the research questions. This reinterpretation of cycles illustrates the rich and diverse nature of the questions under investigation and the challenging world of the research participants.

Table 1 Overview of action research cycles

	Cycle One	Cycle Two	Cycle Three	Cycle Four	Cycle Five	Cycle Six
Diagnosing	My perspectives as researcher, can I find a group of people to test my questions on? (MR)	Participants: Do we know what our role is with health practitioners? How do we manage what we know? (MPR) Researcher: how is knowledge created within the community?	How can we describe the system that we work in? How can it be modelled to explain what we do and where we want to go? (MR)	Can what was learned in the previous cycle be understood and validated by peers who do similar work? (MR)	Do health practitioners understand our role? How do they view us as intermediaries? What do they do with the knowledge they receive? (MR & MPR)	How can we select some technology help us with knowledge management? (MPR)
Action planning	Plan to investigate the area with people similar to the area that I have worked in (EBP)	Plan to ask and observe what is happening within the group to establish knowledge work and creation	Find method that will help map out what is happening within the research context.	Find a group of knowledge workers in EBP who can validate the model from the previous cycle and comment on the work of participants.	Find a representative group of health practitioners and develop questions that will help with informing what we want to know.	Find relevant themes relating to technology from previous cycles and bring together useful information from the literature
Action taking	Find and recruit research participants. Initial discussions with participants to find out what they do.	Diaries completed by participants, feedback given from this and previous cycles for verification and validation	Soft Systems Methodology applied, participants help develop rich pictures and CATWOE. Feed this back to participants	Present paper at a conference and hold group discussion to elicit views on knowledge management and work presented to these peers.	Interviews with 10 health practitioners. Text analysis of questionnaires returned to the unit as feedback.	Pull together information in a questionnaire which can act as selection criteria, pilot these with a range of industry stakeholders.
Evaluating	Participants are knowledge workers, they work with a wide degree of problems in a messy environment.	Knowledge management ideas can be usefully used to improve work processes and enhance the participants' worlds	A generic model and rich picture is used to describe the work of the intermediaries. The processes that take place can be described and understood using SSM.	Many of core constructs developed were of relevance to these peers, knowledge management viewed as an under researched area.	Views of intermediaries varied, but overall they were seen as experts who saved the end users time.	Criteria can be used to articulate a shop for technology to support knowledge management, this something new that needed to be developed
Specifying Learning	My own experiences inform the direction the research will take, I bring biases to the research that need to be made explicit. Participants are often not sure about their role, what they do, and how much knowledge is generated.	Knowledge management is a great idea but there are challenges of bringing this to the public sector, organisation support is the most important lever for change	Divergent views on rich pictures and models need to be brought together to represent a 'group view'. A range of improvement can be suggested to get participants to the desired situation.	A multi-layered model needs to be constructed to best describe knowledge work in EBP, although this is a useful generic effort.	Divergent views on what the role of intermediaries were, but consensus that they were a benefit to the individual and organisation.	Developing criteria challenging and needs the input of people who understand KMS. Skill required for this task were beyond the expertise of most people based in health care.

Chapter 4

4. Cycle One

In this chapter I describe the first action research cycle, which creates a basis for exploring the research situation and data collection. This chapter provides a background to the research, to me, the researcher and to some initial questions that created the impetus for carrying out this research. A rich description of background and worldview adds context and meaning to the research highlighting the interpretive approach taken throughout the research. Findings from this initial cycle are that the knowledge of the researcher within action research and understanding of the environment creates a useful background where questions are raised about the current state of the EBP field. This sets the scene for future cycles and action planning within the research context.

The following table outlines the steps of this cycle.

Diagnosing	My perspectives as researcher, can I find a group of people to test my questions on? (MR)
Action planning	Plan to investigate the area with people similar to the area that I have worked in (EBP)
Action taking	Find and recruit research participants. Initial discussions with participants to find out what they do.
Evaluating	Participants are knowledge workers, they work with a wide degree of problems in a messy environment.
Specifying learning	My own experiences inform the direction the research will take, I bring biases to the research that need to be made explicit. Participants are often not sure about their role, what they do, and how much knowledge is generated.

4.1 Background

My background as the researcher of this project, is one of experience in providing EBP information to health practitioners. From past experience I have seen the rise of EBP, making its way into policy and into the provision of information and advice services throughout the United Kingdom. Such information provision has been in both a traditional health library environment within the National Health Service and a more specialist role within a large nursing professional organisation. This type of work has been the result of a range of initiatives that have depended on government spending on providing information through both the health service and through professional organisations (National Health Service Executive, 1997; National Health Service Executive, 1999).

I identified a range of knowledge management issues while working in this area, which became the impetus for further research in guise of this project.

These issues included:

- lack of sharing of innovation on how to provide information, or 'reinventing the wheel'
- replication of resources in a range of organisations who had different metaknowledge about finding the evidence
- knowledge storage and sharing issues in and between organisations
- lack of knowledge capture and reuse about searching the evidence and about the questions being asked

In contrast to the situation that has been described in the United Kingdom, many of the health information issues discussed in the literature have not been explored within an Australian health care environment. Australia has also seen the rise of EBP, but in a more *ad hoc* way. This reflects the structure of health funding and policy-making that is split between the state and federal governments. Because of this there has been a lack of clarity and leadership, which is reflected in the lack of central guidance and publication in the area, but also through the lack of debate around information issues.

4.2 Diagnosing

In this phase of the action research cycle I describe my perspectives and background as researcher. These highlight the existing knowledge, attitudes and worldview that I bring to the research. These are essential in understanding my role as the participant researcher within the action research.

Before carrying out this research I had worked in a range of information management roles within health care organisations, at local and national level within the United Kingdom. Bringing these skills and experience to an Australian context made me question whether they could usefully inform research questions raised in another country. As EBP is an international movement (Sackett et al., 2000) there is a common and shared understanding of its tenets and philosophy, regardless of which 'western' cultured country they are applied to.

From my interaction with professionals working in the area of health information management and those working in EBP practice, I had heard the term 'knowledge management' used from time to time. I wondered whether what was happening and being described was indeed knowledge management, or just information management being re-labeled. Did these health practitioners really know what knowledge management meant? Alternatively were they using it in what I perceived as a cavalier manner, because they had seen it in the popular management literature?

These questions led me to some initial information seeking on the topic. With such strong literature focusing on the role of information and skills needed for EBP, I searched the health care and IS literature to discover if there had been any linking between these two complex concepts. Findings of a literature review reaped very few rewards. There were some examples of knowledge management in health care (Urquhart, 1998; Sorrells-Jones & Weaver, 1999), but these only made vague links between EBP and knowledge management. My perspective, as someone who had worked in the field, made me question whether I could test out my ideas on a group of similar people working in EBP. By finding a group of EBP people, I could develop research questions and then move into developing a research plan.

4.3 Action planning

From my background and with the issues raised from my previous experiences, a project plan was developed. This was used as the initial proposal for this research. Planning included proposing to investigate the aspects of knowledge related to EBP and whether these concepts could be applied to a group of intermediaries working in the area. To achieve this I needed people who worked in health but focused on an evidence-based approach. This was a challenge to find; many of these roles are embedded within organisations and are not advertised in a public way that was accessible to me as a researcher outside the organisation. My experience of intermediaries led me to speculate

that many of these people could either be working in health librarian outreach posts or in specialist information services.

I chose to investigate the nature of knowledge management sharing and innovation within an information service and I needed to find a community of practice who were focussed on the same issue, that of EBP. This also needed to be a group of more than two people, so that I could investigate a community at work. Information work is not necessarily knowledge work, so that it was useful to have this definition in mind when selecting a group of research participants. Knowledge work has been described as non-repetitive, non-routine work that entails substantial levels of cognitive activity, it includes professional and specialist's work (Drucker, 1993). Characteristics of knowledge work have been outlined (Iivari & Linger, 1999) as:

- based on a body of knowledge
- entails working on representations of objects of work
- stipulates typically a deep understanding of the objects of work and
- the outputs of which entail knowledge as their essential ingredient

Such knowledge work in the context of EBP means gaining the skills to search, sift and appraise the knowledge and then apply it to the situation at hand. EBP has evolved as a movement within health care systems to understand how health resources can be used most effectively to improve health outcomes and the quality of patient care. At an individual level it is a way of helping health practitioners who are overwhelmed with the information explosion

“busy clinicians are now caught in an information paradox overwhelmed with information but unable to find the knowledge they need when they need it” (Muir Gray, 1998, p. 832).

The move of health systems to EBP has meant focusing on the need for clinicians to keep up-to-date with changes in clinical practice and improve not only their own skills in seeking the evidence but also to build on their own body of knowledge of what effective practice is.

To carry out research, I needed to find people that did more than passively disseminate information to health care practitioners, and instead needed to cover the many knowledge sharing processes that have been described in the literature. Such knowledge sharing is described by Skyrme (1999, p.61) as:

- knowledge identification and collection
- knowledge organisation and storage
- knowledge sharing and dissemination
- knowledge access
- knowledge use and exploitation

This sharing happened in parallel to the knowledge innovation cycle. Each of these cycles are ways of describing, analysing and illustrating knowledge. This framework has been used in several ways throughout the research to conceptualise and explain what was happening in the community of practice. This is a way of linking the research to theory. Theories are what Popper (1959) describes as “nets cast to catch what we call the ‘the world’ to rationalise, to explain and master it” (p. 59)

From this background and broad understanding of knowledge management, I endeavoured to find some people and an organisation to fit my requirements.

4.4 Action taking

The next step was to recruit a group of participants who fulfilled the role of information providers in EBP. Against a background of policy initiatives at state and federal level in Australia (National Health and Medical Research Council, 2000; Victoria Acute Health Division, 2000), there have been a range of funded initiatives to address the need to support practitioners when looking for the evidence. Such initiatives provided me with the potential of finding a group of research participants that were close to my own background and expertise in the area. Through contacts in the field and a search of the Internet, I found a group of such within Melbourne, a unit for EBP. Throughout this thesis they are referred to as the 'unit'.

This specialist evidence unit was set up in 1998, funded by the state government in Victoria, with funding matched by the local health care organisation, in which it was housed. In the latter stages of the project, this funding formula changed to federal funding which had implications for the types and scale of services offered by the community of practice. The set of services and customers that the unit dealt with was complex, changing over the life of the research, and can be broadly categorised as:

- evidence service: questions are asked about what is clinically effective
- education: teaching practitioners about EBP and the skills required in being evidence-based
- health technology assessment: assessing new health technologies on behalf of outside funders on a contractual basis
- consultancy services: in statistics, implementation, ethics and committee work

There are a range of 'customers' or users of these services; the main ones being within the local health care provider, physically located in four different hospitals within the same area of Melbourne. Other customers include primary care (general practitioners), professional organisations and private health care organisations. These customers come to the unit to seek their expertise in helping with evidence requests, but also to consult on research methodology and other related areas. Requestors include a wide diversity of people working within a health care context including medics, nurses, allied health practitioners, managers, researchers and health care consumers.

At the time the research began requests coming to the unit were excepted from all comers, with little restriction on who within the organisation could ask for help, for a sample of an evidence request form, see Appendix 3. The rationale for this was to spread the 'word' about EBP and to raise the profile of the unit within the organisation. This approach was extremely successful, with evidence requests rising exponentially over two years. The staff resources available to do the work only limited this and the requests for teaching or advice.

Whilst being approached to participate in the study, the unit wished to utilise my skills and knowledge of EBP. This was done by me as an educator within the unit, creating the situation of becoming the participant researcher, a situation where I was able to get close to participants to gain an understanding of the issues and to be an unobtrusive observer of their work and environment.

An initial visit was arranged to find out what the group did, what the products and outcomes of their work were, and who their audience was. This fact-finding helped to establish whether the participants had a set of attributes that could be used as the basis for research, and also whether they would approve of being researched. The initial introduction

to the unit and its work was done through a set of informal meetings with the (then) business manager and two information officers.

Recruiting participants for the research was met with enthusiasm and interest. Participants included: a doctor, a nurse, three health researchers and two information specialists. These people had been working at the unit for varied times, one had been there since the establishment of the unit, the others were recruited by the unit at a time of expansion in 1999.

4.5 Evaluating

From my background of health information work I have developed my own worldview that would impact on the way the research was conducted. An evaluation of this perspective was one where I viewed the role of information and knowledge creation as pivotal in the world of EBP. From these beliefs I brought my own interests and personal biases to the research, which were declared at an early stage of the research.

An analysis of the literature indicates that knowledge management in health care is an under-researched area and my own experience suggests that the phrase 'knowledge management' was being used to describe many things, sometimes inappropriately. This use and misuse has implications for the future application of KM within the context of health care. It would be useful to develop a conceptual model, framework or theory in the area of EBP so that it can be tested in a range of health care contexts. This could also be used to guide debate and education so that those working in health will have a better understanding of what they were talking about rather than just re-labeling information management concepts as KM.

Initial discussions and observational visits to the unit provided a rich description of the community of practice that was being researched. This development was of "storytelling, a sense making construction of a scenario" (Huberman & Miles, 1994, p. 432). Within this scenario, participants came from a range of health care backgrounds, including direct patient care, university research and health libraries. They described themselves as 'specialists' in information retrieval, epidemiology, and research methodologies. The different training and professional backgrounds created different worldviews of both health and what they contributed to the organisation and to health practitioners asking for assistance from the unit. These varying views and experience have been articulated and recognised through the interpretive approach to this research.

A range of experience and expertise brought a rich skill mix to the organisation, complementing the participants. Each one of them could be described as a knowledge worker, and indeed fitted descriptions of such in the literature (Drucker, 1993). Their world was rich with resources that created both tacit and explicit knowledge, and in many ways mirrored my own experiences of working in the field. This fitted in with the concept of knowledge management, the types and constructions of such knowledge work are investigated in the next cycle, when an indepth description and self-analysis of roles were sought from the participants.

From these initial encounters, I was able to engage the participants in discussion and debate in the areas relevant to my research questions. As a group they looked forward to innovation and creativity, and were attracted to the notion of KM. This seeking out of new ideas was helpful in defining the problem, setting out the proposal and recruiting the

participants; they were committed to participating in this project for at least 24 months. From this cycle I saw the transition from personal experience to generating research questions to recruiting participants for the research.

4.6 Specifying learning

From developing the research questions and literature review, I have learned that the area of knowledge management as applied to health care was an under-researched area. Explicit linking of concepts of KM to EBP was poor with little conceptual basis. What was identified as knowledge management in the literature in many cases, was in fact information management (Moody & Shanks, 1999). This may be used to create notions of something 'value added' and a currency as reflected in the popular management literature. Knowledge management as a concept is an appropriate way of explaining what happens in this knowledge-rich environment.

The literature and my former experience provided me with a useful background and understanding of the operational issues, politics and culture of EBP. This culture was one of questioning decision-making, but also one where a range of rules and protocols attached to information retrieval and provision often remained implicit.

Work carried out by the unit was varied but interdependent. Even though teaching and provision of knowledge were different functions, they were based on the same premise. When teaching practitioners, the unit was getting health practitioners to learn about what EBP was about and the skills that the unit staff actually possessed to help them in the future. These are skills in asking answerable questions, searching the evidence, critically appraising and applying evidence into practice. Teaching and looking for the evidence also overlap with consultancy work, this is where 'outsiders' come to the unit and ask for help, using their specialised knowledge around EBP. Because there were so many discrete yet interdependent services provided by the unit, I, in collaboration with the unit, decided to look at one specific aspect of their core business, that of the evidence unit.

The group of research participants chosen could be defined as a community of practice whose knowledge work was diverse and dependent on a range of skills and knowledge that needed to be teased out in future cycles. Discussion and introduction of ideas in KM was enough to spark discussion and raise an awareness of KM within this small community, even though it was a new concept to many of the participants.

4.7 Reflections on methodology

From this cycle I concluded that this was a messy research situation, where there are a range of different views on the role and function of the community of practice that I wanted to investigate. With this in mind, I wanted participants to reflect on what they did, getting them to describe their roles, asking explicit questions relating to knowledge management, getting their own perceptions of what they thought was happening.

In the next action research cycle I have used interviews to explore the research participants' perception of their work, and how knowledge was generated and stored within the organisation. This data collection is contrasted with observation by me, and also diaries, to get a more indepth idea of the day-to-day work of the participants.

4.8 Chapter summary

This cycle of the research has been about declaring my background knowledge and the views that I brought to the research. It lays bare my values and my pre-existing knowledge within the area of EBP. This cycle has been about developing research questions and finding a group of participants to take part in the research. The information collected this cycle acts as a springboard for the following cycle, by now the participants have been located, recruited and willing to participate in an action research project. What follows next are the participants' views on knowledge creation and how I might help them as researcher in understanding their roles, in how knowledge has been created and develop strategies for problem solving.

Chapter 5

5. Cycle Two

This chapter explores the individual's perspective on knowledge innovation and knowledge management sharing while working within the community of practice. At this point, as a researcher I have a good understanding of KM, and how the research might progress using an action research approach. Data collected in this initial phase is used to explore these concepts through interviews and diaries. Findings from the data collected are fed back to participants for validation, clarification and further discussion. This was conducted through a group interview, which was semi-structured in order to develop the contribution of new ideas around knowledge management. Findings from this cycle were that the participants had a broad set of problems relating to their own understanding of their role, to knowledge work and to knowledge innovation. Through this cycle I saw the emergence of knowledge storage and sharing as major issues, stifled and constrained by organisational culture and support.

The following table is an overview of the action research for this cycle

Diagnosing	Participants: Do we know what our role is with health practitioners? How do we manage what we know? (MPPr) Researcher: how is knowledge created within the community?
Action planning	Plan to ask and observe what is happening within the group to establish knowledge work and creation
Action taking	Diaries completed by participants, feedback given from this and previous cycles for verification and validation
Evaluating	Knowledge management ideas can be usefully used to improve work processes and enhance the participants' worlds
Specifying learning	Knowledge management is a great idea but there are challenges of bringing this to the public sector, organisation support is the most important lever for change

5.1 Diagnosing

Since the beginning of cycle one, I been able to enter the organisation and become familiar with the process of work carried out. I grew to understand the complex role that participants played as knowledge workers. Gaining an overview of their work helped me to move to this cycle where I explored knowledge work and what types of knowledge management were taking place within the organisation.

By discussing knowledge management within the context of health and EBP, I was sharing the conventions of the participants, this was coupled with the advantage of being able to use the same language as participants with their paradigm views about EBP. Through this discussion, I started to develop ideas about the nature of knowledge work within the unit and how the research would progress. Themes and observation from the previous cycle around sources of knowledge and interacting within the community of practice started to emerge prior to asking any direct questions of the participants. This gave me ideas of how I

asked questions in the interviews and how I explained what was to happen throughout the life of the project.

The first research question posed within this research was 'can concepts of knowledge management be applied in EBP?' To investigate this question, I used the participants' perspective to create insight into the knowledge work they carried out in EBP and explore whether their perceptions of work fitted with knowledge management.

5.1.1 Initial interviews

Initial interviews were like conversations rather than formal events with predetermined response categories. I developed an interview schedule (see Appendix 2) as a broad format for guiding discussion. This was not prescriptive but used as an aide memoir to make sure that I covered some salient points about knowledge generation and storage. Interviews took place over a week and ranged from 30 to 50 minutes in length. During a two-week period I talked to each participant about the project, giving him or her an information sheet and gaining their informed consent to participate in the. These interviews were not taped, I wanted participants to give me an overview and a description of what they did and how they contributed to the unit's work. These discussions were written up in note form, these were later word processed and downloaded into NVivo™ for summarising and a thematic analysis. This analysis in the very early phase of the cycle was a way of developing and constructing more focussed data collection, or specific investigation and action taking within the rest of the cycle.

5.1.2 Mapping the landscape

From these interviews there were some of recurring themes. Participants had a very rich skill mix, they needed to know about a large range of facts and had a wide breadth of process knowledge to do their work. Themes emphasised the role of the intermediary and the specialised skills that place them in an exclusive position within the organisation. These skills were varied, but three were consistent across the group of participants, these were literature searching, appraisal and web searching. One participant described this as

"each person brings their own background and skills to the centre, we know who is a expert in searching, so you go and see them for help. But you know that someone else is good at critical appraisal, so you go and see them to check if you've done a good job."

Sometimes expertise was tacit knowledge that was tested out by new people joining the community of practice

"I'd work out who had the most expertise in which area. But I don't think it was explicitly stated that these people had expertise in critical appraisal, these have experience in project management, you know, if you have a question go to these people. I think that's one thing that's quite useful to know but isn't really explained to you."

There were however outliers in the group, who were recruited for their specific skills. The medic of the group sums this up

"I was recruited to help with statistical analysis and epidemiology. Much of the searching for the evidence I know, so I just got on with that bit and developed the job as I went."

Or sometimes the management of others within the unit did not even know that the intermediary had the skills, until work began and movement into other areas was achieved.

"The interesting thing is that people even said to me, 'you were hired to free up other's time so that we can get involved in the interesting things'. So there was a bit of a conflict to start with, like first it was encouraged for everyone else to put their hands up to get involved in other things and I had other staff members on the staff saying 'come on back off a bit, because you were hired so that we could do that.'"

Explicit roles were not allocated, they seemed to grow from within the community

"It hasn't just been evidence requests, I've had a chance to dabble in a lot of different areas and have been supported in doing that. I guess I would worry someone, I would consider myself as a reasonably assertive person. But is someone with a different personality type, placid or not so forthcoming, I don't know if they'd get that opportunity. It's not simply given to everyone, it's a matter of who takes it. So I would probably encourage them to look for whatever opportunity they want and take it regardless of whether they're offered it. And it could be harder for different personality types, to jump up and take the opportunities."

Participants described their work as complex and 'messy', interacting with a range of health care practitioners looking for answers or evidence to support the questions that they had.

This information-seeking by health practitioners built upon their body of knowledge to fill gaps and to confirm what was already known. Information-seeking has been well researched, and we know that health practitioners use the evidence for a wide variety of reasons (Urquhart, 1998). The motivation may be for patient care, research, publication, or personal continuing education.

The health practitioners' body of knowledge has been explored in many ways (Eraut, 1994), but is very different from the body of knowledge of the intermediaries.

Instead of focusing on knowledge about disease and the organisation of health care, the community of practice focussed on this research concentrated on improving, deepening and utilising knowledge about:

- research methodology
- sources of information
- issues of validity and rigour
- credibility of information resources
- searching methods and techniques for retrieval.

Many of these were illustrated through the community's publications where they describe the range of services that they offer. This is explicitly stating their own expertise and the body of knowledge they offer service users (see Appendix 1).

Much of the focus of evidence unit work is about applying levels of evidence (Centre for Evidence Based Medicine Oxford, 1999; National Health and Medical Research Council, 1999) and a concern about rigour and validity, in order to reduce bias in the evidence as much as possible.

These levels related to questions of effectiveness in health care and mainly related to questions of treatment. Levels have been debated and adapted over time, but all concentrate on the idea that it is preferable to seek out level I evidence, failing this other searchers for evidence move to other levels, that is, levels II and III. This pathway of searching for sources of evidence, means looking for systematic reviews of randomised controlled trials in the first instance. Many of the rules regarding where to look are implicit,

but many are also well known with the EBP world of practice and have been made explicit (Glanville, Haines, & Auston, 1998). Knowledge of research methodology is an implicit part of this work, not mentioned by participants, but revealed through the process of carrying out critical appraisal (see Appendix 5). The amount of understanding of research methodology and statistics is outlined in many classic EBP texts (Muir Gray, 1997; Sackett, Strauss, Richardson, Rosenberg & Haynes, 2000) and reflected in the evidence tables where intermediaries summarise the knowledge relevant to each question asked (see Appendix 4).

5.2 Action planning

Through this initial analysis of ways of working, I could summarise that there were some very specialised forms of knowledge work that were taking place, knowledge that was not held or developed within the wider health care organisation. These ideas link with those developed by Druker (1993) and Stehr (1992), and carve out a niche within the organisation for these intermediaries.

Many of the core elements of knowledge management were alluded to in the initial interviews. Eliciting more information about them had to be done in a way that represented the individual's and group's views. This meant developing a diary that could be translated into a web format. This was piloted on colleagues in my department, and then created into a web format for accessibility and convenience.

5.3 Action taking

Action taken during this cycle was in the form of rich data collection through diaries and its subsequent analysis.

5.3.1 Diaries

Once staff had agreed to participate in the research project, a web-based diary was set up for them to complete. Diaries within this context were administered through a specially produced website that could be accessed from the participants' personal computer. The format was structured with predefined fields, but with the flexibility of space to complete as many or as little details as the participant wanted. Such diaries were followed up with participants on a weekly basis. The diary (see Appendix 7) was used to gain the participants' own insight and experience of what was taking place during the week. To gain an accurate overview of what was happening with participants, a four-week slot was chosen in which to collect the data. This would reflect a range of different work that participants engaged in and would reflect both long and short-term work. The idea of diaries and instructions on how to complete them was discussed with participants in a staff meeting. This was followed up by an instructional email. The diaries were completed at the end of each working week, on a Friday. As a reminder, an email was sent to every participant. Diaries submitted were anonymous and confidential; this was to encourage a frank description of what was going on within the organisation.

From a potential total of 28 separate diary entries, 26 were completed. The diaries were kept anonymous so that it is unknown which participants completed this entire task. The quality of these diaries varied in completeness and detail, there were no compulsory fields that required completion in the web format, so the data could be omitted. All information from the diaries was submitted to a Lotus Notes database, so that data from each of the questions could be collated together for future analysis.

5.3.2 Analysis of diaries

Data collected from the diaries was then pulled together and input into NVivo™ for thematic analysis. I described themes as analysis and a way of understanding the participants and their views of both work and the processes of knowledge innovation. I have left more indepth analysis until the final data analysis chapter.

Much of the analysis centred on processes that took place within the community, these are elaborated on in the next section of 'knowledge innovation'. Here we saw a group of participants who were collegial but at times exist on separate islands where they keep knowledge to themselves; there was little time or investment in developing infrastructure to embed it within the organisation. Participants while being frank in the diaries were split between creating knowledge that was of a clinical variety and that of meta-knowledge (knowledge about knowledge). Themes generated revolved around resources; behaviour of intermediaries; questions about the evidence; knowledge innovation and learning; skills of intermediaries; attitudes; knowledge storage and requestors. Some of these themes lie outside the scope of this research, but were important in setting the context of the community and the conditions under which they worked.

5.3.3 Resources

Time was a recurring theme for participants, they worked under pressure with a range of demands in relation to turnaround time for evidence requests and other demands such as education and research and the time to support knowledge work. Support mechanisms to carry out work, such as getting full text materials and use of the databases when needed impeded fast and efficient movement through the work required.

An example of this is getting access to the resources needed to do the work

"Mostly printed out relevant articles or requested interlibrary loans where not available"

and

"yes, except for having to wait for interlibrary loan to come in."

Comments like these illustrate that there was time being wasted in minor administration and non-knowledge work activities, yet not being put into knowledge management tasks that could help the community save time in the long run. For example:

"We have keep a list of URL's but I haven't made the time to add to it yet."

Here each intermediary is consistently creating meta-knowledge that never makes it into the community sphere. The priority was to do core business rather than look after the processes that sit behind the scenes.

5.3.4 Behaviour

Within communities of practice a collegial approach with team-working was implied. Diaries supported this although there was some dissonance on the lengths to which people went to share knowledge that was generated. This is demonstrated through the following comments,

"the knowledge that I obtained this week was shared with co-workers in an informal setting. This knowledge has been archived"

or

"I keep websites bookmarked, but haven't shared these sites as yet."

Here we can see different types of consciousness and behaviour in relation to knowledge within the community. Much of this is dependent on working styles of individuals, that would ultimately impact on what made its way into the community, some intermediaries preferred to share everything, some not so much. These types of situations posed the threat of showing or exposing what intermediaries did or did not know, and perhaps opened them up for questioning and criticism. An undercurrent to sharing knowledge or keeping it to one's self was that it was a way of displaying seniority and tacit power within the community.

5.3.5 Questions about the evidence

Within the community conflict occurred when evidence requests were asked of the intermediaries. This included negotiation of how the question was constructed so that it could be easily answered. At this point it became clear that the intermediary was a 'sounding board' or a way health practitioners to 'make sense' of their knowledge needs. This was often the first time that they had an opportunity to articulate what they were trying to ask or to put it into an explicit format that can be communicated. Intermediaries had a challenge with getting to a point that there is a shared understanding or meaning about what is required and what the question actually was

"I also cleared other requests which had halted at 'is this what you want' stage, and yes, it was what they wanted, when they eventually replied!"

An opportunity was created for intermediaries to put their own interpretation and meaning into the questions being asked. From an evidence-based perspective this could be viewed as unduly influencing the process. But from the intermediary's perspective, this was adding their expertise and knowledge to a 'learning process'. This was illustrated in the following interaction, where several intermediaries share their experiences about evidence questions. In an informal discussion with the intermediaries, they discussed their concerns with me,

Sally *"Another problem is that most of the questions we have to answer are not worded properly. They're not worded in an evidence-based way; in a way that they should be worded, that's ALL the questions I've got (Laughter)"*

Lucy *"it's rare actually"*

Jake *"it's a rare one that's worded properly. It puts so much stress on you, you're trying to figure out what they're asking, you try and figure out the question, and try and find the answer to that question so that you try to find the answer of what you're anticipating they're asking"*

Lucy *"we just try and make it fit"*

Sandra *"Jake, you try and make it fit, oh God. It's funny over time that your searching is not efficient at all, the question sort of 'comes', that's funny, you sort of get familiar with the area then you can kind of guess what they're getting at, but you know, I wish there was some way that, we can get back to the requestor and say 'look we need to work on the question, to make it better'"*

Through this we can see that questions asked of the unit create stress and those receiving them deal with the interpretation of them in a variety of ways.

5.3.6 Learning

Intermediaries' experiences of learning new things varied widely, some were confused about this type of question within the diary, and thought that it was an obvious thing.

Question: Did you find out new things?

"About what? The content or the work?? If the latter, I sorted out how to deal with the volume of material in 1, but will the requestor be satisfied?"

or

"Yes! I always find new things when I am searching for evidence".

On reflection perhaps I needed to discuss the difference between process, clinical and metaknowledge. Learning happened on so many levels with the intermediaries, that there was scope for confusion with such a broad question.

Some participants were, however, very explicit about what they'd learned, both clinically and organisationally.

"The new things I learned this week:

- 1. That some critical appraisal forms are available for assessing the quality of guidelines.*
- 2. That creative protein is a good marker for bacterial sepsis.*
- 3. That Sumatriptan is useless in the aura phase of migraine headaches.*
- 4. The sample size formulae for repeated measures longitudinal data analysis."*

Learning or remembering what had been learned was given a different priority too.

"I didn't learn much this week, except for information related to questions which I tend to forget anyway, once the report is completed".

5.3.7 Attitudes

Intermediaries' attitudes towards work as expressed in the diaries fell into two categories, those of satisfaction and frustration. There was little else expressed as far as feelings or attitudes were concerned. This perhaps reflects a juxtaposition between two extremes in the one job, one of being happy and fulfilled by the work of knowledge worker and taking pleasure in a job well done and that of being irritated and stopped from carrying out the work because of barriers. There was an acknowledgement by the research participants that this work was difficult, which was compounded by vague questions about the evidence or not being able to access the required evidence in a timely manner.

When asked in the diary to describe how they progressed in searching and sifting the evidence the following responses were an indication of satisfaction,

"on a scale of 1 to 10 with 1 being the worst possible outcome, I'd say this week my progress rated a 9".

or

"I achieved all goals I set out to accomplish, and managed to find the answers to the questions".

In contrast to this there were many more comments about the difficulty of getting on with the job of knowledge work.

"The problem is that without seeing the full text (Lit Searches are abstract-only work) it's impossible to know what was covered in the meta-analysis. Also not possible to provide levels of evidence for this diagnosis-variety question. The requestor will probably be disappointed that she will still need to do a lot of work herself on this :("

Note the unhappy text message face at the end of this entry. Here we see a knowledge worker wanting to please the requestor but faced with a difficult task. Interacting with health practitioners posed a problem

"the second question for AQUA is quite frustrating as it really is several questions and some clarification is required from the requestor who only works part-time and hasn't been contactable".

Some frustration was also aimed at the process of sifting the evidence and being rigorous in making sure that everything was covered

"the searching process was not as straight forward as I would have liked. As I was reading through the studies on my topic, I found an article that I had missed which was frustrating because I thought that I was at the end of my gathering all the evidence stage. In searching the various databases for the abstract of this missing article I was surprised to find that the journal was not indexed in any of the data bases, no wonder I missed it".

or

"therefore, it has been a fairly frustrating week in terms of searching. I find that the search tends to take a long time if little is retrieved".

Interpretation was also a challenge, as things were not be as simple and unambiguous as the EBP literature suggests

"last week was really frustrating mainly because the evidence I was collecting for an evidence report was inconsistent and difficult to make sense of. Furthermore not all the papers provided sufficient data to do a meta-analysis".

With the large extent of frustration in this type of evidence work it must be questioned whether this has an impact on other types of work within the community. There was the potential to be disillusioned with the work and unable to contribute to knowledge management work or more creative and innovative aspects of work.

5.3.8 Knowledge storage and sharing

As a precursor to exploring knowledge sharing cycle, I thought it would be useful to gauge the intermediaries' perceptions of how they stored and shared the knowledge that was generated. This question in the diary assumed that they had some understanding of facilities available to them as far as knowledge storage and sharing were concerned. Interestingly this field was completed less than others, perhaps because participants liked expressing themselves in individual and subjective ways but asking tangible and pragmatic questions such as this may have implied that I was testing or judging the participants' competence. Responses included comments such as

"Usual filing of completed report available for any interested staff members".

or

"I keep websites bookmarked, but haven't shared these sites as yet".

Single words such as *'printed'* or *'paper'* were mentioned without much other explanation. Perhaps because the participants were being creative with previous questions and this was operational compared to other responses given.

5.3.9 Skills

Skills were discussed at length when I met with participants face-to-face, this could have been due to the time factor involved and the use of body language and probing questions within an informal interview situation. Within the context of filling out diaries, pragmatic and sometimes administrative skills were highlighted

"Oh, learned to back-up to zip drive".

Interestingly a lack of skill or expertise was reflected on in the diaries, compared to face-to-face contact. This is demonstrated through participant's wondering if they were doing the 'right' thing

"yes, for one evidence topic that had index terms that were logical to me (i.e. a specific type of Glomerulonephritis). I had less confidence for another topic (low urinary tract symptoms) since I found the indexing more than usually unsystematic".

Another respondent states

"I guess one of the major problems was trying to decide whether to include a particular systematic review published in 1995, whose articles were prior to 1990".

The privacy of the respondent's desktop has lead to more candour in describing their misgivings of the EBP process.

5.3.10 Feedback of diaries

After analysing the diary information I fed back to participants in an informal environment. This was an opportunity to verify data collected, to confirm my interpretations, to find out what colleagues thought and another opportunity to collect further data.

Feedback included a range of information, much of which was based on the diary themes, looking at knowledge creation and storage. Besides doing a thematic analysis of the information contained in the diaries, I also counted the number of times themes were mentioned within the diaries. This is the only type of quantitative data analysis completed during the life of the project, and was done as a way of relating to the many quantitative researchers who existed within the group of participants. Many liked to quantify things and liked the idea of knowing how many often people mentioned things. This is illustrated through a simple table (see Table 2).

This session aimed to confirm data collected in diaries and get participants to prioritise problems that might be looked at through the action research process. It was an open forum that participants could contribute to and ask questions of the researcher, there were however, some specific questions that were focussed on, see Appendix 8 for these questions. It was also an opportunity for more direct interaction about the knowledge innovation cycle, gaining consensus within the group and an opportunity for participants to test ideas out in an open forum.

Feedback did confirm much of the data found in diaries, although other questions, anxieties and issues were brought up during the group interview. Data collected from this stage was utilised to inform the development of the rich pictures within cycle three.

Table 2 Themes fed back to participants in group interview

Themes	Times mentioned
Resources	
Time	16
Interlibrary loans	5
Databases	3
Web searching	2
Behaviour	
Team working	5
Networking	7
Sharing	5
Not Sharing	4
Limited Sharing	5
Questions	
Difficulty	11
Length	1
Appropriateness	3
Simplicity	4
Knowledge innovation and learning	
Operational	11
Confirming	2
Methodological	22
Evidence facts	19
Contacts	5
Serendipity	7

Attitudes	
Frustration	32
Satisfaction	16
Knowledge storage and sharing	
Hard disk	2
Paper filing	7
Report document	10
Internalised	4
Oral	9
Email	2
Skills	
Web searching	3
Literature searching	2
Appraisal	2

Feedback to the group focussed not only on knowledge management but was also a forum for experience about working in the organisation. I had a sense that participants did not have much time to reflect on their work or discuss processes rather than evidence issues. The conversation turned to issues outside the scope of the research, which needed to be acknowledged. These have not been analysed but have been noted as factors influencing the participants' views and perceptions of what was happening to them. Comments included

"I think we've raised two important issues (in the group interview), interlibrary loans, the big hold-ups, so you do your research, put in your interlibrary loans, you put the question away, you eventually got the articles to work on and you don't remember where they came from when you did the search, you've got to refresh all of that, I think that's one and obviously understanding the question".

5.4 Evaluating

Through the data collection and feeding back of material to participants, the following can be summarised as an overview or evaluation of knowledge innovation issues within the unit.

5.4.1 Knowledge Innovation

I have used Skyrme's (1999) model of knowledge innovation as a way of analysing knowledge in this cycle of the research. This cycle articulates knowledge innovation in four parts: knowledge creation, codification, embedding and diffusion. I was used this as a starting point to guide my thoughts rather than dictate them, and a useful conceptual framework. Holsapple and Joshi (Holsapple & Joshi, 1999b) cite a variety of knowledge management frameworks, all of which conceptualise and describe knowledge in different ways. None have been proven to be more effective or superior to another in describing knowledge within the organisation. In this chapter I have chosen to focus on knowledge innovation, these were broad concepts that concentrated on the tacit and explicit nature of knowledge. In the next chapter I will concentrate on the pragmatics of knowledge management, focussing on exactly *what* is being done with knowledge in the community and how was linked with knowledge management.

In parallel to analysing the community of practice against Skyrme's model, I also took the opportunity to develop my own rich picture as a way of better understanding where new knowledge was being created. This can be seen in Figure 4. In this picture we see the small and discrete job of searching for the evidence. Within this, the intermediary, as represented by a smiley face, can be seen at the centre of the process, carrying out a range of tasks. The letter 'K' illustrated points at where knowledge was generated. This demonstrates that knowledge creation happens at many points during the process. This is elaborated upon in the next section.

Knowledge innovation in all of its guises were alive and at work within this community of practice. Some aspects of knowledge creation were recognised, planned for and encouraged, some occurred by coincidence and some did not. The analysis that takes place in this cycle helped to inform future cycles, helping with modelling and development of recommendations to the organisation. What follows is an overview of the findings in relation to knowledge innovation in this cycle.

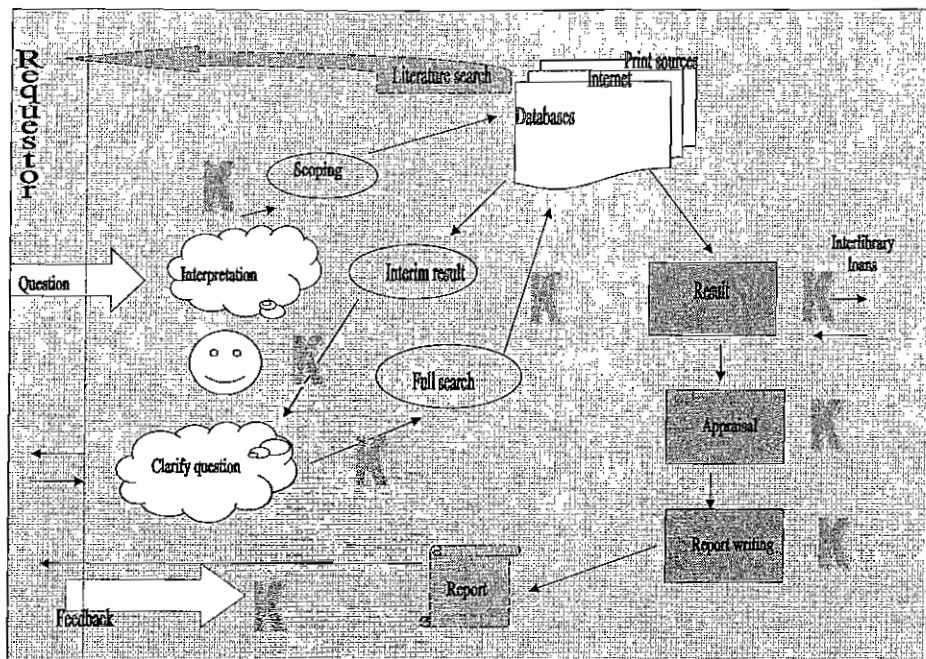


Figure 4 Knowledge being generated when intermediaries search for the evidence

5.4.2 Knowledge creation

Knowledge was created within the community with every activity, not just serving customers, but developing methodologies and ways of working, finding out what was happening within the university and hospitals. The team was always learning and therefore creating new knowledge. Many of the questions that are being asked and answered had never been broached by health practitioners within the organisation or within publicly available information. Interpretation of information and turning it into knowledge that could be used by health care practitioners was the core function and the best example of knowledge creation within the community. Within the evidence unit, knowledge moves in the following pattern throughout its transition from question to being used in clinical practice:

Explicit → Tacit → Explicit → Tacit

After a question was asked of the intermediaries, they searched for the evidence. This process could be explained as:

explicit (publicly available evidence found and retrieved) → *tacit* (interpreted and internalised by the knowledge worker) → *explicit* (written up and contextualised for consumption by the end user) → *tacit* (taken and digested by the health practitioner for implementation and use in clinical practice).

This description aligns itself with Polyani's (1966) idea of tacit and explicit knowledge at work. In this context tacit knowledge is hard to formalise and communicate, this is demonstrated through the interpretation of questions coming into the community of practice. Here some processing with the intermediary happened, this however was difficult for them to explain. Intermediaries wondered if each of them might carry out their knowledge work in different ways. Diaries suggest that this is the case and that each worker valued some types of knowledge creation over others.

"Since I didn't learn anything new, I had nothing to store or share."

"Interestingly, I learnt this quite accidentally; the Information Officer happened to mention her report in another context and then I initiated a discussion with her."

5.4.3 Knowledge codification

Within this stage of the knowledge innovation cycle, a design or a process description is developed; this embodied the idea into a more transferable form. Codification took place in several ways. As a search enters the organisation, it is developed into an answerable question following a specific format. To fit into a helpful format, users of the unit are encouraged to frame their questions in the PICO format. This creates the basic tenets that can then be searched for

Patients

Intervention

Comparison

Outcome

This format for asking questions has been tried and tested by the unit and other EBP organisations. Such structuring of questions gave the knowledge workers a format or currency in questions that could be shared and moved around the community. It forced the health practitioner who asked the question to make their knowledge about the question both explicit and transferable. Many practitioners asking the question had great difficulty

with this, seldom having to be so specific about their knowledge needs, whilst having the challenge of getting someone else to understand the subtlety and nuances of what they meant. This process of asking questions sometimes went on for some days, with the question going back to the practitioner several times for clarification. The following interaction during a group interview illustrated that this was a problem for most intermediaries.

Pam *"But also, they're 'to and fro-ing' between you and the requestor"*

Sandra *"well sometimes I end up chasing them for several days"*

Lucy *"if you can't find them, then sometimes we don't bother".*

Sally *"my problem is that I try and explain PICO to people, and try and get them to fit it into a category, but they're not interested in that, they're just interested in answering the question, and when you are going through it with them, 'but this is my question' they say, I can see what the question is, but it won't fit into PICO, they're not interested in PICO, they just want you to answer the question and I know they want you to answer the question which is fair enough".*

Jake *"Here we see that there is an over-reliance on fitting questions into formats, rather than understanding the basic tenets of clinical effectiveness OR lack the confidence to educate or turn users away and send them to the library".*

Sandra *"But I bet that some of the questions we're not even recognising as what questions they fall into, whether they're prognosis questions, like the category, for evidence-based medicine that's where it's really at, isn't it, the category, because that determines everything else".*

Here we see conflict between intermediaries sticking to the 'rules' of EBP while encouraging their users to do the same

"things were somewhat problematic this week but the difficulties were more with a poor question than the actual searching".

Another form of codification is the formal recording of searching for the evidence. This 'recipe' or template intends to create transparent and reproducible searches, with the intention of reducing bias and being open to scrutiny by both the end users that received the report and also peers outside the organisation. Searching details such as keywords and subject headings used are recorded, with the order of databases and other resources used in the process. An example of this is in Appendix 4.

5.4.4 Knowledge embedding

At this stage the unit's work was further refined and its associated knowledge was encapsulated into organisational procedures and work-related practices. An example of this was the use of promotional and instructional material developed by the community of practice. This communicated the stance or paradigm view of the community of practice to its users and had the added benefit of articulating to users of the service what types of evidence and searching could be expected.

Issues and problems about searching for the evidence were often discussed and even recorded through minute-taking in staff meetings. Solutions to these dilemmas were often recorded and made part of the protocols within the team. Such issues needed to be of a universal importance to gain such embedding, topics of a more personal nature were left up to the individual to embed in their own repertoire of work. Another way of embedding knowledge within day-to-day work was with intensive, apprentice-like training. This one-to-one apprentice-like activity is described by Nonaka and Takeuchi (1995) as 'socialization'. This is where tacit-to-tacit knowledge transfer takes place, where ways of working are observed and learned, in this case through 'piggybacking' with more experienced

knowledge workers. This approach had mixed success. Fiona explains what happened to her

"They tried to piggyback to start with, like I was assigned to Kathy to piggyback and just being in the same office with her, geographically they're saying this is who were assigning as you, support person. They said piggyback, but that meant that piggybacking was the first two or three things that I worked on with her, we did them together, but as soon as the piggybacking stopped everything else stopped".

Knowledge became embedded in the organisation through tacit and explicit modes, workers knew *what* to do and *how* to do it, but if asked *how* and they were not sure. Protocols on what to do, supported the embedding of knowledge, extensive use of the literature in the EBP was used as the basis for this.

Many processes of working were taken for granted. This was an organic issue, when the unit was small, knowledge about process was shared easily amongst three co-workers. After the unit increased in size, such tacit modes became difficult, especially as the group of knowledge workers were physically separated and not available at all times of the week. Different workers participated in embedding knowledge into processes

"if I have been through certain things I will try and document what people might be interested in, like documenting what the PBAC (health technology assessment exercise) process and the first round was and what it was like, what issues came up to try and help people who would be doing the next cycle and I would have to sit down at a meeting that was set up by the PBAC coordinator to kind of pass on the knowledge on what we'd learned from that cycle to people coming into the next cycle, could get their hands on all the little tips that are in the protocols".

The community embedded what they had learned often in evidence-based language or jargon, which was specific and well understood by themselves. It is questionable whether this was understood by outsiders or by those who had limited understanding of research methodology. This created a knowledge-sharing divide between intermediaries and end users.

5.4.5 Knowledge Diffusion

During this phase of knowledge innovation, processes were implemented throughout the community. Their application then generated ideas for improvements and so the cycle was repeated. This was the most difficult part of the analysis, often there was little proof that diffusion of knowledge had an impact on some participants as far as improving things were concerned.

Development of metaknowledge was the most significant type of knowledge that was diffused within the organisation. This included methodological knowledge about the science of appraising and systematic reviewing. Much of this was diffused through formal education and training, in documentation for new staff and for specific types of evidence reports especially those for federal government. Reaping the benefits of knowledge diffusion was unclear, much of this was related to the individuals within the team and their professional backgrounds. Some participants preferred to work alone and engage less than others in a communal feeling of improving the quality or ways of working.

Knowledge of clinical issues and an understanding of the health care organisation were diffused in an *ad hoc* and informal manner. Once again physical proximity to others was the key issue with diffusion. Observation of a working day revealed that many of the workers roamed from room to room within the organisation to diffuse and gather knowledge about the evidence, about the organisation and about processes. This also took place within the

tearoom, and at lunchtimes, when workers spent breaks together. Often the social aspect could facilitate working relationships

"a colleague was preparing a report on guidelines for hypertension and when I brought this site to his attention he found a set of guidelines that had not been located elsewhere (got a coffee made for me). The knowledge that I obtained this week was shared with co-workers in an informal setting".

This was true for the majority, the minority however relied on their key contacts to inform them about what was happening outside their own workspace. On an individual level, workers sought out like-minded colleagues who they perceived as 'experts' that could help them with specific activities such as critical appraisal and searching the literature.

Formal activities for diffusion came in the form of staff meetings on a weekly basis. Observation of this process revealed that this had multiple, often hidden agendas besides knowledge diffusion. One participant explained the participation of Craig, the supervisor in this

"yeah, in those meetings people would mention databases or resources they have used, you'd hear about things even if you hadn't asked for it or 'you might want to look at this database' even Craig would say 'hey there's a lot of stuff in this particular database'".

Here a great amount of politicking, posturing and displaying of expertise took place across the many levels of the community. The role of discussing new knowledge generated could not be underestimated, and is described in this interaction,

Jake *"When we did it (discussed evidence requests) as a group, when you were allocated a question he (Craig the supervisor) would sometimes say useful things, it was kind of helpful for getting started".*

Kathy *"So would it be good to have him (Craig) at our Tuesday meetings?"*

Sandra *"He was coming for a while there. It kind of changed the flavour of things, it really, really changed".*

Jake *"Now it's just get new questions and leave".*

Methodological meetings also took place, these concentrated on more 'pure' types of knowledge diffusion, that of methodology, interpretation and ways of presenting the evidence in a systematic manner. Journal clubs served a range of purposes, the most popular purpose for this was to share methodological issues, several paradigm views were challenged and debated during this process. One participant explains

"informally people will just come up and ask you, I guess people get to share through the journal club series they get a formal opportunity that they've been involved in to present to everyone else".

This was a mechanism for those with minority views, such as qualitative researchers to get 'air time' within the community. One participant with an interest in matters qualitative describes her feelings

"it drives me crazy that qualitative research is viewed as some oddball thing, we have 'special' journal clubs to discuss this, but they do generate quite a lot of discussion and debate".

5.5 Specifying learning

From this cycle I learned that a range of data sources needed to be combined to create a full picture of knowledge innovation within the organisation. Self-reporting through interviews and diaries only painted part of the picture, this needed to be augmented by my own observation and analysis of the organisation's documents (see Appendix 1). Some participants were uncomfortable with full disclosure of what they knew and didn't know, this was despite the information being kept confidential. The group learned that they had had little experience in talking about conceptual issues to do with their work. Reflecting on what they did and what their priorities were, was a way of developing cohesion within the group and trust in me as the researcher. Because participants were unfamiliar with thinking about their own work in terms of KM, it was a challenge to elicit information in an informal way. At times there was confusion and interchanging between the notions of information and knowledge. For some participants this opportunity to reflect on ways of working required time and facilitation. Data collected from the participants was interpreted in terms of a KM framework, this also meant applying my own knowledge and background reading to actions and structures within the organisation.

Rich material was gathered from the diaries, especially in the area of knowledge creation, although 'creation' was open to interpretation at two levels. The first level was new knowledge about clinical and hospital issues; participants learned much about illness, treatment and diagnosis. The other, perhaps more interesting level is that of metaknowledge: knowledge about where to find knowledge. This was in the form of knowing where to go to find out about the evidence, especially when question fell outside the scope of the 'traditional' databases used. There was a wide recognition that there was no systematic capturing and storing of many forms of knowledge that were created. Sharing and recognition of new forms of knowledge often happened through serendipity, through informal channels that are an integral part of knowledge management. There was however lots of potential but there is much that could possibly be slipping through the informal net. The need for systematised knowledge codification and embedding, with better diffusion could be proposed as recommendations to the organisation.

An analysis of what was taking place within the community of practice led to the conclusion that many concepts of knowledge management as outlined in the literature do apply. Some parts of a knowledge innovation model were better displayed in the community of practice compared to others. An example of this is a comparison of knowledge creation to knowledge codification. At every point of the organisation the participants and I had been able to identify knowledge being created. Much of this was not embedded or codified within the community, it simply stayed with the individual, meaning that others within the same community did not benefit from interactions that were taking place. Instead they came across useful knowledge by serendipity.

Confidentiality of participants and their contribution to the project were discussed and treated with great caution by the University Ethics Committee. Despite this and my reassurances as a researcher, I still received the following comment

"Gabby, there was one other issue I wanted to discuss. With those diaries, because there's no anonymity, sometimes I might not tell you that I learned something new because I would assume that because I have worked for the evidence unit for so many months, I should have known something like that a long time ago, and maybe other people feel the same way, that they don't. Because you know us, I could be afraid that you would think I was an idiot".

This illustrated that one of the participants did not trust me as a researcher, perhaps because I was a participant-observer within the organisation, I was 'too close for comfort'. As a more senior member of the team who was expected to know much about EBP and searching, this respondent was potentially exposed for her lack of knowledge. Sharing a lack of knowledge or lack of understanding is an integral part of the knowledge innovation and management. For this community, admitting 'not knowing' in a safe supportive environment was not prevalent and required challenging at a cultural level.

5.5.1 Suggestions for improvement

At this early stage of the research, participants expressed concern with senior members of the community of practice. Craig, the director, was not available to share knowledge at key times. Doing so, was an opportunity for everyone to hear what was happening, to learn and share. Ceasing this activity stifled knowledge codification and embedding. Process knowledge was also lacking at this stage, minute-taking was the most prevalent form of making explicit knowledge about processes of the organisation. This could be improved if the required time and organisational support was given to achieve better knowledge innovation.

Feedback and discussion from the diaries led participants to the conclusion that there needed to be better standard operating procedures that explained the steps of knowledge working, especially in a climate where new staff were entering the community. Developing better ways of knowledge diffusion were also acknowledged, although participants were glad to understand that less formal ways of diffusion were valid, this was part of what they enjoyed about the work. There was however the challenge of letting all knowledge workers participate in such informal ways of diffusion.

Further action was to seek out methods of improving knowledge sharing and utilisation through the use of technology, but also through creating solutions that address culture within the organisation. Suggestions from the team to improve this situation were to make use of the shared computer drive, explore the potential of the Intranet and to systematise the collection and electronic retrieval of completed evidence reports.

Within this cycle I have focussed on knowledge innovation rather than an inventory of knowledge sharing. Closer inspection of how knowledge is being managed and an analysis using the knowledge sharing cycle will be subject of the following action research cycle.

5.5.2 Reflections on methodology

The richness of the data collection techniques used within this cycle enabled me to elicit the 'worldviews' from participants about their own environment and knowledge creation activities. While this was one of the central planks of this research, it also needs to be contrasted with the worldviews of service users, and of peers working in the area. For the next cycle I will use a systems approach in order to more specifically and systematically describe what is happening within the community of practice in relation to KM sharing.

5.6 Chapter Summary

This chapter has articulated the knowledge innovation within the community of practice. A rich description of the complexities of the research environment demonstrate that that several methods of data collection will be required in order to link activities to KM, and then to theory and the research questions.

As an immediate response to participant needs, a range of recommendations was developed to improve what is taking place, which will be tested by the participants through the project. While knowledge creation was the focus of this cycle, data collected created a springboard for developing further the concept of knowledge management and a systems approach to understanding the community of practice.

As a starting point, exploring knowledge creation was perhaps the easiest part of the knowledge innovation cycle. What is now required is to gain a full picture of the knowledge sharing cycle through systems thinking, this will help in systematically exploring what is taking place in the research environment and is demonstrated through the next cycle.

Chapter 6

6. Cycle Three

By this stage the richness and complexity of the EBP environment is being understood. In this chapter, I move to carrying out systems analysis of the community of practice. Here Soft Systems Methodology (SSM) (Checkland, 1990) is used to understand purposeful human activity. This is a method for describing and modelling the current and 'ideal' system within the organisation. A rich picture is used as a way of explaining graphically what takes place when a health practitioner interacts with an intermediary in order to find evidence about effective health care. This work lays the foundation for the next cycle where there is an integration of conceptual modelling and knowledge management, illustrating knowledge sharing within the community of practice.

Diagnosing	How can I describe the system that we work in? How can it be modelled to explain what intermediaries do and where they want to go? (MR)
Action planning	Using SSM to help map out what is happening within the research context
Action taking	Soft Systems methodology applied, participants help develop rich pictures and CATWOE. Feed this back to participants.
Evaluating	A generic model and rich picture is used to describe the work of the intermediaries. The processes that take place can be described and understood using SSM. This is then matched to knowledge sharing in moving towards a new purposeful activity system that future action can aim towards.
Specifying learning	Divergent views on rich pictures and models need to be brought together to represent a 'group view'. A range of improvement can be suggested to get participants to the desired situation.

6.1 Diagnosing

During this cycle I completed an analysis of knowledge management issues using SSM. The last cycle generated a rich description of many of the components of tacit and explicit knowledge within the activity of the evidence unit. In this cycle, SSM was a way of articulating the aims of the unit as a purposeful activity system. All such descriptions culminate in the development of a conceptual model and a description of knowledge sharing.

One action in this cycle was to seek out an appropriate generic model or description of knowledge sharing that reflects what was happening with the participants and highlights the participants' worldview.

Throughout this research, improving ways of working within the community environment have been a motive for me as a researcher. To this point, a general picture of knowledge work and innovation has been established. Recommendations in relation to knowledge management activities from the previous cycle were acted upon in small and systemic ways. The use of senior members of staff as sounding boards and for acknowledgement of new knowledge has been implemented through attending weekly meetings.

While small incremental changes are part of the improvement motive of action research, I needed a systematic approach that was based on users' needs and organisational direction.

To analyse the situation more systematically and to develop recommendations for improvements linked to intermediaries' goals Soft Systems Methodology (SSM) was used.

6.1.1 Soft Systems Methodology (SSM)

Soft Systems Methodology (SSM) was developed to explore 'purposeful human activity'. SSM was used to enhance knowledge of the problem and situation within the unit and come up with a useful intervention for improvement (Checkland, 1981). SSM assisted me in moving beyond simply generating knowledge and theory about participants, to solving real world problems.

As the research progressed participants could gain both an understanding of the world around them, and collaborate and participate in solving problems, which were relevant and meaningful to them. Using SSM gave me a form of structured inquiry, in two streams; one where models of human activity systems were named, modelled and used to illuminate the problem, the other where perceptions of the real world were examined. Comparison of the two structures created debate about change. Applying such inquiry to problem in knowledge management sought to bring about changes in the real world of participants. This cycle also aimed to develop a prototype system to illustrate a proposed KM systems solution that is explored in cycle six.

Data collected from diaries, observation, and interviews provided a basis for developing a rich picture (see Figure 5). This was a graphical representation of the process of how health practitioners asked questions of the unit and the process of intermediaries answering such questions. This created an ideal format for discussion with the participants, as it pictorially represented my interpretation of the process of dealing with evidence requests. The rich picture is a joint representation of mine and the participants' interpretation of what was taking place within the system. This needed to be debated as a realistic and meaningful representation of the evidence unit activity. Through this we were able to see the relationship between the intermediaries, the health practitioner and the type of interaction that took place between the two.

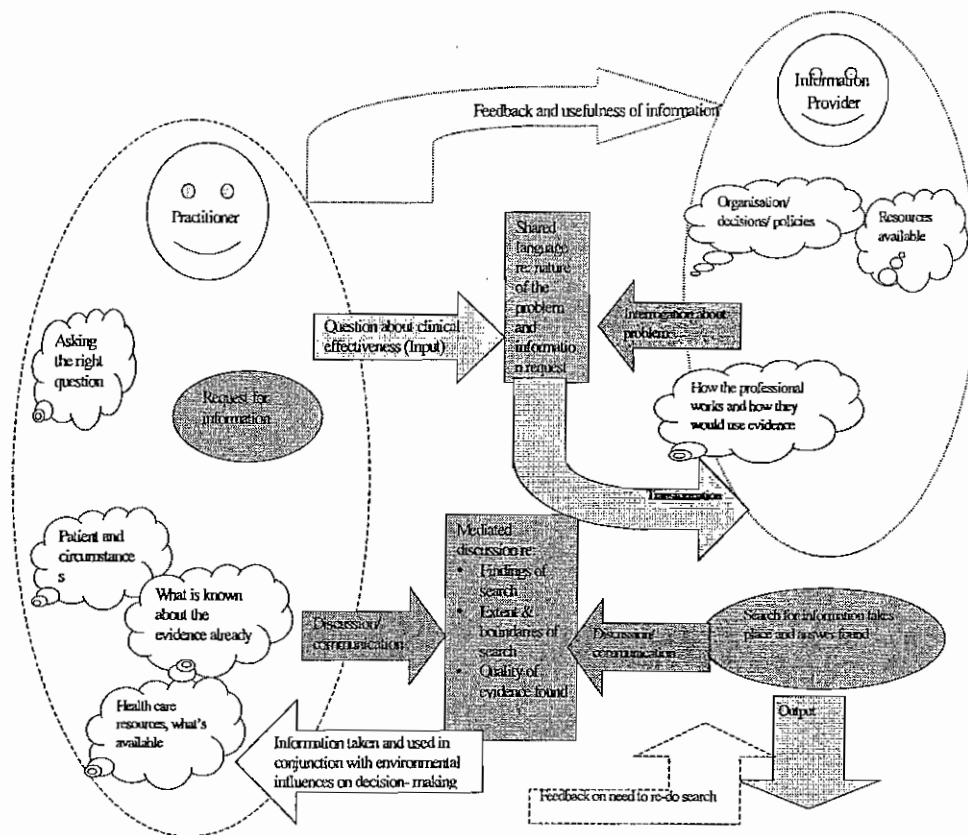


Figure 5 Rich picture of the evidence unit dealing with evidence requests

6.2 Action planning

Part of the action plan was to develop a conceptual model. This model would show both the participants and I what type of system was needed to underpin any technology or process to be developed to help with their knowledge management problems. To achieve this, I needed to gain an understanding of the very basic activity of dealing with evidence requests, searching for the evidence and supplying an answer. From this understanding I could tease out where the knowledge sharing emerged.

SSM was a way of structuring the way in which we think about systems. The key to a purposeful activity system was the transformation process. This was explored by using the CATWOE mnemonic: customer, actors, transformation process, Weltanschauung, owners, environmental constraints (Checkland & Scholes, 1990). This mnemonic reflects the core elements required for a transformation to take place. Within this, we are able to get an idea of not only what the transformation within the system was, but also understand the purposeful activity and who can oppose such transformations from happening.

To this end a CATWOE was developed to articulate to customers the main aims of the system.

CATWOE

- **customers:** health care practitioners
- **actors:** intermediaries who provide the transaction
- **transformation process:** request for evidence transformed into knowledge to inform decisions
- **Weltanschauung:** using the best available evidence can enhance decision-making about effective health care
- **owners:** intermediaries
- **environmental constraints:** time to search for evidence and availability of 'good quality' evidence

Using the above elements a root definition has been developed.

Root definition

A publicly owned health system staffed by appropriate professional intermediaries who retrieve, sift, appraise and evaluate the best available evidence to support clinical decision-making

This root definition expressed the core purpose of the activity system. This core activity depended upon obtaining the right evidence to answer the question, but also the skills of intermediaries involved in the activity. The core element of such a root definition was its transformation process in which the defined input (question about what is effective) is transformed, into a defined output (the best available evidence, made relevant to the user).

6.3 Action taking

Moving from rich pictures and root definitions as a description of what was occurring required the input of the participants. This was a way of negotiating accommodation on what was happening and a way of reflecting the participants' worldviews.

6.3.1 Interviews about rich pictures

These interviews aimed at getting feedback about how close to reality the newly developed rich pictures were. The proposed rich picture from this and the previous cycle were sent with an explanation to research participants the week before the interviews took place. This gave participants an opportunity to read and look at the rich picture before a discussion proceeded.

Six participants were interviewed due to the absence of one of the participants over a two-week period. Interviews were recorded on tape and followed by a semi-structured interview (see Appendix 9 for the interview schedule). The aim of these interviews was to gain feedback about the relevance and feasibility of the rich picture to participants in their role as intermediary. Despite receiving copies of the rich picture prior to interviews, I needed to explain and describe in some detail the components and flow of the rich picture. This gave participants an opportunity to clarify their own understanding of the picture. From this point the interviews began.

Interviews took approximately 30 minutes and sought to find out if the rich picture was a true representation of the unit. This was followed by a semi structured interview format, giving participants the opportunity to elaborate on aspects of the rich picture that were important to them. These interviews were taped and transcribed and then imported into

NVivo™. An analysis of this revealed that there was support and an understanding of what the rich picture aimed to describe. There were however different opinions on some parts of the picture. An example of this is that individuals with an information background put more emphasis on negotiating the evidence question with practitioners and interacting with them to 'get it right'. Those with a health care background took a more paternalistic approach and decided on what was an 'appropriate' question to ask, rather than spending extended amounts of time chasing up users and negotiating a question. Gaining feedback from users after they received evidence reports was achieved in a range of ways, the most common being the completion of feedback form, the other being informal feedback to intermediaries.

The overall consensus was that the rich picture was a useful way of representing what was happening at local level. The largest area of dissonance was where the diagram described interacting with requestors; this depended on the individual intermediary

"I think I've done about twenty or twenty-five of these things I think I've only talked to two of them".

Rather than approaching the requestor after they posed the question, another took the following approach,

"sometimes the question is so vague we interpret it our own way and we offer them (without mentioning it) 'why don't we do it this way or downgrade it to a literature search'".

Focussing on the 'types' of questions was important and could be influenced by the intermediary's background, the model therefore required flexibility to suit the ways in which individuals worked. This was displayed in an interaction with Jake, who had a scientific background

"There are some questions that I avoid, that's the sort of question George (a nurse) likes, I prefer not to because I know it takes a lot of interaction and there is no time for that... ones on modelling for psycho-social services or 'wishy-washy' questions like that. They may be the most important questions but they are not focused enough and they take a lot of effort to allow focusing to take place. So this (referring to a chart or model) may reflect the way we were supposed to do things but I find myself skimping on some of these things to streamline the process to better suit the way I work".

Sharing knowledge and understanding of the health practitioner's world took on different forms

"For some people they may have considerable staff knowledge of some of the information that's already been asked so sometimes I am able to pick up the contacts of the information requests because of the background I have. It might be shared knowledge here and here for example (pointing to rich picture). The practitioner and the information provider might share some of the knowledge".

For another it was negotiating all the way, so that interacting with health practitioners was essential

"I think we all have a certain amount of professionalism, that we want to give people a good service and most people would not want to look unprofessional, and that we really go out of our way to say 'its that what you want? Is that what you want?' If we still can't settle it, we will send the material

and say 'look can we together and work on this, have a look and we'll get together and see how this fits into your question', and that's happened as well".

Others rejected the idea of interacting with the requestor as unnecessary or somewhat harmful to the output of unbiased evidence. In response to questions about understanding the context of health care

"I just concentrate on giving the answer. I think that's ideally how we should be working, as opposed to sending our biased source of information. But maybe I don't know how a lot of them work, I don't know how the organisation works anyway".

6.3.2 Developing a conceptual model

The next action was to turn the rich picture into a conceptual model. The purpose of the conceptual model was to accomplish what had been defined in the root definition. This was an account of 'what the system is', while a conceptual model is an account of 'what the system must do' in order to be the system named in the definition (Checkland & Scholes, 1990). The relationship between root definition and conceptual model was that of 'being' and 'doing'. The following conceptual model in Figure 6 depicts the process of turning a request for more knowledge in the clinical area, the transactions involved and the end product for the user. While this brings together data collected from research participants, it also uses my observations of the community of practice and my previous experience. This initial conceptual model is a way of understanding and articulating how the evidence seeking process progresses, and where knowledge is generated. Up to this point, neither participant, the literature or myself has made this process clear.

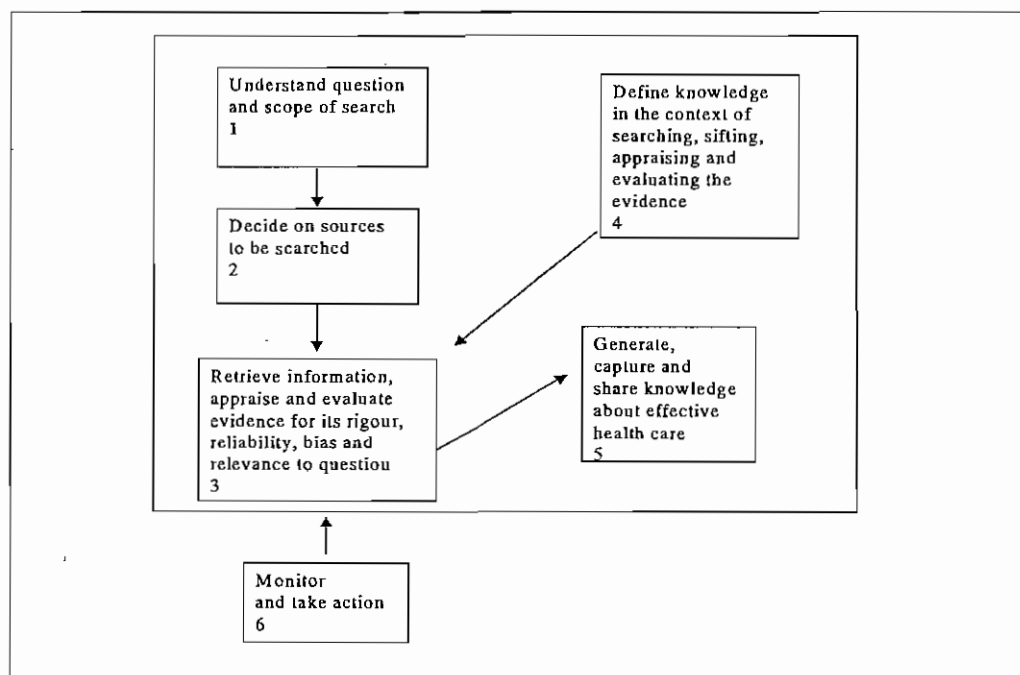


Figure 6 Conceptual model of evidence unit work

6.3.3 Comparing the conceptual model to perceived reality

The next step was analysing the system to compare the conceptual model to what was happening in the unit. This comparison was to “have a well structured and coherent debate about a problematic situation in order to decide how to improve it” (Checkland & Scholes, 1990, p. 42). Checkland (1981) describes four ways in which comparison can take place, through informal discussion, formal questioning, scenario writing and trying to model the real work in the same structure as the conceptual models. From these I chose to use formal questioning with participants, mainly as a way of focussing discussion and getting answers in a timely manner. This took place in a range of one-to-one interviews that were taped and transcribed. I was able to conduct four interviews in one week to gain feedback. Checkland and Scholes (1990) describe a range of methods in gaining feedback and deem it not necessary to gain the views of all participants, but enough to gain a range of opinions.

Some responses to the model were confirming what was happening

“This is a great characterisation of these things”

and

“Well I think that maybe it’s quite generalisable because it’s fairly accurate”.

The exercise of sharing and debating the model was one of clarification and verification. Feedback about the model confirmed that this was indeed a good representation of what took place when handling an evidence request, and its journey towards being answered.

By exploring the conceptual model with the participants I was able to understand to what extent the model and their activities were taking place in the real world. This was the first iteration of a root definition, CATWOE and conceptual model. In this iteration I was seeking to clarify the act of seeking the evidence, the more complex issue of marrying this with the knowledge sharing and innovation cycles is dealt with at a later phase of the research. At this point I had expected the rich picture and conceptual model to closely match the *status quo* within the community of practice. The comparison between the model and the real world was therefore simple and was used as a facility to develop systems thinking and discussion among the participants.

6.4 Evaluating

Sitting behind the conceptual model were a range of knowledge sharing activities that needed to be articulated in order to understand whether concepts of KM could be applied to the community of practice. This was achieved by marrying together the processes articulated in the conceptual model in Figure 6. Knowledge sharing cut across the whole of the conceptual model; that is, each step within the conceptual model represented a range of knowledge sharing activities. To create and understanding of this, I have used Skyrme’s (1999) framework to analyse knowledge sharing. Using this as a theory or framework for explaining knowledge management “highlights and explains something which one would otherwise not see, or would find puzzling” (Gilbert, 1993, p. 21). To achieve this, I brought all these abstract issues together in one table. Here I outlined each step from the conceptual model (column one) and ideas of knowledge sharing and innovation (column two and three) as described by Skyrme (1999). This was a way of linking the issues in one place and see where the knowledge sharing cycle could be laid over the conceptual model. The results of this chapter are combined with an external peer review in chapter 7 to create a more complex conceptual model that marries this work together with the aim of articulating what is needed to move from conceptual thinking to selecting a KMS.

6.4.1 Knowledge sharing activities

Linking the conceptual model to knowledge sharing helped me unpack the KM issues within the organisation and also helped me work with research participants to achieve improvements in their work environment. To do this, I linked each stage of the conceptual model to both knowledge sharing and innovation cycles. In this way, I gained a clear picture of exactly what was happening at each step of the conceptual model, and answered questions about whether knowledge-sharing activities were in place and how improvements could be made to the system. This was a way of linking the 'real world' to what was desired as far a KM was concerned and laid the ground for developing a final conceptual model to reflect KM within the community of practice.

Table 3 Linking conceptual model to knowledge sharing

Step in conceptual model	Knowledge sharing activities present	Knowledge innovation
1.Understand scope of questions	Knowledge identification	Knowledge creation Codification
2.Decide on sources to be searched	Knowledge identification and collection, knowledge access	Knowledge creation
3.Retrieve and evaluate evidence	Knowledge organisation and storage, knowledge access	Knowledge creation
4. Define knowledge in context of searching, sifting and appraising	Knowledge identification	Knowledge creation
5. Generate, capture and share knowledge	Knowledge sharing and dissemination, knowledge access	Knowledge diffusion
6. Monitor and take action	Knowledge use and exploitation	Knowledge diffusion Knowledge access

Using the knowledge sharing cycle on the 'mechanics' of what happens to knowledge within the organisation. Through my analysis of data collection and observation and through the use of Table 3 the participants and I have made recommendations about what the community could do to address some of their KM issues.

6.4.2 Knowledge identification and collection

There were both formal and informal processes in identifying and collecting knowledge, these were both explicit and tacit and changed according to both background and the experience of the intermediary. Broadly developed protocols or criteria of knowledge work were made explicit and were part of training and induction of new intermediaries. Already established and developed criteria for selection of good-quality evidence are understood at an international level and by the participants (Fennessy, 2001; Hunt, Jaeschke & McKibbin, 2000). Many of these are based around levels of evidence, filters and hedges for searching databases such as Medline, and protocols developed for searching by

organisations such as the School of Health are Related Research at the University of Sheffield (ScHaRR, 2000). Many of these tools were useful when there were questions about treatment or intervention, but methodologically these often did not apply to questions concerned with screening and diagnosis. For these problems, different sources and hierarchies were used.

Outside these specific sets of guidance, searching other sources such as the Internet were *ad hoc*, little was saved, discussed or reused in this area. Successful searches in the early days of the unit were shared amongst the smaller team, but as this team grew, there were diminishing opportunities for group identification of metaknowledge.

Experts in searching or identifying the evidence existed within the community and were referred to for their expertise, sometimes through trial and error

"it was never said to me 'if you have a searching question Kathy is our searching specialist, go to her or anything like that... I'd work out who had the most expertise in which area'".

Knowledge generated through the evidence-seeking process was classified in many ways, including by originating source and by information source used. Classification was also applied to the types of evidence retrieved, sifted and placed within evidence reports. An example of this is the systematic reviews and randomised controlled trials (level I evidence) that are used in preference to other types of evidence, such as case controlled studies or case series (Centre for Evidence Based Medicine Oxford, 1999). More qualitative evidence was discounted for the majority of evidence requests, as it fell outside the paradigm view of the community of practice. This was also used as a way of creating boundaries around the scope of evidence reporting. Evidence that was classified as qualitative was not retrieved and was viewed as difficult to interpret from abstract information

"It was quite task to sift the evidence for one question because the protocol for the project is to read only abstracts (unless the articles are available online (because it is a quick turnaround project). Thus it is often difficult to deduce the specifics about a study from the abstract, as the information just may not be available".

Unfortunately for these knowledge workers the classification of level IV evidence, such as case study reports, made life a challenge, as expressed by the following

"Why am I always reviewing level 4 evidence !!!"

6.4.3 Knowledge organisation and storage

Storage and organisation of knowledge differed between type and knowledge worker. Many of the favourite sources used by some did not become communal knowledge that could be easily or automatically accessed by the community, as they were stored on the individual's personal computer. Much of the knowledge created and directly relevant to individual requests were encapsulated within the specific evidence reports. This however, did not necessarily mean that others found out about it

"the report was written, but is only seen by a small group involved in the project".

and

"the information I found went straight into reports. I didn't share the information with anyone".

Hard copies of evidence requests, their related documentation, supporting journal articles and original sources of evidence were kept. These items are retrievable in a manual way,

and the community was constrained by the library systems in the hospital and university and statewide networks that they drew upon for the hard copies of resources. These constraints that Australian Copyright laws (Australia, 1968) had on the reproduction and electronic storage of information from published sources were also relevant. It was unlikely that this issue could be resolved easily without breaking the law under legislation, documents are for personal use and not to be copied.

Because of the manual storage of items and small personal collections, the situation of small islands of knowledge had developed, each intermediary could be unaware of what was held by the organisation. Much of this could be resolved with public discussions regarding knowledge creation within the community. The paper-oriented approach that dominated the local environment was often beyond the control of the community, getting information to turn into evidence reports came from paper sources

"Well, my articles at this present time are sprawled on my desk because I am actively using them. But eventually they will be sent on along with the report".

The community of practice in this situation became victims of wider organisational and systemic inefficiencies that relied on old ways of working.

6.4.4 Knowledge sharing and dissemination

Sharing and dissemination of knowledge took place in many different ways, the most common was sharing knowledge through staff meetings where problems and issues of the evidence were brought to the group. Most knowledge sharing and dissemination was through intermediaries seeking out knowledge through 'pull' technology, this is using technology to seek out what was available in EBP field. No 'push' of knowledge out to users took place on a systematic level. It was noted that some individuals did subscribe in a personal capacity to 'web crawler' services on the Internet. This is where information related to EBP was dropped on to their desktop computers on a regular basis. This type of free service and technology was not shared with the group. Interestingly participants did not mention the use of technology for sharing and dissemination, when asked they mainly referred to face-to-face interaction as the mode of sharing and dissemination. At this stage I interpreted this as a lack of awareness of the opportunities that technology afforded the community. This was not surprising, the majority of participants came from health and research backgrounds where the uptake and use of information technology were often under exploited.

Dissemination of knowledge took place in an *ad hoc* way, and was often dependent on the motivation of the individual intermediary. An example of this was forwarding on new EBP websites. Observation over a two-year period saw two specific individuals do this much of the time. It was unknown whether these emails were followed up or ignored by recipients. Informal opportunities to share and disseminate what happened were often geographically constrained. Those sharing offices or within close proximity were more likely to use this as a method of sharing. Hallway and tearoom conversations were also helpful in seeking out experts for help and problem solving.

6.4.5 Knowledge access

Ways of accessing knowledge were limited and affected by the technology available to the community of practice. Shared computer drives were only be available during the last 12 months of the study; this was due to merging a range of small organisations under the auspices of a new institute of research. There were also differing opinions about the uses of shared repositories for knowledge. Some viewed it as a storage facility for the items that were not wanted on their own personal computers, it is also viewed as a backup for their

files in a safe place. Access to people's individual collections of knowledge was limited, some of it was embedded on personal computers and within the personal filing cabinets of each individual. Manual storage varied across the life of the project, when the community was small, most codified knowledge was stored in hard copy, within one area. As the community expanded, this became more challenging, getting ready access to hard copy was a chore that required 'leg work' and movement between offices. This mode of physical access relates to comments made in the previous section, where the preferred mode of gaining explicit and tacit knowledge was interpersonal, demanding a physical presence of either materials or peers. With a mobile and often part-time working community, this had the distinct disadvantage of not being available when needed.

6.4.6 Knowledge use and exploitation

Knowledge was used as part of the work process where it was refined, developed and occasionally reused. In discussion with, and observation of the participants, this could be viewed many times, each time an evidence request was tackled. The intermediary reused their own knowledge of both resources and EBP methodology to create quicker and more efficient searching and appraising of the evidence. In this situation processes contribute to the ongoing building of memory which reflected experience, and knowledge of the task. Here we can see that the complex task of evidence-seeking was influenced by past experience, the intermediary took the problem to develop their understanding not only relevant to this context, but took the 'knowledge' that had been gained from one encounter, to inform further encounters with other practitioners.

This scenario has been highlighted by Fennessy and Burstein (2000a). As past instances of task performance are stored in memory, the actor has an individual model of the task (implicit/explicit) as well as access to the shared knowledge and understanding of the task developed by other members of the team. To carry out the task at hand, the intermediary 'makes real' the task model by filling it with information relevant to the current situation. Memory helps the intermediary adapt task performance to meet the specifics of the current inquiry. The individual memory helps the intermediary to provide the historical basis of developing, creating and changing tasks to ensure that the information provider reaches his or her goals. This past experience, of individual and organisational memory, moves the intermediary into the position of consistently seeing a range of practitioners seeking the evidence, and thus builds upon these experiences to provide faster, more sophisticated solutions to complex questions.

The use of knowledge that was captured within a community context varied. Much use depended on the individual knowledge worker and the time they had available to seek out existing knowledge for reuse and exploitation. Existing manual systems and lack of file sharing hampered fast and immediate access to resources and knowledge. Availability of co-workers also influenced knowledge use, if peers were around to consult with and share tacit knowledge, then the amount of knowledge use was high.

It was recommended that more proactive knowledge storage and organisation would greatly help the amount of knowledge exploitation. Time was needed to dedicate to the task of doing this so that availability of knowledge from the individual's desktop would facilitate knowledge use. Raising an awareness of the importance of exploiting current knowledge and skills within the community took place as I discussed the hidden knowledge that could help others save time and stop them from 'reinventing the wheel'. An example of this could be reusing teaching materials and notes to form new educational events for unit customers.

6.5 Social and Political analysis

As part of gaining a broad understanding of the context and culture of the organisation, Checkland (1986) recommends that a social and political analysis be carried out. Much of this has been carried out through observation and through interpretation of data analysis as the research has progressed, highlighting the complexities of working in a multidisciplinary environment, where much is left unsaid or unacknowledged.

6.5.1 Social analysis: roles, values and norms

Within the case study there were underlying social issues that were important when thinking about applying KMS. These were the roles, values and norms of the intermediaries that had an impact on the development and implementation of any solutions that were arrived at. This analysis is described as Analysis Two by Checkland (1986), and gave insight into the community of practice, a climate that can possibly be ignored in systems analysis. Analysis of this group is on the research participants only, and focuses on their role as intermediaries not as distinct their originating professional grouping as doctor, nurses or researchers. To this analysis they bring a united in their worldview through their task performance.

The headings of roles, norms and values have been described by Checkland as interacting elements that make up a 'social system', defining and redefining themselves in relation to each other all the time. I have analysed the participants from these perspectives, not from direct questioning but through observation and careful analysis of participant data.

Roles: to carry out a range of activities supporting EBP within hospitals to improve decision-making and the quality of health care. As an adjunct to this, all intermediaries had the role of managing knowledge, their own and that of the community. Knowledge management roles were unrealised roles by the research participants, little was discussed about managing their own work beyond that of 'doing evidence requests' so that introducing new ideas about how to work and a realisation of work process was a challenge.

Norms: differed for the range of clinical and professional groups represented in this team, such norms when applied to EBP also differ depending on background and training in the area. Norms in relation to managing knowledge also differed, those with an information management background and those intermediaries who prefer structured procedural ways of working are more willing to put time in managing knowledge.

The backgrounds of senior staff had an impact on the potential for KM. The casual approach to developing protocols and formalising processes created a challenge for managing knowledge, one participant mentions the frustration

"You'd be frustrated, absolutely frustrated. You can look over the staff members and the staff members who prefer or lean towards more structure are the ones that are frustrated, the ones that don't care about structure and total lack of structure suits their lifestyles... they couldn't care, but there's got to be a balance".

Values: these were intrinsically formed within the group. As the group contained doctors, nurses, information people, and researchers from health care and the academic sector, some of these values were brought into the group. Other values developed over time and were negotiated and became tacit without much challenge. Ideas about managing

knowledge rated a lower value than that of doing the 'real' work of answering evidence questions. The impact of senior staff, management and administration could not be underestimated; their attitude and behaviour developed values that filtered through the community.

6.5.2 Political analysis

Carrying out a political analysis of groups is described by Checkland (1986) as Analysis Three. Politics in this sense is not formal politics, but the power plays and prevailing mood of the community of practice. Within all purposeful activity systems there are politics, this is part of the nature of studying people and the ways in which they interact. Reflecting on the politics of the research situation provided useful insight into what influenced the community to change, improve, or indeed, stay the same.

Paradigms in EBP differ between the clinical professions, with medicine having a fairly narrow focus in acknowledging what the 'gold' standard of evidence is (National Health and Medical Research Council, 1999). For intermediaries in the community, the focus was on systematic reviews and randomised controlled trials. This was reflected in the philosophy and focus of knowledge delivery provided by this unit. In relation to knowledge management and systems to support such work, knowledge became a commodity for power, developing exclusive roles and an over reliance on particular members of the group for their skills and knowledge, this is highlighted through the following statement

"then there's also a flip side of course. That's when you've developed what we have right now, a dependency on a linchpin person that comes from below and really weirdly from above. Management, for instance has no grasp of what's happening on the floor".

My observations of the democratic nature of the community meant that this was not negative, only when it came to leading the group. In this situation, intermediaries were sometimes kept out of decisions that influenced them, and as a reaction to this, intermediaries did their own thing. An example of less positive influences within the community included the restructuring of the organisation

"The way I approached work is "if you can't beat them, join them ... then beat them up. We've had discussions with upper management about how to approach things, my own understanding is, the decisions they make are far removed from the floor, so they can say one thing. I'll say try plan A and they'll say try plan B, sure I'll consider plan B, but I'm still implementing plan A. ... do you remember a few weeks ago when there was this whole talk about restructuring. We got together with a whole lot of information officers to discuss what was wrong with the restructure, what we felt was wrong with the restructure. The end point, was essentially a manifesto to Craig which he didn't take too kindly, ... they (management) pushed on with a structure that's better for managing a group of fifty, it doesn't manage a group of sixteen".

With these comments we can see the divisions within the community that became a distraction for many of the intermediaries, getting KM onto the agenda had become a challenge.

Vocal members of the group also influenced the interpretation of what knowledge was important and therefore what should be stored and shared within the group

"Maybe I shouldn't say this but, I think that questions on continuing education, to me they're not clinical effectiveness questions. They might well be clinical effectiveness questions but to me they're not. So I might not put in so much effort into something that for me is a clinical effectiveness

question. So we might be selective as to how much effort we put into a particular question depending on how important we think it is. For me anyway, I don't know about anyone else".

There also some unhappiness about this

"If they've asked for a comprehensive level C report, then we go into discussion about the level and quality but if it's a literature search, no, just the extent of the boundaries. Well the quality of the evidence is marked against the abstracts but you never discuss it. It is (written) in the report, this is level I, this is level II, this is the hierarchy but you don't have any discussion, it's a bit unsatisfactory".

Intermediaries work at many different levels, the 'officially' recognised one, and the more tacit level

"There are at least three levels at which I work. The most common understanding of what I do is essentially what is written down in my position description ... it's one thing to understand my position description point of view, but entirely different ... but you'll be able to understand what I do on paper but you'll miss out on all the intangible things that I felt I've done over the last two years".

The experiences of information technology amongst participants varied. Most workers had most of the hardware and software that they needed to do their job, but through budget and organisational constraints were sometimes limited to the types of software purchased and used. Within the public sector these restrictions need to be understood and couched within a specific context, I realised that participants were often victims of circumstance and environment. Intermediaries also had the added conflict of working within a health care organisation but also belonging to a university department. In this case it can be said that they had 'two masters' as far as IT was concerned, that of the distant university that set policy and licensed products, and also local IT support and expertise. The knowledge management literature seldom acknowledges such constraints and conflict, rather than presenting a sanitised version of the community of practice, revealing these issues was important to adding understanding and richness to the research story. It also illustrated that the constraints of the everyday work environment prevented a linear approach to carrying out action research.

The politics of this scenario made it difficult for the community of practice to be autonomous as far as funding, infrastructure and IT issues were concerned. Much depended on vocal influences within the parent organisation to make decisions for them. An example of this was the setting up a local server, this took considerable time to purchase and implement because of the aforementioned problems. Discussion raged about the use of the shared drive as an unrestricted storage device compared to a knowledge repository where control of content and codification needed to be addressed. Being a publicly funded health care organisation with a small operating margin meant that the group was unwilling to spend or justify large investments in both systems, software or staff time to carry out dedicated KM work.

6.5.3 Climate of the community of practice

The community became split in half during the life of the project, one group of participants went on to carry out technical appraisals of health technology. The other group was 'left' to carry on with evidence unit requests and implementation of evidence into clinical practice. This had a deleterious affect on the cohesiveness and mood of the participants

"I think another obstacle that stops the organisation running optimally has been the drawn out restructure process. It took a lot longer and was a lot more painful than it needed to be and I think it really dented a lot of morale and it was disruptive to work. People were not feeling as committed and having more to complain about and it did disrupt the daily work. It interrupted everyone meeting their goals".

Despite these divisive forces, the community was still a cohesive and democratic group, who worked towards a common goal. Here we see an observation by one of the participants about internal networks within the community

"All you have to do is look and see who's working with whom, and consistently pairs of people will work together. I think that people know in their own mind and know for themselves who to work with. I don't know if management would realise that 'this person wouldn't work with this person'. But it wouldn't be that hard to put it together ... some people always go to some people, you've got your internal networks about who asks who for help ... it kind of makes it more noticeable that it's happening in the open area. I don't know if it has stopped, that people will talk and they don't want other people to hear them. Yeah, but I don't think management has viewed it, not a ground up thing, I don't think they've directed anyone to anyone".

From the social and political perspective we can see a strong community that works both on the evidence requested, but also binds itself closely together on issues such as methodology and the science of searching and appraising the evidence. This climate, the cohesiveness and politics were the most influential factors that had an impact on work processes, collegiality and the potential for KM to grow within the organisation.

6.5 Learning

Understanding the basics of the EBP process and then developing the final purposeful human activity system will take more than one iteration, one set of modelling and one attempt to capture what was taking place in a very complex situation. The lesson from this process is that using SSM in very complex situations requires several iterations, not just one. The second iteration that builds on the work of this cycle is further developed in cycle four of the research.

By developing a systems approach to describing the community of practice, the participants and I were forced to explain processes and conceptualise them. This was also aimed at bringing together and unifying processes within the evidence unit. At this point many participants were doing things 'their own way' which led to diverse interactions with unit users and diverse styles of developing questions and answering them. With knowledge work, some unity in ways of working would be useful in facilitating better knowledge sharing and innovation. The aim of improving these activities would be to preserve knowledge within the community, to save time.

Recommendations for this cycle cover the whole scope of knowledge sharing and innovation and focus around utilising IT systems, developing knowledge repositories and systematising many of the resources collected by the community. An example of this was one intermediary entering electronic requests that could be sent direct to users in electronic format later. These recommendations were fed back to the participants and to senior staff within the organisation; some stimulated interest and were acted upon, especially in relation to utilising networked computer resources. The acceptance, rejection or longevity of such suggestions for change is reflected on in more detail in the discussion chapter.

Through this action research cycle, we can see how and where information is transformed into knowledge and where value is added in the process. The major advantage in applying

the SSM to KM research has been explicit modelling of the context of the research, which is absolutely essential when talking about *knowledge* as opposed to *information* management. By being clear about this difference, I can say that concepts of KM rather than information management can be applied to this community of practice. This separates this unit from a traditional library or information service.

One of the questions in this research is developing selection criteria for a KM system to support knowledge sharing and innovation. To achieve this it has been necessary to specify what the system does, and what activities require support within the system. This cycle has gone some way to highlighting system issues, these are further developed in chapter 8.

6.6 Reflections on methodology

Developing a conceptual map of the system's activities was an initial step to understanding a complex range of tasks that took place within the community of practice. This has been part of developing a complex picture that can be built upon in the following chapters.

I was disappointed that an instant answer about a complete conceptual model using SSM was not achieved within this cycle. Articulating knowledge sharing and innovation and linking them to the EBP cycle was a lot more abstract and difficult than I had anticipated, this is because there was no groundwork to understanding these issues before I began. Guidance in the literature on turning rich pictures, CATWOE and root definitions was not as clear or helpful as I had hoped.

The social and political analysis were useful as they exposed a range of issues and challenges within the community that required addressing if the group was to move on to successful improvement in their current situation and any future implementation of a KMS.

A potential byproduct of this cycle is the use of the conceptual model within other EBP contexts. This will need to be tested out with other people in the field to see who will be able to validate the model and give credence to the idea that KM within this context can indeed be modelled. This is explored in cycle four. This cycle has been useful in applying systems thinking to a complex issue and has been a way of understanding the movement of an evidence request through the unit. Linking these steps to knowledge sharing and innovation had laid important ground for developing a KMS model in the next cycle.

Analysing activities from a knowledge sharing perspective created recommendations for improving these activities within the organisation. I brought an outsider perspective to analysing activities that had become far too familiar to the intermediaries.

6.7 Chapter summary

In this chapter I have applied systems analysis to understand purposeful human activity. This was achieved through using SSM, which helped in gaining a clear understanding of the system and also the context and culture that lies behind such human activity. The rich picture of the evidence-seeking process was used, a stepping stone, developing a conceptual model to illustrate knowledge management in relation to searching for the evidence. Laying this initial groundwork was important to tease out the small evidence-seeking and appraising steps. Unpacking these created a wealth of self-knowledge within the community of the complexity of the process. Carrying out a social and political analysis uncovered many aspects of the organisation that could not, or would not be articulated through conventional data collection means. These reveal that all is not well in the organisation, and provide a good overview of what barriers to successful change and KM implementation may arise in the future for this project.

Representing this work as the initial conceptual model and linking it to knowledge sharing and innovation helped to develop a new model that represented the 'ideal' of what could be achieved. This is a simple model of process that requires more integration with KM in order to create a conceptual model that can be used as the basis for a KM system. To achieve this I take a model that represents the evidence seeking process developed in this cycle and integrate it more closely with concepts of KM. This takes place in the next cycle. In parallel to this, there is a need to validate the theories and modelling that have taken place so far. This is achieved in the next cycle, where I seek peer review in order to validate what has been completed so far.

Chapter 7

7. Cycle Four

By now I had gained a good understanding of the research participants and their environment. The participants and I wanted to know if models and concepts of knowledge management related to others working in similar EBP situations. To explore this and to gain external validation of the ideas developed so far, I sought peers working in the same area could understand the conceptualisation of KM in EBP. To achieve this I took the project to an international conference, using this as an opportunity for external validation of rich pictures and models, and gave other experts in the area the opportunity to add their perspective to the research situation. This cycle builds on the SSM activities in cycle three, creating a second iteration of SSM linking the initial conceptual model of activities to knowledge sharing and innovation. This culminates in the development of another CATWOE, root definition and conceptual model for KM within the community of practice.

Diagnosing	Can what was learned in the previous cycle be understood and validated by peers who do similar work? (MR) Can work done in the last cycle be built upon to develop a final conceptual model? (MR)
Action planning	Find a group of knowledge workers in EBP who can validate the model from the previous cycle and comment on the work of participants.
Action taking	Redevelop the conceptual model in the light of feedback from participants.
Evaluating	There was value in getting external validation to triangulate and build a second conceptual model
Specifying learning	Many of the core constructs developed were of relevance to peers working in EBP, knowledge management was viewed as an under researched area. Building a sophisticated conceptual model required many data sources and marrying together of concepts

7.1 Diagnosing

Findings from the third action research cycle are used within this cycle to develop a final conceptual model of what is required of a 'purposeful human activity system' for KM within the community of practice. To achieve this and to gain some external input and validation of the process so far, I looked outside my own research situation. External validation has been defined as "the degree to which such description can be accurately compared with other groups" (Kincheloe & McLaren, 1994, pp. 151). I looked for a forum where I could test my ideas and the already developed rich pictures and conceptual model. This needed to be with peers who understood the idea of EBP and information systems. This had the potential to be a very narrow audience, but would need to be a group that already had an understanding of information management and systems issues. External validation of work was useful for many reasons, including making sure that concepts were not just a figment of the investigator's imagination (Mitchell, 1979). Bernard (1994) argues that the validity of a concept depends on the utility of the device that measures it and the collective judgement of the scientific community that the construct and its measure are valid. He states that "validity itself depends on the collective opinion of researchers" (Bernard, 1994, p. 43). With this in mind, during this cycle I have strived to elicit this collective opinion, feeding it into the research where appropriate.

7.1.1 Peer review

The validation exercise took place with a range of peers who were involved in supplying evidence-based health information for other organisations and in countries outside Australia. This was done at the Symposium of Information Management Research in Sheffield, United Kingdom in June 2000. The event was chosen because the audience was one that would understand the concept of EBP and the research methods employed for the study, soft systems methodology. Interestingly this workshop took place at a conference where another workshop participant presented a paper preceding mine on knowledge management, highlighting it as a 'fad' or as rebadging concepts in information management. I felt that this might have had a negative influence on what I was to present and the interaction with the participants.

The participants of this session ranged from evidence-based health care providers to health informatics researchers to health care practitioners interested in health information research. The event took the form of a workshop comprising 16 participants divided into small groups, with a presentation of my work and then a 30-minute group discussion. During this time participants looked at rich pictures, as seen in Figures 4 and 5, and the conceptual model that had been developed by the intermediaries and myself at the unit. Participants were asked to discuss cover the following points

1. Does the rich picture reflect what happens with other EBP information providers?
2. Can it be applied to individuals as well?
3. How much knowledge is generated during the process?
4. Are there other skills required for a KM EBP environment?
5. Does understanding the context of health care delivery matter?

During the discussion I moved between the small groups to facilitate discussion and to answer any questions that arose. Feedback was given to me during a 30-minute informal discussion where participants were able to summarise from their small group discussions and add further comments during the ensuing debate. The following comments sum up some of these experts' thoughts on the model

"Well, intuitively it feels right, just because you've given us the top level, in any of these categories on your ... you could burrow down, we think that they would come across as a lot more complex, there could be a sub-model within each of those individual models."

"I think that it certainly pretty much reflects my experience, I have a thought about an additional skill between 3 and 5 and I don't know whether that was on your original list, and that's the ability of the researcher to summarise the results in a way that retains and doesn't distort the findings of the publications they found through their literature search and I think that's something that's quite an important skill, but I can't remember if it was on the list of skills in your presentation"

While many participants agreed with the model, there was an acknowledgement that it was difficult to model the messy world of seeking the evidence

Participant "Well, we were just saying that a lot of work goes on preparing a systematic review which is actually not reflected in the neat terribly manicured search strategy that appears at the end of the systematic review".

Gabby "So what happens to all of that extra stuff that's generated?"

Participant "Well it's sitting in boxes, it's not binned yet, but some of it will be, but all of that outcome is about 50% of the work that's gone on".

There were also alternative views within the group about what health practitioners or other seekers of evidence bring to the interaction. This was helpful to develop ideas about how the model could be improved, or create new modelling at more micro levels

"I appreciate what you have isolated the information bit (of seeking the evidence), because of your area of expertise and it's something that we've said that we relate to. So if you don't have an idea of where you're aiming for it can become a very bland information need and one of the things that we said was all these sort of variables like people at different levels maybe asking the same thing according to your anatomy (by this he means model), but one could be a patient, one could be a doctor or one could be a nurse. So that where they're coming from and where they're wanting to get to and what prior knowledge they have all of these things external to that interaction would have to feed into your model".

Focussing on concepts of knowledge management was a challenge in this session, as there were different interpretations of KM, here we see an interesting analogy

"Isn't knowledge management about making subsequent use of it, information processing is a bit like what drives the internal combustion engine, that there is a lot of exhaust that you wouldn't even bother capturing unless you knew the you could recycle it and use it profitably. That's dissipated knowledge, what you're seeking to capture are things that can be reused or can inform future decisions, for example you wouldn't design an information system to capture absolutely every transaction because there is a lot of necessary waste that you live with".

Perhaps one shortcoming of running a workshop with a short time-frame was to communicate ideas of systems thinking and developing a model that did not become an end in itself. When discussing the conceptual versus the 'real world', it was easy to get entangled in the problems of EBP

"I believe that you catch many of the important bits, but there's a lot that sits underneath, one problem that I have is that if I had a problem about understanding a question, say I have a question, I don't at all see how this is going to help me answer that question in practice".

More broad comments about why practitioners come to intermediaries to search for the evidence were highlighted

"One of the things that we talked about is that not everybody goes into literature searching or knowledge searching with questions originally in their mind. My research has to do with deaf people's access to health care, when I first started thinking about it, I didn't know what the questions were to ask, so part of the searching for knowledge and understanding was to get to a position where I could ask the questions, so to get to that point you have to go and do searching but you do your searching without questions, it's a very broad brush type of approach. It's that broad brush approach that brings you to your number 1 on here, understanding the questions, scope for the search, and sometimes people come along and say 'I'm interested in whatever the subject is'.

They don't necessarily have questions about it until they get indepth knowledge and understanding".

This poses an interesting dilemma for EBP and clinical effectiveness information services, do they take 'all comers' as questioned by one of the intermediaries in cycle two. The issue of focussing on only specific clinical effectiveness questions was a cause of tension in many discussions around this issue.

Personal agendas of health care practitioners were also getting played out in sessions like this, which become tangential to the original discussion. While wanting to stick to the salient points of debate, it was difficult to prevent the development of interesting ideas about EBP

"Points 1-3 I see clearly as a start to a systematic review and that is fine, but then there's all the implementation side and how I actually get people to change their behaviour and how I identify the problems that these people may have with changing their behaviour. How do I get that information, how do we discuss that information how do we implement it? How do we evaluate it and the data we get back are of high quality and are useful? I don't see that or maybe I'm missing something, but I don't see much of that".

From this comment, perhaps there was a requirement to develop rich pictures and models beyond the scope of the intermediary interacting with the health practitioner. What happens outside this small system mattered to the health practitioner, perhaps more so than what is happening between them and the intermediary.

In conclusion to this section, I can say that the workshop was a useful exercise in gaining feedback and validation of both the rich picture and model. These ideas were easily understood by this group of participants and provided some added credibility to what had been developed through the research. At this point I finished using the Sheffield participants as informants in this cycle, and switched back to using the community of practice as informants for the next phase of this cycle.

7.2 Action planning

Pulling together the information gathered from the peer review and ideas generated from the participants in relation to the first iteration of the conceptual model became the impetus for redefining a more KM-oriented root definition. The outcome of this was to develop an improved CATWOE that helped develop a model of where the research participants could aim towards in order to improve their knowledge sharing and innovation. Taking into consideration the cumulative learning in relation to the community of practice and KM activities identification I developed the following:

CATWOE

- **customers:** intermediaries
- **actors:** intermediaries who provide the transaction
- **transformation process:** turning information and ideas into useable knowledge (tacit or explicit)
- **Weltanschauung:** using knowledge enhances decision-making and knowledge work about effective health care
- **owners:** intermediaries

- **environmental constraints:** time to capture and make explicit the knowledge that is created

Using the above elements a new root definition was developed.

Root definition

A publicly owned knowledge management system staffed by appropriate professional knowledge workers who create, store, share and use knowledge to help them carry out knowledge work

Within this root definition I have used the word 'system' to represent a holistic view of a system, one which includes people, infrastructure and technology. Here the focus moves away from one of just supplying evidence to one that reflects the underlying knowledge sharing. This idea of a holistic system is reflected in the literature as

"an arrangement of people, data, processes, interfaces, networks and technology that interact to support and improve both day-to-day operations in a business as well as support the problem-solving and decision-making needs of management" (Whitten & Bentley, 1998).

7.3 Action taking

Gaining peer review and validation was an excellent opportunity to think about redeveloping the original conceptual model. At this point I had the understanding of an external audience who could clearly see what was being achieved through the original conceptual model, a mapping of the evidence seeking process. Whilst interesting, this did not help or enable the community of practice to improve what was taking place. What is described in the next section is how the original conceptual model was used to as a springboard to a more sophisticated and KM oriented suggestion for improvement.

7.3.1 Justification of the conceptual model

The development of a second conceptual model was done for two reasons: the first was to take what had already been learned in previous cycles and integrate more complex concepts of KM systems; the second was to add value to the simple process of just mapping what was taking place. This second reason was where I had the opportunity to act as researcher as enabler. I could add my knowledge and expertise in the interpretation of current situation, moving towards improving these processes with the use of a KMS.

The new model differs significantly from the original conceptual model, which only reflected the process and actions required in seeking the evidence. While this was a useful starting point, the second conceptual model reflects that behind the original conceptual model sits a range of knowledge sharing activities that needed to be articulated in order to understand whether concepts of KM could be applied to the community of practice. Knowledge sharing activities underpin the whole of the conceptual model; that is, each step within the conceptual model represented a range of knowledge sharing activities. This work is taken from table 3 amalgamates the evidence seeking process with the need for a KMS, which is explained in section 6.4. This second and somewhat more sophisticated model, that highlights where knowledge needs to be captured in a potential KMS. This second conceptual model makes use of information collected in the previous cycle, combined with the feedback of the peers in this cycle and information integrated from table 3.

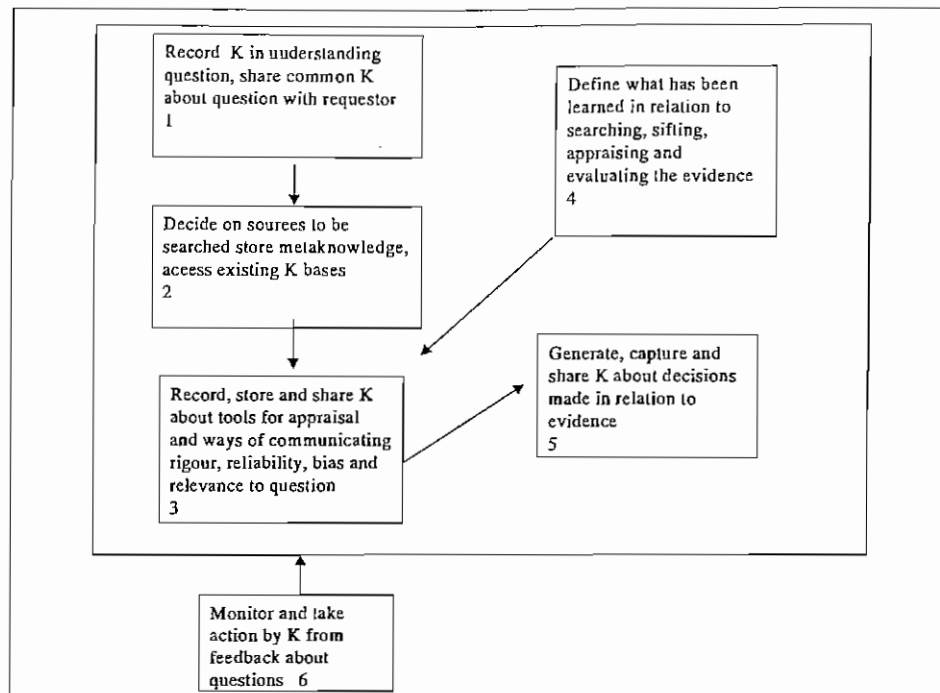


Figure 7 Conceptual Model of a KMS

Key: k= knowledge

This is shown in Figure 7. Here we can see that knowledge-sharing components are present in all steps of the model. This is the 'ideal' situation for utilising knowledge to enhance the practice of the intermediaries as they search the evidence and provide evidence reports. In this situation knowledge may be tacit or explicit in the first instance. By doing something concrete with the knowledge as suggested, intermediaries are codifying the knowledge.

If we compare this conceptual model to the one developed in cycle three (Figure 6) we can see some similarities and many differences. The basic evidence-seeking tasks are present within this model. There has been a merging of these tasks with knowledge sharing as described by Skyrme (1999) to create a KM conceptual model applicable to the evidence unit.

7.4 Evaluating

Looking outside the immediate research environment to gain external validation added credibility and weight to the findings that I had reached so far in the research. Checking out the participants' and my own ideas gave me confidence that we were on the 'right track', and that the concepts developed so far were not of my own invention, but understandable, useful and relevant to similar intermediaries. The collective judgement of the peers gathered was that the original conceptual model, as outlined in the previous chapter made sense and could be used for a variety of purposes. With the scope of utility I used it to further develop the idea of bringing together the original description of searching for the evidence as a process with KMS functions. Through this development I developed what is considered the final conceptual model. This was not a means to an end, but a way to structure debate around how to improve the KM situation of the research participants. This time I chose to use informal interactions with participants to find out what they thought of the model. The aim here was not to improve the model, but to "to find an accommodation between different interests in the situation, an accommodation that can be

argued to constitute an improvement of the initial problem situation" (Checkland & Scholes, 1990, p. 44). In parallel to this, an analysis of cultural issues within the community was required, so that I could gain an understanding of motivations for change. These issues are discussed in section 7.4.2.

7.4.1 Comparing the conceptual model to perceived reality

Now that I had some more tangible ideas about what a KM system could look like, it was time to discuss it with interested members of the team. I looked for volunteers at this stage who had an interest in KM and were interested in thinking conceptually. I chose three individuals from within the overall group of participants, a senior member of staff and two intermediaries. With the time constraints of getting feedback and getting participants together, I felt that this was a representative group who could speak on behalf of the team. These discussions were informal and focussed on comparing the real world with what can be summarised in table 4. The last column is suggestions for improvement in the current real world situation.

These discussions were augmented by data collected in other cycles, especially the participants' observations of knowledge within their own work. One way of comparing models to perceived reality is to fill in a matrix. Checkland and Scholes (1990) suggest that this is a way of summarising "ideas for change in the situation or new ideas for relevant root definitions". By using the suggested matrix I brought together steps sharing and innovation within the evidence-seeking process. Observations and ideas about whether these currently exist in the community of practice are commented on. Many of these 'judgements' or observations were subjective and often depended on the individual intermediary. The first row of headings, in bold italics, is taken from Checkland and Scholes (1990, p. 43) as a starting point for articulating ideas. From this I have taken the data from participants and myself and completed the matrix

From the table we can see that many of the KM activities within the unit are taking place, most of them are easy to judge through physical artefacts. Unfortunately, many of the activities did not exist or happen for every intermediary, this was often dependent on their individual motivation and workload. There was, however, plenty of scope for improvement, these recommendations are listed in column five of the table.

The point of the comparison between model and real world was to find an accommodation between different interests in the situation, and accommodation that can be argued to constitute an improvement of the initial problem situation. This 'accommodation' meant finding a middle ground between the needs and desires of the research participants and those of myself, as researcher. I wanted the project to follow the plan that I envisaged, the participants wanted their life to be easier but without too much disruption or extra time added to their current activities.

Getting to a stage of improvement in the research situation required knowledge of the culture of the community. I gained this through participant observation and this informed the stream of cultural inquiry. By this stage as a participant observer I had spent more than 24 months with the participants, attending meetings, working alongside them and interacting with all individuals within the team. Checkland and Scholes (1990) put this down

"to human affairs, the feel of them, their felt texture, derives equally or more from the myths and meaning which human beings attribute to their professional and personal entanglements with their fellow beings" (p. 44).

To understand this, Checkland (1986) developed SSM's Analysis Two.

Table 4 Comparing the conceptual model to the real world

Activity	Exist or not in the real world	How was it done?	How was it judged? Criteria and current judgements	Comments New 'what's', alternative 'how's' etc. Ideas about changes
Record knowledge in understanding question, share common knowledge about question with requestor	Yes, depends on the intermediary	Written on forms, mainly stored in individual memory. Discuss with requestor to clarify question	Seen through personal notes and comments recorded Interacting with requestors happens on ad hoc basis	Develop central repository to encourage all intermediaries to interact and negotiate with requestors Get requestors to be more detailed and focussed when asking questions
Decide on sources to be searched, store metaknowledge, access existing knowledge bases	Yes, depends on the intermediary	Follow protocol for searching the evidence metaknowledge discussed	Transparency in evidence report, knowledge made tacit, sometimes lacking in detail and jargonistic Group knowledge and understanding of metaknowledge varies	Explicitly develop embedded knowledge about non-database sources searched (e.g. web pages) Put tacit knowledge into lay terms Develop accessible repository for metaknowledge
Record, store and share knowledge about tools for appraisal and ways of communicating rigour, reliability, bias and relevance to question	Yes	Embedded in evidence tables, where summarising integrated tools	Transparency of reports, available on the Web Style in which evidence reports are written Knowledge that intermediaries and requestors have of these issues	Pool knowledge about appraisal tools used into a central repository Develop reports for more full description of methodological issues Learning opportunities to develop requestor knowledge
Define what has been learned in relation to searching, sitting, appraising and evaluating the evidence	No	Individual learning is tacit, group learning is not captured Passed on in situated learning in face-to-face interactions Not explicitly stated for requestors, dependent on levels I and II evidence	Individual's report that they have learned something, difficult to judge or quantify Learning takes place by novices, who measure their performance compared to knowledge work experts	Describing lessons learned from the process of evidence reports, methodological challenges Create forum for sharing ideas on a regular basis
Generate, capture and share knowledge about decisions made in relation to evidence	Yes	Done at several levels, individual and community Some knowledge is not consensual in this area	Recorded in evidence reports, but not embedded into the community Potential for decision outside current protocols Few decisions made when level III and IV evidence are concerned	Pooling knowledge about decisions that have an impact beyond individual reports Forum for sharing and debating decisions and knowledge gained More explicit knowledge available re: worldview of community communicated to requestors
Monitor and take action by knowledge from feedback about questions	Yes	Recorded on feedback forms	Forms brought together and collated, statistics only	More qualitative analysis of feedback forms Interviews with requestors for qualitative feedback on their knowledge

7.5 Specifying learning

From the peer review of work carried out in this cycle, it was clear that intermediaries outside my own specific research environment understood the ideas that the first iteration of the conceptual model represented. Some elements of the model were relevant to everyone, but some were not, this depended on whether the information services specified had a local or national remit. The more localised the intermediaries were, the more important it was to be close to, and to understand the local context. National EBP services was far more removed from their users so that their acting as intermediaries in the traditional sense was more difficult. At this more national level these services did facilitate decision-making in relation to the evidence, but did not do so as a reaction of end users. They do this instead for funders and policy makers with the tacit understanding that end users will get hold of the knowledge, when and if they became aware of it.

The challenge of quickly and clearly representing a systems approach to KM within EBP was a useful goal to achieve. The careful selection of a group with whom I shared common language and ideas was not underestimated.

Knowledge management as a concept within EBP was understood and validated by the peer group, who both supported greater dissemination and support for the concept. I was cheered by the following comment from a well-regarded EBP professional. This quote is taken from the peer review workshop, described at the beginning of the cycle and pertains to the generic transferability of modelling the knowledge sharing and innovation

"I think that this model is generic enough to be used in a range of professional areas, where there is an accepted corpus of knowledge that people accept as a body of knowledge. So that lawyers have case law, engineers have a range of specifications, and then there has to be some understanding of not exactly of a hierarchy, but some understanding of the relative value of evidence. So they are the sort of characteristics that can be used in a range of industries ... with the ORACLE project, we certainly found that law and engineering were other areas that we could immediately identify".

Here we have the suggestion of international KM within a global community of practice within EBP. Metaknowledge was an important priority for one of these participants who saw that similarities between what was happening with the community of practice within this research and where she works in the United Kingdom and her knowledge of what takes place in New Zealand.

"What has stuck me about this is that there are a range of national organisations within the UK that are providing this type of service, I know that there's yourselves (the unit) and the New Zealand group doing a similar thing. Is there the potential, once you've got your basic outline, to distribute it, and getting feedback, or even an international discussion list, of groups who work in the area to share information with, and the methodologies that they use?"

The second iteration of a root definition, CATWOE and conceptual model brought much of the SSM process to an end, within this cycle it culminated in a range of suggested improvements that the community of practice could aim for. These suggestions were fed back to the community as a whole during their weekly staff meeting where they were discussed. The main reaction to these suggestions was 'who is going to do it?' and 'who has the time to do it?'

The final product of a conceptual KM model in EBP acted as a road map for improvements with the research situation. Improving the participant's situation was one

part of the action researcher's motivation. The other was to generate theory. I hoped that the conceptual model could be used to illustrate the complexity of knowledge sharing and innovation within this sophisticated area of practice. It could also be used as an educational tool to help those working in the field understand that there was more to EBP knowledge provision than only moving information from source to user. This linked back to one of my motivations for carrying out this research, the frustration of people using KM as a throwaway replacement term for information management. The use of this model for intermediaries working in EBP highlights the specialist nature of their work and the need for support and systems to underpin the EBP activities.

7.6 Reflections on methodology

One of the aims of this research was to develop a conceptual model of KM that could be applied to EBP. I feel that this has been achieved within this chapter, and is one of the final products of the research. This model should stand the test of time beyond the life of this project and will act as a template for continuous improvement in relation to KM within the community of practice. The challenge in this cycle has been to bring together the data collected from intermediaries to influence SSM. Gaining outside validation not only in relation to rich pictures and conceptual modelling, but also to applying the concept of KM to EBP was a contribution to triangulation and validation of the research.

Gaining external validation was useful in adding strength and credibility about the findings of the research so far made me justify and move away from the rarefied atmosphere that comes from working in a close, perhaps even cosy research environment. Despite the fact that all of the participants had a good understanding of EBP and the role that information played within this context, there was still scope for misunderstanding and debate in what I was communicating through the peer review process. Gaining outside challenges and ideas gave me the impetus to move forwards with the research with new enthusiasm.

The process of gaining experience and bringing systems thinking to the unit, and getting participants to reflect and discuss what was happening moved them towards conceptual thinking.

Now that a model of what the participants could aim toward has been created, this could be used as a springboard to looking for a KMS to support knowledge sharing and innovation. This is tackled in cycle six of the research.

7.7 Chapter summary

This chapter has seen the second iteration of a conceptual model using SSM. This iteration builds on the work of the previous chapter and is strengthened through the triangulation of gaining external validation through peer review. By moving from a simple conceptual model that only represents processes, I have integrated this with concepts of KM to create a more sophisticated representation of KM in EBP.

Peer review has added weight about the transferability and relevance of rich pictures and models to people working in similar communities of practice around the world. To further enrich the triangulation of what is happening within the research, I sought health practitioners as end users of the evidence-seeking process. This aims to find convergent and divergent views of the role of the intermediary within the decision-making process, providing a broader overview of the community of practice.

Chapter 8

8. Cycle Five

At this point of the research the role of the intermediary had only been explored through that of the intermediaries' eyes. While external validation had taken place, this had been mainly achieved through similar individuals as those within the community of practice. By finding end users of the unit I wanted to gain a different perspective and insight into what intermediaries contribute to their decision-making. So far, the research has taken a discrete view of KM and the intermediary, looking beyond the small community of practice, to the wider environment adds greater depth in understanding the issues and challenges faced when working within a wider organisation. Data from health care practitioners was collected in two ways to achieve this goal, through text analysis of questionnaire feedback and through semi-structured interviews with a representative group of health practitioners. The outcome was mixed, their views of intermediaries differed, although there was convergence on many of the themes, that of the intermediary being an methodological expert and of saving the precious time that practitioners had.

Diagnosing	Do health practitioners understand the intermediary's role? How do they view intermediaries? What do they do with knowledge they receive? (MR & MPr)
Action planning	Find a representative group of health practitioners and develop questions that will help with informing what we want to know
Action taking	Interviews with 10 health practitioners Text analysis of questionnaires returned to the unit as feedback
Evaluating	Views of intermediaries varied, but overall they were seen as experts who saved the end users time
Specifying learning	Divergent views on what the role of intermediaries were, but consensus that they were a benefit to the individual and organisation

8.1 Diagnosing

As part of the action research, participants wanted to know what the views of their users were. What did they think of the unit as intermediaries? Did health practitioners see the unit in the same way as the intermediaries and what was their interaction with them? These questions were asked for many reasons, because the unit needed validation and support for what they did in the face of external funding, but also it was a way of making sense of the conceptual model that had been developed on previous cycles. Until this point of the research, the interactions and feedback sought from users of the unit were limited to completing feedback forms. While this provided useful quantitative data and broad ideas of satisfaction with services it did not provide an insight into what users felt about the unit or what was contributed to the evidence-seeking interaction.

The majority of people working within the unit had quantitative research skills, which had been useful in developing questionnaires and doing statistical analysis of the results collected from them. The participants looked to me as a qualitative researcher to help them collect more indepth views and perspectives from their users. This also created the opportunity for me to talk to users and get a different perspective compared to the formal written views that had thus far been solicited from them.

8.2 Action planning

To take a more detailed look at what users of the unit were thinking, the participants and I discussed how we could elicit information from them. One way was to review the comments that were returned to the unit as part of the feedback form. This could be achieved through text analysis and then developing themes from the data. The other way was to carry out a range of interviews with a representative group of unit users from different health disciplines and locations across the organisation. A draft interview schedule was developed; this went through a range of iterations, as there were divergent views of what needed to be asked. Some participants wanted to know what users were doing with the evidence that was sent back to them, others wanted to know about training for critical appraisal of the evidence. There was a consensus on who should be talked to, including heavy, occasional and non-users of the unit. This would create a broad range of views on any questions that we came up with.

With the final version of the semi-structured interview schedule, ethical approval was sought from the university so those selected health practitioners could also be used as participants in the research. To find out who had been using the unit I was given a range of names of unit users by management. This provided me with a group of potential interviewees whom I contacted with a letter of invitation to interview (See Appendix 10).

Feedback form data was collected on a regular basis by the unit, being sent out with evidence reports and also through follow-up mail-outs. These responses were given to me in an aggregated and anonymous form, for more complex discussions, I have given participants pseudonyms. The free text responses from these forms had already been wordprocessed and loaded onto a spreadsheet, so that it was simple to transfer these on disk to NVivo™ to analyse.

8.3 Action taking

From this preparatory work I was able to move into doing some data collection in the field.

8.3.1 Health practitioner review

Eliciting views from health practitioners was through a round of semi-structured interviews. Interview participants were chosen for me from a list of contacts from an in-house database. Letters were sent to users inviting them to participate during a three-week period. Uptake of interviews was 25%, which made a total of ten interviews, this was a small response and it is recognised that this self-selecting group was probably motivated and enthusiastic about the unit. Responses collected from these interviews could therefore give a partial picture of how practitioners viewed the unit. Given the nature of this research, data collection from a small sample was appropriate for the methodology used, I did not seek a statistically representative sample. From those interviewed, two of the ten participants identified themselves as non-users of the unit, but were aware of the unit's services. These two individuals nominated themselves for interview, because colleagues originally invited to interview had now left the organisation.

Staff interviewed ranged from senior to junior staff, including doctors, nurses and professionals allied to medicine. Breakdown of individuals included:

- two nurses emergency department
- one nurse continuing professional development
- one professor of medicine working in clinical practice
- one psychiatrist

- one emergency physician
- one rehabilitation physician
- one intensive care nurse
- one infection control scientist
- one project worker in planning and development

Sites covered were

- one local community rehabilitation unit
- one large metropolitan teaching hospital
- one smaller metropolitan hospital

This use of a range of different physical locations provided a contrast in staff and experiences. This was useful from the perspective of whether proximity and profile made a difference to health practitioners as far as the unit was concerned.

Interviews proceeded in an informal manner, with the researcher explaining what would take place in the interview and the main intentions of data collection. The interview schedule was followed on all occasions (see Appendix 10), although this was diverted from on occasion to give participants the opportunity to cover all the areas that they were interested in.

Text from the interviews was taken and analysed using NVivo™. From this I developed a range of themes in relation to intermediaries and health practitioners' roles in the evidence-seeking interaction.

8.3.2 Feedback form analysis

As previously mentioned, I was able to access an aggregated anonymised form of feedback collected by the unit over a period of six months. Feedback evaluation forms were given to every user of the unit, these forms were used to elicit information about satisfaction and use of evidence reports requested by health practitioners, see Appendix 11 for an example of the form. Users sent the forms back to the unit where the administrator transcribed the data into a spreadsheet. In total, there were 163 separate comments from a range of users. It is unknown how many unit users completed these feedback forms, and whether they came from a wide group of users or a smaller group of more frequent users.

Data collected by the unit through the feedback forms was the purpose of quality improvement, the text responses had never been closely analysed. Despite this, they did provide a rich source of free text comments about the unit that had not been previously analysed in a qualitative way. From the comments a broad range of themes arose, many around satisfaction with the finished product, some about the timeliness of the service, but many about the users' interaction with the unit. These were the themes that I have focussed on for the purpose of this research.

8.4 Evaluating

The main focus of this cycle was to find out what unit users thought of the role of the intermediary. Responses were clustered around three themes; the intermediary's role as expert, what contribution health care practitioners add to the evidence-seeking process and the intermediary's impact on decision-making.

8.4.1 Intermediaries: why use them?

The most broad and yet fundamental issue that underpins all of the following data analysis is why use an intermediary? Rather than seeking the evidence themselves, there must be reasons why health practitioners go to others to facilitate the evidence-seeking process. To date this has been explored in a range of health literature and includes the health care practitioners lacking skills, (Shaughnessy & Slawson, 1999) time and understanding of what to look for (Pluchak, 1989).

Articulation of information needs relating to the problem was an issue. Until practitioners talk to someone else about the issue, they have a problem in expressing information needs and relating this to the problem at hand. 'Making sense' of complex problems using intermediaries as a decision support may pose a challenge when practitioners have trouble trying to articulate the problem. One exasperated practitioner sums this up,

"I had no idea what I was looking for, I had hundreds of questions and no way of knowing how to ask them in a way that was focussed".

To resolve this, a conversation needs to take place between the practitioner and the intermediary. At this stage the practitioner can receive feedback about the viability of the question, whether a search for the best available evidence is appropriate, and whether there are a range of questions. Such a conversation becomes part of a transformation from question, to information sharing to shared knowledge about the issue at hand.

8.4.2 Role as expert

Health practitioners looked to intermediaries to help them for a variety of reasons. Many of these reasons were simple and explicit, some however, have been interpreted within the context of knowledge management framework. These more complex interpretations in the research context can also be linked to concepts of organisational learning, memory and innovation, and are discussed in the overall analysis. Intermediaries were recognised as 'experts' in the area of EBP. The label of expert is ill defined, but for the purpose of this analysis can be defined by the Oxford English Dictionary as "a person who is very knowledgeable about or skilful in a particular area"

Experts add their specialist knowledge and skills to a complex problem, their learning and consistent tackling of similar problem leads them to become more efficient and effective in what they do. This includes the rigour with which they search and appraise the evidence; the completeness of the evidence they collect and the timeliness of how they do it.

8.4.3 Rigour of searching the evidence

Searching the literature for evidence to support practice and, more recently, using tools such as the Internet are widely recognised skills (Kirby & Miller, 1986; Palmer, Lusher, & Snowball, 1997). Despite this staff were encouraged to do it for themselves

"If it's quiet, either management encourage you to go down to the library, that's the appropriate environment to be doing searches, or have a room that has a computer set up, away from the nurses' desk, away from the phones, where you can do your work without being interrupted. You get constantly interrupted if you are sitting at the desk. It's not the sort of environment where you want to be trying to look things up".

Part of the role of expert was to act as someone who understood research methodologies, who could work out the reliability and the generalisability of the evidence found while searching. Trust and recognition for these skills was important if the 'right' evidence was to be found

"Information gained was non-conclusive; the quality of the search is astounding. Lack of evidence inspires research".

There were however some varied views about what intermediaries were searching for

"Literature search could have been more extensive by including terms other than 'mental/retardation' and 'intellectual disability' such as 'learning difficulties', 'developmental difficulties', 'developmental delays' etc".

Even when the search did not bring up everything that was expected, there was still a positive outcome

"There was an article given which was irrelevant to our study but did provide us with some concept planning".

Overall we can see that unit is consistently seeing a range of practitioners seeking the evidence, and thus building upon these experiences to provide faster, more sophisticated solutions to complex questions.

8.4.4 Appraisal

Appraising the evidence once it is retrieved is another specialised skill that takes considerable experience to master and execute in a confident way (Grimes, Bachicha & Learman, 1998; Hunt & McKibbin, 1997). Teaching such skills has been shown to be difficult to do and the amount retained by clinicians has been proven to be small (Hyde, Parkes, Deeks & Milnes, 2000). It is not surprising that clinicians look towards the expert to define the rigour and validity of what is often a very large amount of information.

Findings from this study show that health practitioners see intermediaries as 'experts' who have the skills to do this more quickly and have a role in deciding the value of the evidence on behalf of practitioners. As one informant states

"I was looking for comment on the worth of papers".

Intermediaries who described their work in previous chapters support what is said in the literature,

"we look at the validity of the evidence we search, this is less bias because we are not based in clinical practice and concentrate on the methodology without worrying about the context around us".

This is one of the cornerstones of evidence-based decision-making (Sackett, 1997), eliminating as much bias as possible to create generalisable knowledge that is applicable to the local health care context. The desire to utilise someone in a role removed from direct clinical practice who has experience of evaluating validity adds value and credibility to the knowledge generated from this evidence-seeking process.

The interpretation of evidence as information into knowledge also means that intermediaries have added to their own knowledge and the community's knowledge. This is

achieved through recording decisions made about appraising the evidence and the final decision about what is effective health care.

8.4.5 Completeness

The breadth of searching for the evidence was beyond simple database searching, and this was perhaps the difference between a regular health library service and this particular unit. The EBP movement has moved towards prescriptive and accepted pathways of using information sources to be searched in order to produce a complete and rigorous result. The unit followed levels of evidence (see Appendix 6) and began with searching the Cochrane library focussing on randomised controlled trials and moving down the levels (National Health and Medical Research Council, 2000; Centre for Evidence Based Medicine, 2000). This meant focussing on sources that looked to reducing bias in reporting such as systematic reviews of randomised controlled trials to more biased sources of evidence of effectiveness, such as expert opinion. If questions are not fulfilled by level I and II sources, then levels III and IV may need to be explored. Looking at levels of evidence beyond systematic reviews required wider searches of the Internet, the learned societies and grey literature.

Such completeness in covering a range of sources was realised by practitioners who used intermediaries

"very impressed by the range of databases able to search far more than I can access easily using university OVID databases (this contains Best Evidence, Medline and other relevant databases), thanks".

Just how exact and explicit the breadth of resources was sometimes unknown by end users, despite it being explicitly recorded in the evidence report (see Appendix Six). An intermediary explained this as

"we have an agreed pathway to follow when we search for the evidence, the less level I and II evidence we find the wider we have to go, this means going to wider literature and appraising primary sources".

Confirmation that there was little or no evidence to support some decisions was deemed to be just as important, and was often much more difficult for both practitioners and intermediaries to conclude...

"no information was available on the subject investigation. It's at least good to know that".

"The literature search done by the unit was very thorough. However the studies to answer the question have not been done".

This process of being inclusive in searching for the evidence contributed to the ongoing building of memory, which reflected experience, and knowledge of the task. Such a complex task was influenced by past experience of the task of transforming questions for evidence into action. The intermediary took the problem to develop their understanding not only relevant to this context, but took the 'knowledge' that had been gained from this encounter, to inform further encounters with other practitioners.

These themes were mentioned consistently and illustrated an understanding by end users of the skills required to rigorously search the evidence

"Information gained was non-conclusive; the quality of the search is astounding. Lack of evidence inspires research".

There was also recognition that rigorous searching took time,

"Unfortunately asked for search with insufficient notice for it to be done comprehensively. Ideally, speed of service should be improved".

And the contribution as a useful resource

"The way I would use the unit is as a resource: as a reference resource. You have the expertise of knowing how to do the searches for parts of the questions in a particular area. A bit of research and a literature review so to speak can be very powerful".

There were also users looking for a greater interpretation or judgement on the worth of the evidence

"Was looking for comment on the worth of papers, already had the references".

8.4.6 Timeliness

The time that it took to complete a rigorous search and appraisal of the evidence varied according to the complexity of the question, and the amount of evidence that could be found in searching. Measures of timeliness in delivering both of these tasks to support decision-making were of a personal and subjective measure, but in valuing these subjective worldviews, we can see some interesting insights into how intermediaries save time. The speed with which intermediaries carried out both searching and appraisal of a wide range of evidence was illustrated through their own evaluation of work, the more evidence projects they worked on, and the more efficient they became. Practitioners also reflected on whether they had the time to complete the task

"great service particularly for clinical staff who do not have the time during their working day to do this sort of thing".

An evaluation of the intermediaries' performance was elicited by questions in interviews and feedback forms, where performance was assessed,

"this was a rush job that the unit completed very quickly".

and

"I was impressed by the timeliness and of contact and efforts made".

Practitioners were at pains to point out that they had little time away from providing care to carry out searching for them. The alternative was to carry out the task in private time.

"Main barrier is time!! Even though I strongly believe evidence-based practice is integral to my practice, I have little time to access and familiarise myself with the associated information".

"Heavy workloads mean that all research or reading has to be done in my own time. Sometimes then too tired or fed up to put in extra time".

8.4.7 Contribution of health practitioners to evidence-seeking

There was a good understanding amongst health care practitioners about the role of the intermediary, but less so of what the health care practitioner could bring to the evidence-

seeking interaction. There was an expectation by some users that a more indepth interaction would take place when negotiating the question being asked.

On feeding back to users about their question, we see some users wanted more interactions with the unit. This also reflects the intermediary experiences on wanting to negotiate the question and how much moving between unit and users should take place,

"when people initially have ideas, would like to meet with unit staff to help formulate the questions. Access to service was great".

In contrast to this, some unit users had a project approach to clinical effectiveness scheduling meetings with the intermediaries,

"There were two meetings of about an hour and a half each on a range of issues and they sort of emerged. There was not much controversy about them they just came up ... I think we've used the unit this time like an out-source probably to get a bit more input as well. The people are really quite talented. They've got a lot of experience in dealing with other projects, they've got a lot of expertise which we probably didn't have at that point".

Despite some intermediaries' personal working styles, which worked against the ethos of interacting, users were still seeking them out to discuss and debate the search for evidence. We can see that users were prepared to contribute to the evidence-seeking interaction by clarifying and negotiating what they were looking for rather than passively expecting to receive a package of information.

8.4.8 Paradigm views about the evidence

Through intermediary self-reporting there was a tacit understanding about what types of evidence would be retrieved and interpreted for the purposes of producing evidence reports. This tacit knowledge was made explicit through unit publications, such as their website and final evidence reports. This knowledge was not shared with all end users and led to some dissatisfaction with the unit's services

"Not sufficient evidence available via research trials only level IV- difficult to validate. Staff were most helpful and approachable".

"Would like greater evidence other than that from Codmare - already had this information and it doesn't offer any conclusive recommendations. Would also like more information on different types of iron therapies and which are best (including dosages) (organic vs. non-organic)".

"There was nothing wrong with your service. Basically there is not much written about case management and community health nursing within Australia. The search was limited to results to case management within Australia".

The sharing of knowledge about types of evidence and the role that intermediaries had to play in selecting 'best evidence' were not universal. Through this dissonance we can see varying expectations between knowledge provider and end user. Differing views about what constitutes evidence have been widely reflected in the literature (Cutcliffe & McKenna, 1999; Newman, 1996). While such a broad paradigm debate sits outside the scope of this research, I think that it is a useful point to raise in relation to user expectations and the use of the evidence in decision-making. On one side of the debate we see intermediaries with a specific view of what constitutes evidence, on the end user side we see a different view of

evidence. Leaving this issue unresolved leads to disagreement about what constitutes a helpful and useful service to aid decision-making.

8.4.9 Impact on decision-making

One of the research questions for this project was to explore the intermediaries' impact on decision-making. I found that this was an extremely complex question, which could be vaguely answered by some participants, pointing to general areas of care

"The likelihood of the report influencing my practice is based on the overall findings of my study which did indicate a change in practice".

"Awaiting Medical Director's feedback since handing it on. Doctor Jenkins also using information for on-site practice changes".

"Protocol change then compliance will be monitored".

Fortunately through interviews, I was able to push health care practitioners harder about what had really happened with the evidence; one participant presented me with a list of what had happened to the evidence they had requested.

These types of tangible examples are what the unit needed to justify the money spent on the evidence service.

Gabby *"You've got this video together ready to go? Fantastic that there's a tangible product!"*

Nurse *"Yes, that's the end product of it"*

Gabby *"It's called 'Adult basic life support: a learning package for the clinical environment.' Do you show that around the hospital?"*

Nurse *"Yes. Basically this is a learning package for nurses to prepare themselves for annual assessments that we do here. Although this booklet follows the Australian Resuscitation Council guidelines, and we have to follow them, there are variations because I was targeting this video for the clinical advisor. There are quite a few basic CPR (cardiopulmonary resuscitation) videos but they are designed for the (clinic)... We focussed this video and the booklet for the clinician on the ward with the equipment available. And this has led, for example, on to the workplace and also we augmented it by seeing changes in depth of the guidelines".*

Where change did not take place, this was because the evidence was either inconclusive or supported current practice, on feedback forms

"Will not affect practice - result did not indicate need for change".

Through interviews

Nurse *"But most of the outcomes of your searches coincide with what we have done".*

Gabby *"So it was really backing up what you were doing?"*

Nurse *"Yes it is backing up what we do"*

An interesting aspect of the influence of evidence on decision-making was the end users' own knowledge management activities once they had got hold of the evidence. There was an implicit view at the unit that evidence was being used for the 'common good', that is to improve patient outcomes. This was not the case, as one senior consultant explains

"I use all of the evidence requests for my own use, rather than them informing questions about clinical practice, quite a few informed my own research that had been carried out, this confirmed my own thoughts and findings".

Here we see an evidence user who is not sharing the knowledge but is building his own, or using it to contribute to the development of new knowledge. One practitioner gave his overview of what the unit achieved in his discipline

"The unit has a role in keeping doctors on the right path, by giving good quality information about what is current or up-to-date. Many physicians slip off the path of being objective in their practice especially when they work alone. Such are the benefits of working in the public health system, you have a range of support mechanisms and infrastructure to make sure that this doesn't take place".

So despite sometimes not having a direct link to changing clinical practice, the evidence did eventually add to individual and collective knowledge bases. Whether this could be explicitly linked to working with patients is the scope for further research.

8.5 Specifying learning

This cycle of data collection raised more issues compared to the questions raised at the beginning of this research. Data created useful and timely qualitative feedback to the unit on how they provided services.

Information collected from the interviews and text analysis was fed back to the intermediaries in a workshop. This was an opportunity to discuss the mode of data collection and what took place in the health practitioner interviews. The participants and myself then discussed the anonymised data. The reaction to this feedback was mixed, participants felt there was a lack of generalisability of the conclusions I had generated, this is understandable as most of them were quantitative researchers. Some comments, such as those relating to levels of evidence were rejected outright by the participants. I felt that I was challenging their paradigm view and asking uncomfortable questions about their being in touch with their users. This was also a constructive workshop where a range of solutions to problems were discussed and acted upon, including putting evidence reports into a more user-friendly format and to further investigate the use of evidence in decision-making.

It was a challenge for participants to hear that not all users were completely satisfied or that they were using evidence for the 'common good'. They were however heartened to see that their role as intermediary was highly valued and respected within the organisation. Overall the qualitative analysis of user views provided a much-needed insight into how the unit was performing and created scope for future investigations and service development.

Many lessons were learned by both intermediaries, the health practitioners participating in interviews and me in this cycle. Intermediaries learned much about the value of using user views to improve the practice of the unit. This was especially useful in how the evidence was communicated to users, the simpler it was, the more useable it would be to them in clinical practice. Other learning was to challenge the notion of what 'evidence' was, accepting other paradigm views and justifying the unit's worldview. This justification and reconciliation of dissonance was important to realise in relation to selling the unit and communicating notions of informed decision-making.

A small working group which was motivated to improve services within the unit acted upon these points. This included improving the format of evidence requests and evidence forms. An easy to understand glossary of terms offering explanations as 'randomised controlled trial' and critical appraisal was developed. This aimed at facilitating the understandability of the jargon, so that users could make sense of the evidence. A work programme was developed where some intermediaries would take a more proactive role in

linking with problems in clinical practice to develop evidence questions, here problems or questions about effectiveness would be raised at clinical level when they occurred. This was used to raise the profile of the unit and demonstrate that the evidence could make a difference to clinical outcomes.

Intermediaries learned that qualitative feedback was a useful way of augmenting what was collected by more quantitative means. They learned that while feedback forms were provided, they only informed part of the service delivery. As far as clarifying the roles of practitioners and intermediaries, this varied and there was no united view by users of the unit or what role they specifically play. Most users however did value and understand the role of the intermediary as contributing to decision-making and improving the quality of decision-making based on best available evidence. The challenge was to get these users to provide more than opinion about what was taking place, that is, their own 'evidence' in the way of hard outcomes, to support their use and the work of the unit.

Practitioners learned that feedback and integration of evidence into clinical practice were important for the continued life of the unit. I had challenged them to think constructively about what they had done with the resource intensive evidence reports that they had received. With some of them there was a realisation that the service provided was not 'free' and had a limited life linked to external time-limited funding. Proving that the unit demonstrated an impact was important if the service was to continue. It was therefore in the interest of players to contribute to the group's knowledge about what role the intermediaries had on decision-making. Another more subtle and tacit understanding held by the unit that was not effectively communicated to these users was the expectation that something would be done with the evidence, that it would have an impact on decision-making. I communicated this expectation during interviews and interactions, this was accepted and understood by the majority of participants I spent time with, but came as a surprise to one senior consultant.

My own learning from this cycle was that some intermediaries had a limited knowledge of qualitative research, so that many of the findings that I came up with were rejected as not being rigorous or generalisable. This perhaps led to some cynicism and even rejection of my findings and recommendations by a minority of participants. Fortunately, many of the participants were enthusiastic about the findings, and planned to put into action many of the findings immediately. This included redesigning the forms that are given to users for requests, and to include a lay glossary of terms for those users who receive evidence reports.

8.6 Reflections on methodology

Data collected from this cycle was useful for triangulation of data. Obtaining another perspective about the role of the intermediary and the evidence unit was achieved by talking to users. Collecting data from users of the evidence service helped to create the possibility of interpreting both the convergence and divergence of results produced by the use of different sources of data, this is explored in greater depth in Chapter 10. Much of what was found confirmed the views of intermediaries and myself; this was especially the case of the intermediary as expert and time saver. The use of interviews provided a helpful contrast to the feedback forms that had already been collected by the unit.

8.7 Chapter summary

This cycle has provided a useful contrasting view of the evidence unit and has explored what happens with the evidence once users of the service received it. This helped me as researcher to understand that KM issues extend beyond the immediate environment to the whole organisation. Feeding back user views to the intermediaries had mixed results, some of these confirmed their worldviews and ways of working. Other findings were rejected by the intermediaries and caused a challenge to the status quo. The final outcome of this was a positive move towards improving some aspects of the evidence unit, making explicit knowledge and ways of communicating the process of KM.

By this stage the range and complexity of data sources has created a rich understanding of both KM and challenges that context and culture within a research environment can create. By gaining this background, I could move onto helping the participants with a more specific issue, the selection of a KM system. Data gathered and analysed helps in providing the background for such system selection, this is tackled in the next cycle.

Chapter 9

9. Cycle Six

This chapter describes the process of developing selection criteria for helping the participants' select KM system software. This is set against an organisational understanding and articulated need for some specific IT in helping facilitate KM processes. Conceptual modelling from chapter 7 creates a useful understanding of the KM steps that must be supported through the selection of any KMS. Rather than being the sole solution this is only one strand of a wider problem-solving strategy. The aim of this cycle is to discuss issues concerned with selecting such a system to support intermediaries. SISTeM (Cycle 1) is used as a problem-solving approach within an action research framework to analyse KMS issues, human computer interaction and developing criteria for selecting a system. Selection criteria for knowledge management systems are then outlined and applied to a case study in EBP.

Diagnosing	How can we select some technology to help intermediaries with their knowledge management? (MPr)
Action planning	Find relevant themes relating to technology from previous cycles and bring together useful information from the literature.
Action taking	Pull together all information into a questionnaire which can act as selection criteria, pilot these with a range of industry stakeholders.
Evaluating	Criteria can be used to articulate and shop for technology to support knowledge management, this is something new that needed to be developed.
Specifying learning	Developing criteria is challenging and needs the input of people who understand KMS, beyond the expertise of most people based in industry.

9.1 Diagnosing

Through cycle two a range of knowledge management system (KMS) issues were identified. Would it be feasible to introduce a KMS within the unit to improve knowledge storage and sharing? Before this question could be answered, participants wanted to know what products were available on the market that might serve their needs. As an outsider to the KMS industry, I knew that there are several products available, but all of them used different languages to describe their systems and platforms. What was needed was a way of helping participants select and compare the technology available. This would move away from the problem of comparing 'apples with oranges', that is, comparing systems which on the surface look very different. We identified that the unit did not have the time and expertise to select a KMS by themselves but would need some consultancy to help them to do so. I was given the permission and authority to develop a range of KMS selection criteria, relevant to the unit's needs but also including a range of perspectives from the literature.

While it was useful to use SSM in diagnosing KM needs in cycle four, it is not helpful at the stage of thinking about using information technology or for concentrating on human-machine activities. To help with this phase of the project Soft Information Systems and

Technologies Methodology (SISTeM) was used (Atkinson, 1997; Atkinson, 2000a). This provides a more practical approach to promote

“operational decision-making and bringing about the integration of organisational, information and technological changes within the situation” (Atkinson, 2000a, p. 104).

SISTeM was used within the rest of this action research cycle to help in identifying KMS selection criteria. This approach has also been used within a variety of health care settings by the developer of SISTeM and so is relevant to the area of investigation in this thesis. The methodology contains two cycles, the first focuses on strategic decision-making and broad principles, and the second cycle covers operational issues, with decisions for action and processes for decision-making.

Using this methodology was a way of articulating what was needed from a KMS in order to aid action planning. The phases of this action research cycle describe part of this process rather than describing the whole methodology, and as with SSM, has been used as a problem solving approach. The emphasis is on Cycle 1 of the methodology, at strategic level, which is where decisions of principle were used to guide decision-making in KMS before practical decisions for action were made.

SISTeM Cycle 1 began with an analysis of the problem situation and moved to a decision, which would lead to change and the new problem situation being explored through Cycle 2. Exploring the situation at hand provided a focus on information systems as described by Atkinson (2000a) in the community of practice, current and future, but also the impact that these have on how intermediaries do their job. A political and social analysis also helped to explore the role that IT staff had to play within the community of practice, and the experiences and attitudes to KMS and IT by potential users of a system.

9.1.2 Root definitions and conceptual models

During Cycle 1 human-machine systems that relate to knowledge management issues and tasks were identified. A root definition and CATWOE, as described in Soft Systems Methodology (Checkland & Scholes, 1990) were drawn from past work of mine (Fennessy & Burstein, 2000b). The human activity system had been defined in cycle three of this research, so that articulating the human-machine activity was a simple process.

CATWOE

Customers: intermediaries at the unit

Actors: IT staff, intermediaries

Transformation: knowledge at the Unit transformed into knowledge system components

Weltanschauung: Knowledge creation, storage and sharing are necessary for effective knowledge management

Owners: intermediaries, IT staff

Environment: intermediaries, IT staff

Root Definition

A unit owned knowledge management system operated by unit staff and owned by the Institute that enables knowledge creation, storage and sharing.

This root definition and CATWOE differ from those developed in cycles three and four of the research. Here we can see the integration of information technology and the intermediaries, the main focus is the KMS.

9.1.2 Developing expressive models

Having identified the system, participants worked together to develop an expressive system model linked to the root definition. This model consisted of both human and machine activities; figure 8 shows such a system model. This also took into consideration literature in the area of KMS development (Liebowitz, 1999), where a wide variety of knowledge management processes have also been described (Holsapple & Joshi, 1999a). This was an excellent way of identifying which activities within the system needed to be supported using IT and which ones did not.

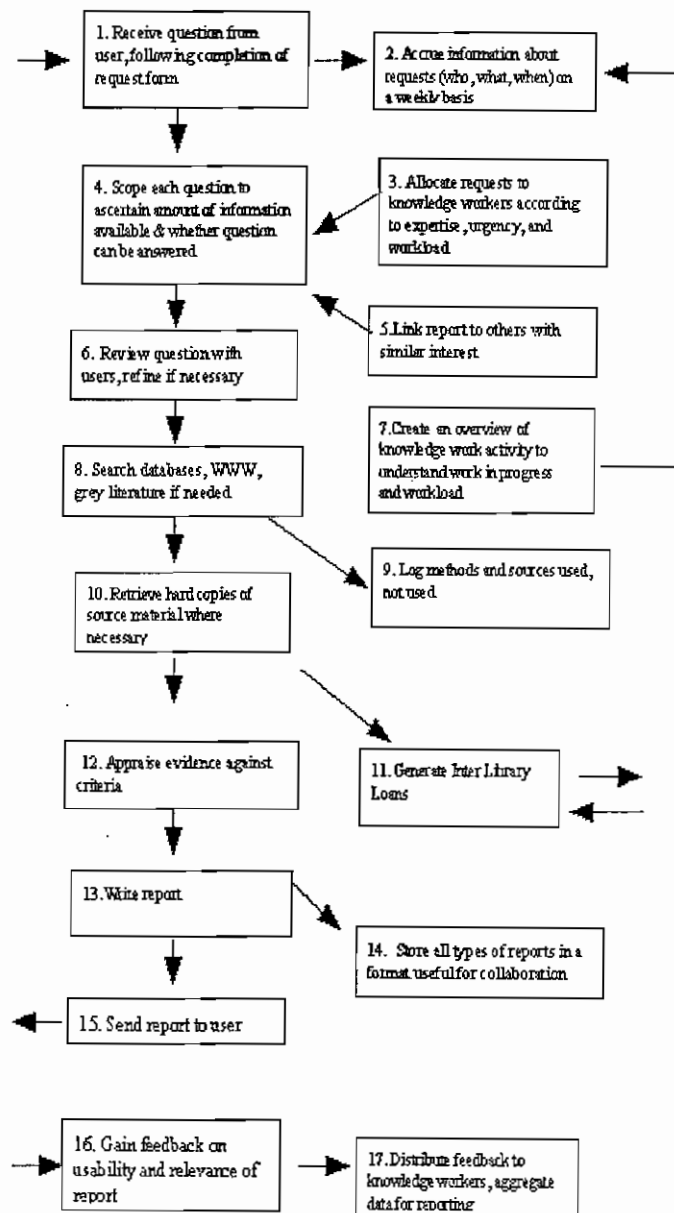


Figure 8 Expressive model of the community's KMS

There were also tasks within the organisation that were identified as problematic. They were tasks that could be improved using IT, but also required organisational and cultural changes. Table 5 expands on knowledge management activities and links them to KMS sub-activities. Such activities have been explored in conversations with participants and observation of their knowledge work.

9.1.3 Debating the model

A debate about what was articulated in the model took place, including intermediaries and IT staff outside the unit but working for the parent organisation. This was a way of taking what IT already existed, combining them with new components needed to create a more efficient and integrated system. Such debate brought social, organisational and political issues to the fore. While this was at times emotive and contentious, some tangible outcomes were reached, including decisions on functionality and current IT infrastructure. One IT support person said

"hey, they don't take any notice of what I have to say, they (managers, unit heads) are the ones making the decisions about IT in this organisation. They don't realise that I have the expertise to advise them, they are working to their own agendas, which often conflict".

At a pragmatic level, implementing a KMS could help intermediaries with the knowledge sharing and innovation problems that were articulated in cycles two and three. These KM problems that could be helped by the implementation of a KMS included the knowledge capture, storage and sharing processes, but could also help in restructuring work flow to encourage a more systematic approach to managing knowledge.

Table 5 Expressive model incorporating machine knowledge components

1. RECEIVE question from user, following completion of request form. NOTIFY group that request has arrived.
2. ACCRUE information about requests (who, what, when) on a weekly basis CAPTURE data for future use.
3. ALLOCATE requests to knowledge workers according to expertise, urgency and workload. CAPTURE data about who is carrying out request. MATCH request with data of skill mix and workload.
4. SCOPE each question to ascertain amount of information available and whether question can be answered. SEARCH databases for information relevant to request.
5. LINK report to others with similar interest. SEARCH internal information with current request.
6. REVIEW question with users, refine if necessary. UPDATE request where necessary.
7. CREATE an overview of knowledge work activity to understand work in progress and workload.
8. SEARCH databases, WWW, grey literature if needed RECORD search strategy STORE databases used and websites visited
9. LOG methods and sources used, not used (rationale if considered useful). STORE serendipitous knowledge for future work. STORE rationale for decisions made.
10. RETRIEVE hard copies of source material where necessary. SEARCH library catalogues for appropriate information.
11. GENERATE interlibrary loans (ILL). CREATE overview of ILL activity re: loans waiting, satisfied, costing, turnaround time. CREATE messaging to supplier where needed.
12. APPRAISE evidence against criteria. RECORD decisions about appraising individual articles. COLLATE into evidence tables.
13. WRITE report. CREATE word processed document.
14. STORE all types of reports in a format useful for collaboration. CREATE Adobe PDF documents. MOUNT on website.
15. SEND report to user. COLLECT data on time report sent. COLLATE statistics on completed work and turnaround time.
16. GAIN feedback on usability and relevance of report. COLLATE data. STORE findings of feedback. AGGREGATE data for reporting.
17. DISTRIBUTE feedback to knowledge workers. SHARE with researchers for evaluation.

Many of the debates about KM systems continued to the end of the project, especially in relation to cost and the place that a system would play within the community. At this stage I sought a 'robust accommodation' between competing actors and stakeholders. This meant finding an accommodation between the needs and realities of the intermediaries, IT support and management within the parent organisation. I was successful in achieving agreement in principle in relation to the model and processes that needed supporting. The funding, training and implementation of any system however would be food for future discussion and debate. Until this, the community would not be able to move on to Cycle 2 of SISTeM, where implementation of a KMS could take place. Despite this, it was useful to see what was available on the KMS market, as cost and training were overriding factors in selection and potential implementation of any system, I needed to find out what was available.

9.2 Action planning

From analysing what activities could be underpinned by KM systems, I needed to develop criteria against which I could compare products that were available. My first step was to read the literature about KM systems, to understand what was available and how they supported KM. The following quote summarises my experiences of reading about products

"Over the past few years there has been a rapid growth of technologies that their vendors characterize as knowledge management software ... It is fair to say that no single product offering satisfies all of the organization's KM needs" (Holsapple & Joshi, 1999b, p. 7.11).

Knowledge management systems (KMS) are tools to effect the management of knowledge and are manifested in a variety of implementations. Alavi and Leidner (1999) describe these as

"Target(ing) professional and managerial activities by focusing on creating, gathering organizing and disseminating an organization's 'knowledge' as opposed to 'information' or 'data'" (p. 2)

I felt that gaining an awareness of KM technologies was valuable, this is echoed in the KMS literature (Holsapple & Joshi, 1999b). Participants had little experience in selecting software, or enough knowledge to inform what they were looking for, instead they charged me as the researcher to look for them.

A literature review revealed that there were divergent views about which activities or processes are encompassed by knowledge management and could therefore be covered by a KMS technology. Frameworks ranged from simplistic linear steps to more sophisticated ones (Holsapple & Joshi, 1999a; Holsapple & Joshi, 1999b). Many of the frameworks, describing processes and technology did not conflict, but instead used different words for similar concepts (Bhatt, 2001; Binney, 2001). From the review, I came to understand that there was no right or wrong framework, so once again used the initial framework I had chosen by Skyrme (1999). This included:

- knowledge creation
- knowledge identification and collection
- knowledge classification
- knowledge representation

- knowledge organisation and storage
- knowledge sharing and dissemination
- knowledge access

Other criteria added during my discussions with the participants included:

- administration, training and support
- cost

Technology can help to structure knowledge and represent explicit knowledge. From a KMS perspective the variety of technologies is large (Skyrme, 1999) and are described in table 6. From this table, it can be seen that there are a host of possibilities facing the community of practice, when looking at technology to help them solve some of their knowledge management problems. Unfortunately, many organisations such as the unit, had limited knowledge outside their core competencies in order to make the appropriate decisions about KMS.

Table 6 Knowledge management technologies

	Functionality	Examples of tools
Knowledge-based inputs	Extracting hidden information. Filtering according to profiles. User oriented presentation. Condensing information.	Intelligent agents. Email filters. Relevance ranked searches. Concepts retrieval. Visual maps. Data and text mining.
Knowledge process	Retrieves old evidence reports. Rules and induction. More rapid combinations.	Case-based reasoning. Experts systems.
Knowledge repository	Holds most current information. Single point of reference.	Thesaurus management.
Knowledge flows	Timely routing. Improving work flow. Alerting users to change.	Emails. Workflow software. 'Push' technology. Intelligent agents.
Knowledge outputs	Supports thinking processes. Informing decision-making.	Cognitive tools. Idea generation and visual mapping. Decision support: meeting support.

(adapted from Skyrme, 1999 p. 73)

9.3 Action taking

The knowledge sharing and innovation outlined above provided the framework for developing criteria or questions about product functionality. I went on to develop a questionnaire or shopping list that could be used to help answer my questions about which KMS would be suitable for the community.

9.3.1 KMS questionnaire development

To test and 'make real' any criteria for selecting a KMS, it made sense to further develop these ideas into a tangible product by asking specific questions linked to broader concepts of knowledge management as described by Skyrme (1999). Using his knowledge sharing cycle, I linked these concepts with my knowledge and information from the literature, such as that presented in table 6. This linking created the basis for a questionnaire, that focussed

on creating clear and understandable questions that could be posed to KMS vendors in order to elicit information about their products.

Linking concepts from earlier concepts of KM to specific questions is illustrated in figure 9. Here the questions follow the knowledge sharing cycle, deconstructing each concept in several ways. Beyond these knowledge-sharing questions, the participants and the university I studied in were concerned about the cost of any potential system. As part of the publicly funded health care system, participants were concerned about the potential for spending money on overheads such as software or training in how to use software. Could the costs be any different if the system was tailored to the community of practice compared to an off-the-shelf product? With these issues in mind the following questions were added to the questionnaire.

Cost

- Can this product be tailored?
- Do you supply after sales support to tailored systems?
- Can we buy modules?
- How much does it cost to purchase?

Training

- What training do you offer? Please state...
- Duration of training? Please state...
- Is training included with the product?
- Do we have to pay for training?

Anxieties were raised by IT support staff, how onerous would the introduction of software be to their current workload and could it be supported within current constraints, both time and hardware?

- How hardware resource intensive is your product?
- How much server space is required for the system? Please state...
- How many different administration roles are needed to support this product?
- What ratio of users to support personnel would you anticipate for your product?

To test its understandability and usefulness of what had been developed, I piloted the questions within my own department (School of Information Management and Systems) and with two separate stakeholders from industry. They provided feedback on the relevance and understandability of questions. These comments were then collated into the final version of the questionnaire.

The most expedient way of testing the new criteria was to try to apply them by finding products by searching and finding KMS sites on the Internet. This was difficult to do, as many sites did not give enough information to test the criteria I had developed. To get a better picture of what KMS products could offer, I needed to contact developers or companies to test the criteria in a more rigorous way.

9.3.2 Administering the KMS questionnaire

There were, however, a plethora of KMS providers in the marketplace, with some estimating the market in applications will exceed US\$1billion worldwide by 2002 (Romberg, 1998). A range of sources that have surveyed the industry have come up with

over 65 vendors (Delphi Group, 1997) and Internet searches by me during 2001 revealed over 200 vendors.

The language of marketing and purchasing such products is a long way from those working in health care. Systems selection is outside the scope of work for such professionals and the marketplace is a confusing and somewhat crowded place. This exercise was aimed not only at developing an understanding of functionality of KMS systems available, but also to create an end product that would facilitate selection of products in such a large market place. I was looking for organisations I could send my questionnaire by email (see Appendix 13).

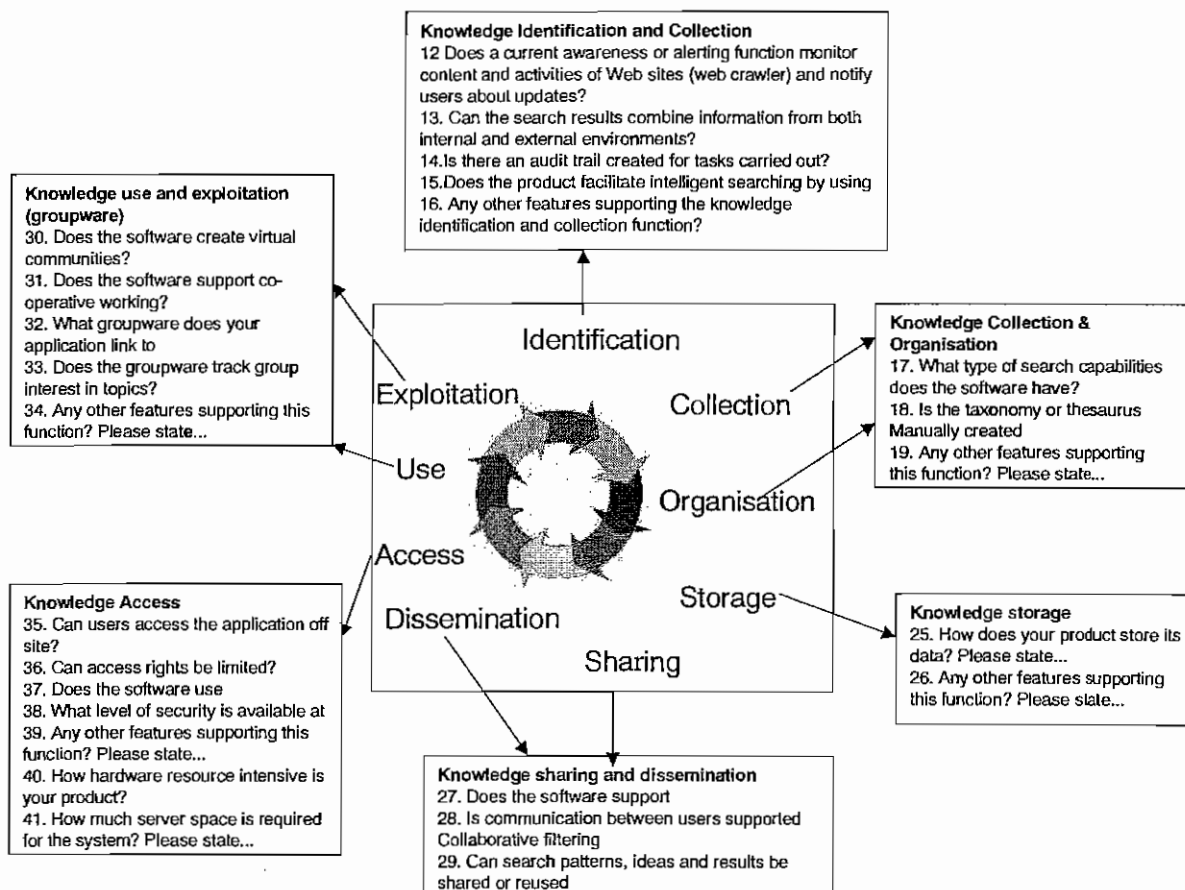


Figure 9 Linking the knowledge sharing cycle to the KMS questionnaire

My search of the Internet began with 'knowledge management systems'; this exercise provided more than 200 different products. I also combined this broad search with a list compiled from the literature and industry analysts' websites (Delphi Group, 1997; KM World, 2001).

Each organisation from the combined list was searched for on the Internet through the search engine GOOGLE™. At this point there was some overlap of lists, providers and products. From the suggested list of approximately 150 organisations, ten no longer existed, and eight had been taken over by other KMS providers. Some sites, despite being cited in the literature, did not provide explicit references to knowledge management, and even where this was completely absent, questionnaires were still sent out to organisations. This was because many companies changed terminology to suit marketing needs, what was once considered KM has been transformed into e-business, although often the products

were the same. This illustrates the dynamic nature of the field and the changing focus of websites.

Some indepth searching of sites needed to take place in order to find an appropriate email address for sending the questionnaire to the organisation. On a range of sites, email addresses were not available at all, so that the questionnaire was pasted into the query page provided, and sent that way. The most appropriate email address was usually one allocated as 'for further information', but marketing and sales emails were also used. One hundred and eighteen questionnaires were sent by email to respondents, these are listed in Appendix 14. A follow up reminder was sent ten days later. Email was chosen as the medium to use because of its speed and convenience. Responses to this questionnaire are discussed in section 9.4.1

9.4 Evaluating

Selecting KMS could be a time intensive process, approaching a range of KMS suppliers to test the selection criteria in the form of a questionnaire was cumbersome and challenging. Discussing and debating the potential introduction of a KMS was fraught with social and political dimensions that would not have been uncovered unless the systematic approach derived from SISTeM was used.

9.4.1 Feedback from the questionnaires

Responses to the questionnaire were external validation of the selection criteria, from the emails sent out there were six responses. External validation is discussed in detail in section 7.1. From these responses I sought to find the understandability and usefulness of the criteria and therefore validation of the questions. This was a low response rate, but was not disappointing, as the main aims of this exercise to articulate selection criteria and create a comprehensive list of questions about functionality. This exercise looked for a small range of products that could be compared and contrasted in functionality so that recommendations could be made to participants. More importantly the process of how to go about eliciting product information provided useful insight into the industry and difficulties in finding out what was available on the market.

Information elicited from KMS providers was aggregated by me and reviewed, against the criteria. The following products were identified through responses and met many of the criteria:

- Metastar enterprise
- Advantage KBS
- Ultimaus Workflow suite
- Brainranger Portal
- Organik
- Objective

One of the outcomes for success for this exercise would ideally to have been a demonstration copy to try out before making any recommendation to the community. This was offered in only two cases. Some of the software providers could however provide demonstration versions for a price, including one company for A\$40,000. Such a cost was

outside the budget for this project. An analysis of the responses to this questionnaire is discussed in section 9.5.

9.4.2 Social analysis: roles, values and norms

Like SSM, SISTeM also recommends carrying out a social and political analysis. This was useful in exposing underlying issues that could impact on the selection and criteria development for a KMS, and included stakeholders beyond the immediate group of intermediaries that I was involved with. By looking at the community of practice of intermediaries, I could see that there some identifiable and uniting social issues that were important when thinking about applying KMS. These roles, norms and values of the intermediaries that could have an impact on the development and implementation of any solution that was arrived at.

Roles: each intermediary contributed a range of skills and expertise to the community. What these roles had to offer in relation to IT was never made explicit. There was however an implicit understanding that 'someone' should be doing 'something' about IT and KM issues, I concluded that this meant a person working in an IT or administrative role.

Norms: differ for the range of clinical and professional groups represented in this team, such norms when applied to IT and IT competencies in this area differed depending on background and training in the area. The group norm was one of being able to use and cope with new technologies when they became available.

Values: these were intrinsically formed within the group. The group contained doctors, nurses, information people, and researchers from health care and the academic sector, some of these values were brought into to the group from previous experience of IT and expectations they had from working in highly IT literate and enabled environments. Other participants did not value the role of systems or IT in what they did and saw it as a 'necessary evil' only sometimes seeing its future potential.

Despite these identifiable roles, norms and values, they needed to place within a wider institutional context, were influential stakeholders did not see issues in the same light. IT support staff were viewed as 'the someone' who had to do 'something', but they viewed their role as one of supporting the organisation's objectives, which up to this point did not include KM issues. Influencing this from a researcher or intermediary perspective was difficult, getting such issues recognised required influencing the vocal management team within the institution. By contrast the IT staffs' norms and values worked against too much innovation, it was even discouraged to some extent, too much innovation meant too much work. Set against this, management had a direct hierarchical command on what IT staff could do, and how it was done, even if this conflicted with the IT team's values. An example of this was not gaining the correct software licensing or university clearance for application use.

9.4.3 Political analysis

In relation to KM and systems to support such work, participant's individual knowledge and rank within the organisational hierarchy affected their influence on how systems and technology were used and developed. Those contributing to the politics and influence from a political perspective were wide and often fell outside the community of practice of intermediaries. Intermediaries often acted as a united group, despite their differences in professional backgrounds, they focussed on the evidence seeking task, so were helpful in 'pushing' a KMS agenda. Beyond this small group there were many other players within the

political domain, their motivations were quite different from the intermediaries. The two most noticeable groups that could be identified in this political domain were management within the wider institution and IT support staff. These groups often held conflicting and philosophically opposing views. Both these smaller groups had a direct impact on the intermediaries as far as any IT implementation were concerned, and could forward or stymie any initiative that was brought to the parent organisation. This support depended on political agendas, and whether the issue was viewed as popular or sensitive at the time.

To a large extent these two groups, drowned out the wishes or opinions of the research participants, and were very vocal stakeholders who influenced the IT agenda. One IT support person reflects on this

"Peter (a senior manager, not related to the intermediaries) has the work 'information' in his title, so everyone presumes that he is the expert. This is often not the case, he has an academic background in the area, but doesn't know much about the day-to-day operating of systems. Because he is high up in the organisation, people defer to his 'superior' knowledge. On the other hand, Craig (another senior member of staff) thinks he knows what he's talking about, and because he's so persuasive, he gets people on board about decisions on IT".

Here we see that position within the hierarchy, rather than knowledge or experience of IT, is more important than a working knowledge of IT or systems. The potential for this to lead inadequate and costly decisions was high. This situation also ignored the skills and expertise of the intermediaries, many of whom had broad experience and exposure to IT in a range of workplace settings.

At a cross-organisational level, the situation was blurred, with those in the organisation confused about who actually had the 'final say' over decisions in relation to software and licensing, this was previously described in section 7.4.3. Most intermediaries had high level skills in relation to IT, but within the scope of their work were limited in extending the use of new applications the parent organisation. Despite this some participants saw that they had the best of both worlds, using the IT resources of the local health care organisation, but gaining access to university information resources and licensing. There was the possibility of playing one off against the other. This could be used to the unit's benefit, but put IT support staff in the awkward position of trying to resolve differences

9.5 Learning

This cycle created a range of learning opportunities for myself and the unit, these focussed on learning more about the unit's KMS needs, about the product market of KM systems and learning about the social and political climate that influenced decision-making.

Obtaining an agreement between an expressive model of a KMS and the participants was simple and uncontroversial, moving it onto the real world and implementing it was more difficult and beyond the scope of this research. I feel that it was important to think carefully about the social and political analysis that influence the selection and potential implementation of KM systems, this information required sensitive handling and feedback. 'Double loop learning' as described by Argyris and Schon (1978), looks at restructuring organisational norms to reflect the new knowledge gained during the research. This happened by participants articulating KMS needs which in turn raised an awareness of how and why current systems were used. It also challenged the wider organisational decision-making processes, and was often viewed as an uncomfortable challenge to the *status quo*.

Participants enjoyed the experience of analysing the political and social side of their work, something that was new and at times controversial.

Creating a KMS questionnaire was a useful way of framing criteria and bringing together lessons from the literature. Linking to knowledge sharing and innovation was much more difficult than the literature or those working in the field had suggested. Testing the criteria out in the real world was helpful in gaining an insight into usability and understandability of systems. As with most questionnaires, eliciting product information required incentives or benefits for the respondents. The questionnaire was sent to a general email address within many organisations, which could have had an impact on the response rate, as no individual was identified to answer it. Receiving a summary of findings was not enough incentive for many potential respondents. As this research project is qualitative, the small response rate was less of an issue, compared to those studies where comparison of KM systems is the primary goal.

There were different levels of understanding within the KMS market about what made up a KMS, and many of the questions were difficult for some respondents to understand. While jargon was avoided within the questionnaire, some was still retained as shorthand that could be quickly understood within the industry. Unfortunately some jargon acted as a barrier to answering the questionnaire. It is acknowledged that the questionnaire was long, which could have been a disincentive to complete it. The challenge was to cover all areas of knowledge management activities within the one data collection exercise. Because of the time limits set for this project, an exhaustive search of the Internet and other sources was not done, this may have provided an even larger target group for administering the questionnaire.

Developing criteria and a questionnaire for the selection of a KMS was a challenging and time-consuming task involving reviewing the literature to distill knowledge activities, and finding the large amount of KMS. The participants learned that what seemed like a simple task of shopping for a KMS in a virtual environment became complex and required a good understanding of KM systems.

Carrying out a social and political analysis in relation to IT and the introduction of a KMS threw up many contentious and often unspoken issues. Gaining diametrically opposing views highlighted that the selection and potential introduction of innovation exposed agendas that required recognition, 'buy-in' and ownership of all groups if the innovation was to be successful. Gaining consensus about the benefits of introducing a KMS required appealing to the different stakeholders' concerns and fears. To do so required a good knowledge of the KMS and what was required of it in terms of training support and cost.

9.6 Reflections on methodology

SISTeM was a useful methodology for building on the lessons of SSM used in previous chapters. It created the finer, more explicit link between human-machine activities that was required to develop KMS selection criteria. From an analysis of the KM environment studied, many of the KM functions identified were found within many KMS products on the market. Before looking at products it was useful to have an understanding of what was required so that time and resources were not wasted. This understanding could be taken on to a future implementation project with the community where SISTeM Cycle 2 could be used to make tangible decisions regarding procurement. The overriding issues, at this stage were whether any such solutions were:

- systematically desirable

- culturally feasible
- organisationally value adding
- informationally and technically feasible and
- ethically defensible (Atkinson, 2000a)

These were perhaps the most important criteria to be reached by any system before functionality was even considered. At a pragmatic level, implementing a KMS could help intermediaries capture and store knowledge about their searching and appraising the evidence as they went. A KMS could provide decision support for those who have trouble articulating their questions in a format that can be easily answered. While resolving KMS issues is a step in the right direction, it must be remembered that

“many organisations try to build KM programs and architectures before building the cultural collaborative or business foundations for these programs... they are of little value unless tied directly to easily seen business benefits” (Coleman, 1999, p. 12.14).

The success of this project was to unpack difficult issues and turn them into a ‘shopping list’ for selecting KM systems.

9.7 Chapter summary

This cycle has explored a range of issues in relation to developing and understanding the selection process for a KMS. This has been set against a rich description and analysis of data collected from a range of stakeholders, reflecting many different views within the research environment. There were several predisposing issues that needed to be explored before selection criteria were developed including having an understanding of the organisation’s knowledge sharing and innovation and an understanding of the KMS market. Testing selection criteria was more difficult than anticipated, it was difficult to apply the criteria to publicly available information on KM systems. Instead I needed to test the criteria by sending them to KMS providers. Using SISTeM to link human-machine interactions and a social and political analysis of the community provided useful insight into issues and problems that could affect system thinking at a strategic level.

This is the last action research cycle, the next chapter pulls together the data analysis from all action research cycles to gain an overall picture of how the action research cycles contribute to an answering the research questions.

Chapter 10

10. Findings and conclusion

This chapter brings together information generated from the analysis of six action research cycles. Strands and themes that emerged are tied to the research questions defining which ones have contributed to new knowledge.

Findings from the research have created new knowledge relating to:

- the development of a conceptual model of knowledge management for intermediaries
- identifying the role of intermediaries in knowledge management for EBP
- development of knowledge innovation and sharing activities and KMS selection criteria for the community of practice
- methodological extensions to the study of knowledge management focusing on social, political and cultural factors and the social construction of problems and solutions
- a new approach to applying action research

10.1 Reflections on methodology

Through the life of this project there were innovations and challenges created by the use of action research. As discussed in chapter two I have reinterpreted the application of action research. This has been a way of looking at the same problem and themes from different angles building in triangulation throughout the research process. From an interpretive perspective, the seven principles of interpretive research identified by Klein and Myers (1999) have been demonstrated through this research. By doing so the research

“focuses on the complexity of human sense making as the situation emerges... it attempts to understand phenomena through the meanings that people assign to them” (Klein & Myers, 1999 p. 69).

Multiple angles were useful in exploring a range of stakeholder views and sense-making, whilst answering several research questions during the life of the project. Reflecting on the methodology throughout the life of the project has helped me improve and change tack as required. Overall comments on the application and usefulness to research are as follows.

10.1.1 Achieving improvement through action research

The aim of action research is to improve the rationality of the community's practices, while developing understanding of both the situation and their practices (Lewin, 1946). My role as action researcher was at times that of an evangelist, one of identifying the preferred course of action. This was inherently a political and sometimes controversial role. From the research the participants and myself defined improvement in many ways. Improvement in the research context was individually constructed and was dependent on the worldview of the individual. For me as the researcher, improvement meant understanding, articulating and communicating what was taking place in the community of practice. Going as far as describing and mapping processes was enough to satisfy my objective. Juxtaposed with this were participants' understandings of improvement. For some participants improvement meant documenting knowledge intensive processes and developing standard operating procedures (see a template of this in Appendix 12) to create consistency and

understandability of the evidence-seeking process. An alternative interpretation of improvement was understanding and being more responsive to user requests. All of these diverse interpretations of 'improvement' meant that as an action research project, it succeeded on many levels to gain a change and move towards a desired state of being for the participants.

By modelling and process examination the participants and I were able to identify gaps that could be focussed on for the purposes of knowledge management. Some of the improvements achieved directly linked to KM were:

- improving the lay language of evidence reports
- collecting qualitative information on the end user experience
- improving the initial process of asking questions between user and intermediary
- developing an understanding of the impact of the evidence on decision-making
- storing and sharing knowledge from a central repository
- getting a KMS provider to carry out an independent assessment of the unit
- debating the unit's worldview of what evidence means, thinking more broadly about the relevance and usability of evidence to use in practice

Some of these improvements for practice were considered and tackled by individuals within the community. This was especially true after giving feedback from health practitioners as end users. Action was taken immediately because it was seen as 'core business' that had an impact on the usability and relevance of the evidence reports. Questions about user versus intermediary paradigm views were challenged by the group and to some extent were rejected, not through dominance of one paradigm over another, but rather through a lack of understanding of alternative paradigms. To resolve this intermediaries working in EBP require exposure to other paradigms about the evidence through reading, journal clubs, and discussion with others outside the local paradigm. This will enhance both education and information provided by the unit, and create a higher degree of relevance to the end users.

On some occasions the participants did not act on my suggestions for change, reasons for this were varied and complex. There was a range of interacting factors preventing the community from moving forwards on KM issues, including resource constraints, power and politics, priorities and insight into the nature of the problems being debated. These complexities created a richness and challenge to me as researcher that were considered within the bounds of the study. Learning from this was as important as gaining from the successes of the project.

The implications of this partial uptake are to improve future KM and action research by disseminating the findings, from this the information systems (IS) discipline can gain just as much as learning from successes. Rather than putting a positive spin on action research projects (Baskerville, 2001), understanding failure assists in improving techniques for KM implementation and methodologies for understanding the complexities of the research environment. Within this complexity, understanding that there is a range of definitions of improvement can help researchers view action research projects on many levels. The complexity of the participants' situation has added to the understanding of the research environment or application of theory.

10.1.2 Taking risks in action research cycles

Some suggestions for the pragmatic improvement in the community of practice were approached with caution. The unit was unwilling to put the time or resources into training,

consulting or reorganisation of their explicit knowledge. An example of this was a visit by the parent organisation's record-keeping and storage expert. Advice and support from an expert individual was offered freely and competently, but was passed by as a tool to help with knowledge storage and retrieval.

This short-term view of providing resources to facilitate KM raises the issue of whether KM can be sold to 'cash strapped' organisations when there was a perceived lack of obvious short-term benefits. This issue says more about the climate of working in health care, where there is a desire to demonstrate short-term outcomes compared to taking a longer-term view. This culture is endemic and is fuelled by short-term initiatives and funding by government departments. To make KM appealing, researchers and those implementing change require an awareness of this culture and skills in catering to this need for short-term outcomes and impact.

One risk of exposing KM issues is that of exposing systemic issues or problems, many of which are beyond the control of the research participants. The tension is one of highlighting issues, but also pointing towards pragmatic and realistic opportunities for improvement and change.

Baskerville (2001) warns that action research is "full of risky assumptions" (p. 196). Part of this risk is assuming that improvement with the research participants will be simple and automatic. In most action research projects, the researcher needs to be prepared for some improvements in the research situation not being achieved; this is part of the learning and research process. Part of the learning from this research is that the rhetoric versus the reality of KM are two different things. Suggestions that look attractive at an abstract or conceptual level may not be borne out in the real world when cash decisions need to be made. In the wider scheme of the unit's problems, KM was low down the list.

This rejection of improvement helped me to gain insight into the complex worldviews of the participants and the messiness of the organisation much more so than if they had taken the suggestion for improvement and gone forward without question.

10.1.3 Generating theory versus generating action

During action research there is the tension between generating change and generating theory. For me as researcher the tension was real and at times the need for generating theory drove the project compared to that of generating change. Generating theory within the context of PhD research is easy to achieve compared to that of changing practice. Change requires a raft of skills to drive and facilitate change within the research environment. I was fortunate to have some of these skills through my previous work experience in change and implementing the evidence into practice. Maintaining an impetus for change however, requires long-term involvement with the community of practice and the authority to instigate change, two factors that as a participant observer in a life-limited project, I lacked.

This tension is debated by McKay and Marshall (2001), who see it as a dual imperative. The sustainability of theory generation has been proven through the documentation of the project and consequent publication of theory oriented peer reviewed articles (Fennessy, 2002; Fennessy & Burstein, 2000a; Fennessy & Burstein, 2000b; Fennessy & Burstein, 2001). Change, however, is more difficult to measure and sustain within a work environment where groups and individuals have an impact on whether changes succeed or fail. I believe I was successful in achieving a balance between my needs to generate theory and the participants' needs by generating debate, adding insight, providing support and

problem-solving. Part of the participants' need for improvement was the articulation of implicit work processes, part of the action and change was to gain insight into these process and to better understand when and where knowledge was generated. This has been achieved throughout the life of the project.

10.1.4 Merging diverse worldviews

Part of this research has been to develop a new perspective in the application of action research through a reinterpretation of the methodology. I have looked at the same problems from a range of stakeholders' perspectives. The challenge has been to negotiate and merge these diverse views to make sense of issues that have been researched in this project. Bringing this together has created collective representations of meaning.

Durkheim (1961, c1915) referred to these representations as widely available categories of meaning and understanding, this includes social forms as community, home, family as collective representations. Accommodating these representations took place on a range of levels, much of this was achieved through my positive relationship with the research participants and through my facilitation skills. Bringing together views was achieved through discussion, debate and negotiation. Meaning is seldom predetermined, it is always articulated with concrete particulars, engaging institutional frameworks, formal and informal categories, cultural patterns and socially established structures of meaning (Geertz, 1983).

Collective representations of views about knowledge management and intermediaries enter the interpretation process through what Schutz (1970) described as "schemes of interpretation", as widely available, experientially acquired frameworks for making sense of everyday life. Bringing together these interpretations into a joint collective view was achieved within the context of "individual biography and interpersonal relations, reflecting and perpetuating culturally promoted understandings of and oriented to everyday experience" (Holstein & Gubrium, 1994, p. 267).

Obtaining an accommodation as prescribed by SSM (Checkland & Scholes, 1990) or SISTeM (Atkinson, 2000b) in relation to rich pictures, models, and directions for improvement raised the question of what accommodation meant. Gaining an accommodation did not necessarily mean gaining consensus. This is reflected in the IS literature by Checkland & Scholes (1990), which points to

"the accommodations which are generated, modified and dissolved by politics will ultimately rest on dispositions of power ... accommodating those interests is the business of politics, and the concept will apply to a company or work group or a sports club as well as to a city or nation state" (p. 50).

While this accommodation was achieved in some areas, such as an agreement on a conceptual model, there was more dissonance on the perceived role of the intermediary and introducing a KM system into the community of practice. Dissonance provided fertile ground for misunderstanding, conflict and disappointment. Despite this, when dissonance can be articulated and acknowledged by stakeholders, there can be movement towards more inclusive interpretations of concepts of knowledge, knowledge work and the contribution that intermediaries can make in decision-making.

Understanding the social world that people construct, is often taken for granted by researchers and participants. Highlighting this construction was a way of

“safeguarding the subjective point of view is the only but sufficient guarantee that the world of social reality will not be replaced by a fictional non-existing world constructed by the scientific observer” (Schutz, 1964, p. 8).

While gaining an accommodation in views within the research, acknowledging dissent is also useful as a way of offering alternative explanations of what might be. A genuine recognition that indeed dissenters do have a point worth making meant that diverse worldviews were taken into consideration, suggesting that there was often no ‘right’ or ‘wrong’ way in which to tackle KM within an organisation. This notion of dissent links with Popper’s view of the law of falsification, where we can value new theory generated because of “its success and its being a true theory, but also because it may be false” (Popper, 1972 p. 14). The interpretation of dissent within action research is a phenomenon that has little attention paid to it but has risk attached to it. I dealt with dissent in an intuitive way, accepting that some ideas of knowledge management would not gain complete support of the participants. This was dealt with as it arose and was handled through negotiation, marketing and sometimes evangelism.

The challenge was to bring these diverse interpretations into a coherent analysis and conclusion.

10.1.5 Role as participant observer

My role as participant in the research was a rewarding and insightful experience. Through this I was able to see the lived experience of participants within the community of practice, here as a researcher I was able to “intuitively apprehend its essence: we felt, enjoy and understand it as reality” (Fals-Borda & Rahman, 1991, p. 4). Adding my own ‘worldview’ was created through my own prior experience and my interpretation through data collection and my own reflective diary. It was useful to record my observations and also my feelings and interpretation of the research.

The challenge of being the participant observer was to avoid being caught up in the political and personal machinations of participants. In order to collect data and interpret it from a collective perspective I needed to avoid letting my own thoughts and feelings take dominance in the research process. At times I felt that participants used me as a player in their conflict with management. While this added insight into the research process, I avoided the temptation of taking sides.

Being a female researcher with an information management and systems background combined with a long experience in EBP was both helpful and threatening to participants. The power and impact of these factors on both participant behaviour and their responses to improvements in the research situation were considered as part of the social and political analysis discussed in chapter seven.

10.1.6 Bounds of the study

This study was conducted within the usual time limits of a PhD research project. During the life of the project I spent nearly two years working alongside the organisation. One constraint of my role was that while working with the community, my ability to influence the organisation’s agenda for prioritising improvements and implementation of change was limited. The politics and power operating within the community were strong factors in which ideas were often not challenged or debated. I felt that, as someone who was neither part of the medical establishment nor a member of the full-time staff.

Interpretive research techniques are rife with criticism (Guba & Lincoln, 1994), these have been tackled in chapter two. Findings of this research need to be couched within an interpretive paradigm, the findings are neither generalisable nor representative of what happens globally with intermediaries or with organisations that work in EBP. With interpretive research there is no single reality (Guba, 1990).

The next section does however address some of these concerns.

10.1.7 Truthfulness, consistency and transferability

Traditionally research has been evaluated in a positivist manner, this includes applying criteria such as objectivity, validity, reliability and generalisability (Denzin & Lincoln, 1994). Interpretive researchers have however argued that using such measures is not appropriate, objectivity cannot be reached (May, 1986; Strauss & Corbin, 1990). Reliability and generalisability are difficult to achieve when the emphasis is on the perceptions of the participants in relation to social processes and situations. Validity is however appropriate for action research and is achieved through the use of multiple data sources, with the validation of data by participants and external stakeholders.

10.1.8 Triangulation

Triangulation creates the possibility of interpreting both the convergence and divergence of results produced by the use of different sources of data. Through the use of a range of methods across the cycles, convergence and divergence of themes arose. Blaikie (2000) suggests that the weakness of one data collection method may be the strength of a different form of data collection. Observation of practice provided a different perspective on the participants' actions, which at times contradicted what they told me as interviewer. The danger was taking a simplistic view of combining methods, that they provide a more complete picture of the same phenomenon (Hammersley & Atkinson, 1995). Constructing explanations required locating the data within an understanding of the wider context in which they were located and against a background knowledge of this type of phenomenon (Mathison, 1988). This was achieved through my prior work experience in the field of EBP and also by working as a participant observer within the unit being studied. This background knowledge gave me an informed starting point on which to build my analysis.

With these caveats in mind, I have combined a variety of techniques to explore different aspects of a multiple socially constructed reality. Each technique in turn "provides reciprocal support for in the case of convergence or an explanatory challenge in the case of divergence" (Blaikie, 2000, p. 274). This was made possible because the range of methods used share similar ontological assumptions and was achieved through using a range of informants: intermediaries, health practitioners, outside peers in EBP, my own observation and the occasional observations of management and IT support staff.

10.2 Answering the Research Questions

Findings of the research are grouped according to the research questions posed at the beginning of this project. These questions cut across the action research cycles, much of the analysis informs the answers to these questions.

Part of this research was building on the theoretical stance outlined in chapter 1. The KM constructs developed at the beginning of the research were demonstrated continually throughout the life of the project, helping strengthen my own stance on KM, and acting as a way of drawing together key themes from a broad range of data sources.

Findings are linked to an overview of the analysis provided in table 7. The following section draws together the data analysis that took place across the six action research cycles, pulling them together to answer each of the research questions posed at the beginning of the research.

This data matrix brings together analysis that has taken place throughout the action research cycles. This table addresses the questions of:

- In what ways are knowledge management processes of identification, collection, storage, sharing and dissemination, access, use and exploitation manifested in the community of practice?
- What is the role of the intermediary in providing knowledge for health care decision making?
- Can a knowledge management system be identified that will match the requirements of the intermediaries within the project?

Table 7 Final data analysis organised according to research question
 In what ways are knowledge management processes of identification, collection, storage, sharing and dissemination, access, use and exploitation manifested in the community of practice?

Question themes	Judgements/ overviews from the data	Participant views contrast	Implications
Knowledge sharing	<p>Knowledge sharing depends on professional background and exposure to other 'positive' work cultures.</p> <p>Multidisciplinary skills required to optimise KM processes.</p>	<p>Not everyone needs to understand the role information or knowledge plays within the community, others can 'just tell' us about it</p> <p>Health care practitioners would like to link into knowledge without much effort on their part.</p>	<p>Mere communication does not influence a positive attitude towards a knowledge culture.</p> <p>Experience and exposure are more useful learning experiences</p> <p>Improvement in systems to facilitate sharing of knowledge gleaned about the evidence out into the clinical environment in an understandable useable form.</p>
Knowledge innovation	<p>Awareness of knowledge creation depended on knowledge of the complexity of the EB task, those with little understanding underplayed knowledge innovation.</p>	<p>Intermediaries valued some types of knowledge as more important or valid than others.</p> <p>Knowledge about clinical things only recognised.</p>	<p>Education re: the role of all types of knowledge within the community.</p> <p>Demonstration on how meta and process knowledge can be reused to improve current work.</p>
Organisational memory	<p>OM is built upon every time an evidence request is completed. The capture and utilisation of this is poor.</p>	<p>OM is captured in organisational process and procedures.</p> <p>Building on memory of end users doing it for themselves is minimal because they don't get enough practice at searching and appraising.</p>	<p>Turnover of highly trained staff means loss of OM.</p> <p>Unless knowledge is shared between intermediaries, it will be lost from the community.</p>
Leadership	<p>Poor leadership in community leads to low morale on many issues.</p> <p>Lack of consultation stymies intermediary motivation.</p> <p>Credibility is important for respect of community and moving towards improving KM.</p>	<p>Intermediaries separate themselves from management.</p> <p>Several leaders amongst intermediaries.</p> <p>Management oblivious to real issues affecting intermediaries 'on the floor'.</p>	<p>Improvement in management and leadership skills within the community is needed.</p> <p>More consultative style and inclusion in decision-making.</p> <p>Free time and job rotation for managers to find out what happens at grass roots level, involvement in producing evidence would increase credibility.</p>

Question themes continued	Judgements/ overviews from the data continued	Participant views contrast continued	Implications continued
Culture	<p>Lack of strategy leads to uncertainty of direction and thus under investment in thinking outside direct EB tasks.</p> <p>Low respect for information management skills, macho medical culture leads to hierarchical attitudes about what matters.</p> <p>Small operating margins Short-term funding lead to lack of investment in support and infrastructure.</p> <p>Public organisations have problems in justifying overhead expenditure time on 'other' tasks.</p>	<p>Some intermediaries thought strategically but felt frustrated in getting themselves heard.</p> <p>Recognition of information management at grass roots level, collegial mood of helping the community.</p> <p>Managers think that this is not an issue and is part of 'today's working world' so cannot be helped.</p> <p>Operating within small budgets shows effectiveness.</p>	<p>Unless long-term thinking about valuing knowledge and the skills attached to KM is done, only limited term initiatives such as the unit will be a waste of taxpayers money.</p> <p>Democratisation of the workplace for inclusive decision-making needs to be trialled.</p> <p>Greater debate at funding level and when making bids for money for support money to underpin primary activities.</p>
Power	<p>Knowledge as power is alive and operating amongst management, especially among senior staff KM detracts from this.</p> <p>Agendas changed often moving the priorities or goal posts.</p>	<p>Intermediaries: power lay with medics within the community, power plays and keeping positions is important to insecure members of staff in the community. They retained their knowledge rather than sharing it.</p> <p>HC Practitioner with greater influence use more evidence.</p> <p>Tribalism and power are the most important influences on all decisions</p>	<p>Education about the use and impact that sharing knowledge can have, knowledge sharing should enhance position not detract from it.</p> <p>Role of evidence as empowering all health care practitioners to 'argue their case'.</p> <p>Long-term goal of recognising the importance of evidence in decision-making, rather than who you are.</p>

What is the role of the intermediary in providing knowledge for health care decision making?

Question themes	Judgements/ overviews from the data	Participant views contrast	Implications
Expert	<p>Adds credibility to clinical/ research work.</p> <p>All questions have a range of agendas.</p>	<p>End users will only use experts if it suits them, if the evidence is contrary, they will reject it.</p> <p>Evidence fulfils only part of the health care decision.</p> <p>Some intermediaries consider some individuals within the community to be experts but not others.</p>	<p>Marketing and education about what experts can contribute to decision-making.</p> <p>Increase the awareness of the limited role that evidence has to play in decision-making.</p> <p>Wider opportunities for intermediaries to share their specialist expertise with the community.</p>
Judge/ arbitrator	<p>This helps in times of clinician disagreement.</p> <p>Clinicians don't like confrontation, falling back on experience and tacit knowledge.</p> <p>Hospital lacks understanding of effectiveness and uses unit as 'the answer' for innovation, quality and other initiatives as required by funding agencies.</p>	<p>Intermediaries don't see this as a legitimate role at micro level, but important at macro level.</p> <p>Evidence is used as a persuader.</p> <p>Hospital unworried about understanding effectiveness issues, will get mileage out of unit for as long as possible.</p>	<p>Education re: life of the health care practitioner important in understanding the limited role of evidence. Context, experience, policy and patient preferences need to be understood to add to decision-making.</p> <p>Training about conflict resolution and negotiation re: decision-making.</p> <p>Mileage from evidence units only have a limited life.</p>
Paradigm views about EBP	<p>Intermediaries provide a narrow paradigm view of evidence, this is reductionist and exclusive.</p> <p>Follows government and hospital policy.</p>	<p>Some participants questioned this view of level I & II evidence as main focus.</p> <p>Views of consumers are left out of evidence reports.</p>	<p>Transparency and communicating of EBP 'worldview' important, range of approaches need to be used to search for the evidence.</p>
Importance of role	<p>Depends on paradigm view held by end user.</p> <p>Depends on climate of government policy and emphasis of the needs of funders.</p>	<p>Coming from an EBP background shapes views, intermediaries saw evidence as a main driver for decision-making.</p> <p>Under-appreciated and unrecognised role.</p> <p>Practitioners saw intermediaries as a discrete role, only part of a wider process of decision-making.</p>	<p>Policy, marketing and education of how intermediaries contribute to decision-making.</p> <p>More research in quantitative terms to demonstrate impact; this approach appeals to those working in health.</p> <p>Education and debate regarding the nature of 'evidence'.</p>

Question themes continued	Judgements/ overviews from the data continued	Participant views contrast continued	Implications continued
Time	<p>Clinicians are not given time to build EBP skills within current work.</p> <p>Clinicians prefer to spend time in clinical work.</p> <p>Short time frames for research.</p>	<p>Intermediaries foster self help of end users doing it themselves.</p> <p>Some end users don't want to</p>	<p>Steer away from forcing end users to do it for themselves or actively create protected time to search or appraise the evidence.</p>
Impact on decision-making	<p>Few explicit links to decision-making or impact on health outcomes.</p> <p>Influence as intangible addition to decision-making.</p> <p>Sometimes evidence not even cited by those receiving evidence reports.</p>	<p>Intermediaries see evidence as one of the prime motivators for decision-making.</p> <p>Health care practitioners see evidence as part of a wider picture, this depended on academic background and profession.</p> <p>Range of views on demonstrating that evidence was used in policy or purchasing decisions.</p>	<p>End users need a formal agreement to collect data and demonstrate impact on practice.</p> <p>Further research on the role of evidence in decision-making compared to policy, ritual etc.</p> <p>Training and education needed on how to cite evidence in relation to decision-making.</p>
Quality of interaction	<p>The quality of the interaction between intermediary and end user varied.</p> <p>This depended on intermediary background and amount of interaction or articulation of the problem.</p>	<p>Background and quality of interaction led to heightened satisfaction and greater understanding the process.</p>	<p>Better training for intermediaries in how to better interact and elicit information from users.</p> <p>Getting users to be more self-dependent can be helped by spending more time interacting with them.</p>

Can a knowledge management system be identified that will match the requirements of the intermediaries within the project?

Question themes	Judgements overviews from the data	Participant views contrast	Implications
Knowledge of community	Self-knowledge of work processes important when selecting systems.	Reflection on work process was a foreign concept.	Strategies for understanding own community of practice and knowledge work must be put in place before KMS selection.
Money	Overriding factor in decisions made about infrastructure and systems support.	Would prefer to do it 'the hard way' rather than investing for long-term gain. Depended on professional background.	Long-term benefits can be linked only to organisations that have longevity. Benefits of trialling software need to be marketed to KMS providers better.
Knowledge of KMS	Difficult in a community where key competencies concentrate on content of EBP rather than the process. KMS providers lack of transparency about what aspects of KM their products address.	No time to look around or understand KMS.	Consultant role important; KMS providers need to understand concepts of KM to communicate to customers.
Power	Power plays and hierarchies play a role in who 'knows best' about technology.	Paternalistic decision-making saves time and effort when it comes to IT Negotiation is not possible with the University, therefore being innovative is a waste of time What the University doesn't know won't hurt them	More open attitudes about what advice expertise staff beyond high level management have to offer More transparency by management and parent organisation about how decisions are made re: IT
Technical Infrastructure	Intermediaries victims of circumstance re: control of their IT infrastructure and support.	There were different interpretations of what technical infrastructure was required to support KM activities. Interpretation of infrastructure depended on previous knowledge and experience.	Proactive discussion and mature debate about IT with parent organisation. Willingness to invest in infrastructure.

From the data matrix, the following sections elaborate on the findings.

10.2.1 In what ways are knowledge sharing activities of identification, collection, storage, sharing and dissemination, access, use and exploitation manifested in the community of practice?

By asking this question I explored whether all of the steps in the knowledge sharing cycle were present within the community of practice. Using Skyrme's framework (2000) provided a useful framework to articulate and explore these constructs, without such a framework, being systematic or through in the KM investigation would not have been possible. All of the different parts of the cycle were present and were highlighted during different phases of the research. Systems thinking helped me to explore and analyse the cycle in its entirety, many of the steps or indeed a holistic cyclical approach could not have been highlighted through one data source, or through one specific action research cycle. Instead knowledge sharing constructs were present and identifiable across the research process, supporting my original theoretical stance that KM can help the organisation in reaching its goals in knowledge creation and sharing.

10.2.1.1 Knowledge sharing

Many of the sharing activities identified through the framework were more prevalent compared to others. Understanding this in my position as participant observer meant that some knowledge sharing activities took significant time to reveal, requiring a range of data collection techniques to discover. Process of knowledge collection and storage were easy to discover, as they were tangible and easy to recognise. This can be contrasted with more abstract concepts such as knowledge access and exploitation. Participants could point out and conceptualise many knowledge sharing activities, but their tacit nature was difficult to articulate.

This project provides evidence of the challenges of exploring these activities, the implications for other researchers working in similar circumstances and complex environments is threefold:

1. The time and investment in understanding the organisation should not be underestimated. Rather than using a top-down approach of senior key informants to understand the organisation's KM issues, a more inclusive approach will reap meaningful insight. Untangling the complexities of KM requires more than a 'tick box' approach to finding out about knowledge sharing and innovation.
2. A range of data collection or modes of inquiry can uncover a complex picture of the research environment. Relying on a small range of stakeholders does not provide a clear or coherent picture of knowledge management successes or deficiencies. Stakeholders throughout the organisation are needed to provide multiple perspectives on KM.
3. Using an interpretative approach in eliciting the individuals' construction of their world may create a range of interpretations of knowledge management; some of the views of individuals may not reconcile with the group. This interpretive approach to understanding knowledge management is a different way of understanding a complex and sometimes emotive issue.

As an interpretivist I was interested in how people saw knowledge, what values and weighting they gave to different aspects of KM. Their own perspectives translated into practice in the world around them. Views on what was happening within the community of practice differed, subtly, not radically between participants. Each intermediaries' acceptance of improvement in KM depended on whether they came from an "information based

culture" (Southern & Murray, 1994) or not. Participants who had prior experience and training in information and library work supported information ideals. This has implications for participants we approach within communities of practice, targeting champions for knowledge management. Convincing those who already have an understanding of the tenets of knowledge storage, sharing and exploitation makes easy allies compared to those who have no background in this area. This is especially true for the organisation investigated in this project, leaders and key decision-makers had little exposure to ideas of information or knowledge structure. Managerial exposure through reading, professional development of ideas of KM will reap benefits. How reasonable is it to expect this? If leaders and managers do not have the time and motivation to carry out this task, they need a skilled and influential individual within the community to play this role. This role requires an influence on decision-making at all levels of the organisation.

Taking these factors into consideration should be couched within a wider strategy of selling the benefits to KM to research participants or stakeholders. As a researcher, my job was to target all of these at the same time, despite their knowledge or attitude to KM. I needed to gain the enthusiasm and commitment of the participants to move the project forwards.

10.2.1.2 Knowledge innovation

Awareness of many of the steps of the knowledge innovation cycle such as knowledge creation depended on the individuals' own awareness and understanding of the complexity of the EB task. If intermediaries understood the amount of skills and indepth knowledge work required to do the task they could explain and understand how they were turning information into knowledge through their own interpretation and repackaging of the evidence. Some less experienced intermediaries had a more simplistic and mechanistic interpretation of the evidence-seeking process; these were often people who were new to the field. This mechanistic view of turning information into evidence was matched with some practitioners' views of the process; those who knew less about what was going on 'behind the scenes' failed to see the added value that the unit provided in decision making. Those holding this view underplayed the knowledge innovation that took place. Raising awareness of knowledge work and its contribution to knowledge innovation within this context will ultimately raise the value in which the unit is held. Induction and training about the complexity and steps involved in the knowledge innovation cycle can instil an awareness of what intermediaries contribute to the process, while selling the role that they have to play within the organisation.

Knowledge innovation relating to clinical practice was highly valued within the community; this reflected the background and motivation of opinion leaders and management and the overriding values of working within the organisation. The result of this was that intermediaries valued some types of knowledge as more important or valid than other. Process and metaknowledge were undervalued, and less likely to attract the investment needed to make the community more effective in how they carried out evidence requests. Making process and metaknowledge a visible part of the EBP process can act as a way of highlighting that knowledge innovation reaches beyond the primary task at hand. It acknowledges that time and support is required for the indirect knowledge work carried out by intermediaries. Applying concepts of knowledge creation, codification, embedding and diffusion to cover a greater range activities that the community engages in will mean that activities and functions within the organisation will not have to compete for support and attention of intermediaries.

Knowledge of the context of health care delivery was an aspect of knowledge creation that set the scene for knowledge creation around the evidence. There was a dichotomy between

creating unbiased evidence and that knowledge creation in this context is peppered with tacit knowledge about the organisation and the background of the intermediary. To make knowledge relevant and applicable to the clinical context within the hospital, intermediaries were required to step outside the dictate that EB knowledge is unbiased to take into consideration what was happening in the local context. This can be contrasted with national EBP organisations that have a wider remit for supplying evidence to wider audiences. In this situation there is less need and ability to take into consideration the local context, the knowledge generated has to be less context specific and more generalisable so that it is applicable to more situations.

From applying the knowledge innovation cycle to EBP, the gaps in evidence and knowledge about a range of health care intervention raises many questions. To date, gaps in knowledge have often been ignored. One way of addressing gaps in knowledge that are generated through clinician questions and the lack of success that intermediaries have in finding good quality evidence need to be captured and fed back to research funding bodies such as the National Health and Medical Research Council. In this way, research funding can be put to use in

10.2.1.3 Organisational memory

The concept of organisational memory was explored while examining ideas of KM within the community of practice. This was the organisation's ability to remember and learn from its past (Atwood, 2002). Organisational memory was built upon every time an evidence request was completed, including context, values, insight and experience (Davenport & Prusak, 1998). While organisational memory is an integral part of knowledge work and knowledge management, it is worth highlighting it separately to emphasise the contribution that intermediaries make to EBP and the impact that the loss of memory can have on such a knowledge-rich community.

By completing a continuous stream of evidence reports, intermediaries were building memory. By doing so they not only became experts in EBP, but in the process of seeking and appraisal, making them more efficient and effective at the task. Compared to this, the health practitioner, casually carrying out the same task, perhaps only a few times per year. Despite training in these tasks, the building on memory of such end users is minimal, their infrequent learning and retention of the complexity of the task, makes them less able to do a rigorous, timely search and appraisal of the same evidence.

Despite this consistent building of memory, its capture and utilisation were often poor, leading for further justification for the improvement in KM within the community of practice. Capturing memory in organisational process and procedures was attempted by some intermediaries, but was proven to be onerous without organisational support and recognition. The turnover of highly trained staff meant loss of organisational memory was a significant issue. To address this, 'knowledge harvesting' of staff before departure would help in tapping into memory. Greater long-term investment in the knowledge innovation and sharing cycles in a systematic way would also prevent such loss of organisational memory.

10.2.1.4 Leadership

Leadership for KM within the organisation was variable, this was displayed through interviews and observation. Conflict with leaders was not conducive to improving the work environment. A lack of respect and credibility of those leading the organisation raised issues of whether KM could be successfully sustained beyond the intervention phase of the project and through my influence as the researcher. While liking the idea of KM and its

benefits, committing the time and resources required were not forthcoming throughout the life of the project.

As participant observer I was at the epicentre of the power games and conflicts within the organisation. Taking a step away from this was difficult, while not getting enmeshed in the emotive atmosphere of interpersonal relationships. Much of this atmosphere coloured the 'worldviews' of the research participants, and I acknowledge that the reasons for this were complex. Rather than analyse these, I used them to contribute to an understanding of the complex nature of KM within the organisation.

Unless individuals are motivated and working towards a common goal, successful knowledge sharing and innovation cannot occur. Motivation and recognition of the individuals' contribution in creating useful knowledge are drivers to participate in KM. What does leadership in this context mean and how can it be achieved? Leadership in KM is being open-minded and creating opportunities for organisational learning and growth by providing support and opportunities for intermediaries to proactively engage in knowledge sharing and innovation.

Within the community of practice the need to acknowledge that there was more to work than just generating evidence reports and focussing on issues of evidence and methodology were important. Unless this happens, little reflection on metaknowledge or the activities that underpin KM can take place. To achieve this requires mature and confident leadership, one of seeing the value of other activities beyond the immediate business of supporting health care decision-making. Creating a long-term strategic view, beyond the day-to-day means that leaders need to understand that short-term investment can be useful for the longevity and enhancement of the KM environment.

10.2.1.5 Culture

Of all of the themes emerging through out the life of the project, culture and leadership were the most pervasive. They were the most contentious and divisive part of being a participant observer in the research.

There was no homogenous culture within the community of practice, which made it difficult to communicate, sell and influence KM. Nearly every participant had a different professional background, each bringing their own values, norms and biases to the community. At times this was useful, as it added a multidisciplinary aspect to problem-solving, but the overall paradigm that won through was one of medicine. Cultures beyond medicine were challenged and sometimes rejected in a hostile manner. An underlying fear of challenging the dominant paradigm was exposed at times, strong members of the group in the minority felt empowered to challenge the status quo. The use of action research and questioning the shortcomings of the organisation was another way of challenging the dominant paradigm while highlighting potentially unattractive aspects of culture and leadership. This implication of challenging the organisation is to do so in a constructive and supportive way, minimising the opportunity for alienating the research participants or the researcher from the inquiry process.

The environment in which knowledge management needed to operate was closely linked to and even dictated by the culture of the community of practice. This was a consistent and underpinning theme that influenced the impact of any knowledge management project. While looking at the KM environment was not a specific question of this research, it was an integral factor influencing the success and failure of improvements within the community of practice. To an extent these human aspects of KM are raised as a concern

within the literature (Swan, Newell, & Robertson, 2000), without acknowledging them, KM remains an isolated and esoteric concept.

The research has been a useful study of applying concepts of knowledge management in the public sector. This is a growing area of investigation, which is creating new rules about drivers for knowledge management and incentives for knowledge sharing (Leun & Al-Hawamdeh, 2001). Much research has also been carried out looking at KM in government environments, there are some parallels to this community of practice in health care (Asoh, Belardo, & Neilson, 2002).

Much of the older KM literature has focussed on the private sector where incentives for sharing knowledge attached monetary values. This ideal is not one that can be utilised in the public sector, operating margins are too small. Despite this, using ideals of corporate citizenship and the altruism in contributing to better patient outcomes can be overexploited in the public sector. An example of using these ideals rather than pay and recognition is well debated with nursing remuneration (Hancock, 1999; Kearney, 2001). Altruism can be used as a way to elicit value only to a certain extent, there is a growing recognition that this is on the decline in health care and can no longer be relied upon to sustain the sector (Jones, 2002). These ideas of using or eliciting worker altruism filter throughout health service culture and are as true in this community of practice as they are in the direct clinical environment.

The environment of health care research and development has the added stressor of short-term funding driving the business. In some ways the research participants were victims of funding rounds and the constraints imposed by funding bodies. Communicating anxieties and challenges to funders regarding the benefits of supporting and resourcing KM may ultimately compromise the relationship between funder and the recipient. Despite these fears, KM would enhance the 'business-like' picture and added value that the unit would like to portray to gain continued funding. Having insight into knowledge innovation and sharing is one way of illustrating a reflection on practice and the direct contribution not only to the funded project but to the wider field. Funders can share lessons learned from this community of practice informing where their money would be best spent in generating knowledge about EBP at a national and local level.

10.2.1.6 Conclusions from this question

KM is an applicable concept that is well suited to the knowledge-rich environment of EBP. The benefit of utilising KM within these contexts are wide, increasing the sharing and access to knowledge about health care, and about metaknowledge. The value of KM requires targeting and marketing especially to participants who do not have an understanding or background in information concepts. Participant observation as a way of investigating KM needs to be treated with sensitivity, issues of culture and leadership can expose organisational conflict, much of which can be systemic and unresolvable.

10.2.2 What is the role of the intermediary in providing knowledge for health care decision-making?

The aim of this question was to tease out whether the intermediary had a role in contributing to health care practitioner or the organisational decision-making. In doing so, the research demonstrates that individual experience, both personal and professional have a role to play in creating and disseminating knowledge. Each intermediary contributed to the decision making in the wider organisation and therefore had a distinct role to play in contributing to patient care. Part of this question was to understand the relationship

between the intermediary and evidence, this differed between individuals to some extent, but all followed accepted pathways in order to make sense and interpret what they found on behalf of the end user. The relationship with health care practitioners was also explored to understand whether interpretation, feedback and understanding of the organisational context were important in turning information needs into explicit questions that could be answered by searching and appraising a wide range of sources.

The lessons learned from a small group of intermediaries highlight implications about their role for the local health care organisation and for others working in the wider world of EBP information provision. Intermediaries make a valuable contribution to the health care decision-making process. This research illustrates that it cannot be replaced by decision support systems, due to the complexity, interpretation and novelty of each question asked (Fennessy & Burstein, 2000a).

10.2.2.1i Intermediaries as expert

The overriding response to intermediaries within this research was that they were experts at searching and appraising the evidence, experts in research methods and interpretation of what huge amounts of evidence they had to offer. The role of expert is emphasised through their building and utilisation of organisational memory, compared to the casual evidence-seeker. Using experts added credibility to clinician's decision-making and justification to some types of clinical practice. The recognition of the role of intermediary as expert was underplayed by health care practitioners, to raise the profile of this role in the health care community there need to be explicit links made between changes in clinical practice and the role that intermediaries have had in this. This would strengthen the role of the intermediary and in gaining continued funding from the government.

Despite the recognition of the role of experts in providing evidence, this recognition did not spill over into the day-to-day decision-making of those who requested the services of such experts. From this we can see the selective use of experts to suit health practitioners, or perhaps the recognition that decision-making within the hospital context is far messier than the tools and techniques that EBP have to offer. If this is the case, then intermediaries as experts need to recognise their role often can be limited. These two contrasting views of expert, being pivotal and sometimes only a small part of decision-making process illustrate that there is a scale of contribution that evidence can make. Much of this can rely on the paradigm views of the requestor of the evidence but also of the type of question being asked. Questions that required a holistic view of the patient and their involvement and participation in decision-making were more prone to using the evidence as only a small factor in the scheme of decision-making. This was particularly the case for nursing and occupational therapy.

The selective use of evidence and experts took place when it suited the requestor. This contradicts organisational and government policy about the drive to being evidence-based. If the hospital and government want more evidence based decision-making they need to hold practitioners at an individual and collective level accountable for their decision making and encouraging transparency in how and when the evidence is used.

Taking an introspective view of how experts were considered in the community was helpful in understanding who had influence in knowledge creation and decision-making. Participants within the research had definite views about what was considered an expert in searching or appraising the evidence. These experts within the community were sought consistently to provide guidance and expertise. Intermediaries were viewed as experts as they provided leadership and voice for issues in EBP, but also if they had had extensive

demonstrable expertise in matters of EBP. Recognition of these individuals as experts was not universal, at a practical level it was well known who had expertise, unfortunately this was not recognised at management level, so that experts were often not rewarded for the contribution they made to the community. Where this was the case, the experts were often not proactive in providing leadership and support to colleagues who needed it. To improve this situation, raising an awareness of skills and prior experience is important to utilise the experts effectively and to retain their skills within the organisation. Without recognition such experts become disaffected and leave, taking with them the knowledge and organisational memory.

10.2.2.2 Intermediaries as arbitrator

Beyond being experts at the evidence, the unit was used as a tool in defending clinicians during times of clinician disagreement. Intermediaries therefore acted as the unbiased and scientific arbitrator during conflict at a practical level. Use of intermediaries in this way illustrated that clinicians did not like confrontation, falling back on experience and tacit knowledge of experts, pushing the focus and conflict onto an external third party. In this way the evidence and unit were acting as an arbitrator in times of disagreement, this was sometimes used as a 'safe' way to challenge senior clinicians openly. This role or use of the unit and intermediaries was seldom fed back to the unit, it was unsurprising to see therefore that while the unit had its supporters, it also had its opponents. Once the issue was raised with intermediaries they were unhappy to see the evidence used in less than 'honourable' purposes, displaying their altruism and perhaps naiveté about decision-making at clinical level.

When looking through hospital documentation and publicly available documents, I saw many references to the unit as 'the answer' for innovation, quality and other initiatives as required by funding agencies. While it was fair to claim this role to some extent, it displayed a lack of understanding by the hospital about the role of evidence and the limited role that intermediaries had to play in solving hospital problems. I would question how long the unit could be used legitimately for these purposes. The unit had a role in helping the hospital understand the role of evidence, and how it could be used more constructively to enhance patient outcomes. To this end, a more indepth understanding of the role of context, experience, policy and patients in the contribution to decision-making would be useful.

10.2.2.3 Paradigm views about EBP

There were different views about the role of evidence in decision-making and what actually counted as 'evidence' within the organisation. This difference was most noticeable between medics and others, that is nurses, allied health and other non-medics in the hospital. This contrast was exaggerated within the community of practice because of a similar mix of professionals and because of the consistent devotion of time to the issue, at a theoretical and pragmatic level. Intermediaries provided a narrow paradigm view of evidence, this was reductionist and exclusive, creating some unhappy end users of their services. The interpretation of good quality evidence to mean systematic reviews or randomised-controlled trials was the inherent paradigm view, although not one that remained unchallenged. This challenging of the dominant view created tension, and often-healthy academic debate within the community, but by contrast not in the wider hospital community. Instead such differences created angst and sometimes resentment by users of the unit, leading to lack of uptake of the evidence into practice and sometimes an undervaluing of the service being offered. More explicit statements about the dominant paradigm view being offered by the unit could resolve some of this tension and the limitations presented by such a view. This research made some of this issue visible, creating discomfort amongst some of the intermediaries. This however remained an unresolved

issue, the enormity of tackling the task was beyond the time and academic skills of many of the research participants.

To resolve this, there needs to be greater national and international debate on the issue in the medical literature, this would inform and justify any change in paradigm view for the unit. It is telling that this debate has taken place consistently in the nursing and allied health literature but still, there has been little merging of debate between the disciplines. This debate will need to influence national and local policy by funders and those setting the health care agenda, such as the National Health and Medical Research Council and Department of Human Services (Victoria). When this is achieved, the unit's relevance and the applicability of a more inclusive approach to evidence will contribute to more systemic implementation of evidence into practice across the hospital.

Another important aspect missing from the dominant paradigm view within the study was that of the patients' perspective. By not taking into consideration this perspective, the unit was limiting the usability and clinical relevance of the evidence requests to end users. New methods and ways of integrating this type of evidence need to be found, this needs to be balanced with the rigour and unbiased knowledge on which the unit prides itself.

10.2.2.4 Importance of the role

There has been a wide range of benefits demonstrated through the use of intermediaries in this project. These have been from an end users' perspective, where they come into contact with intermediaries and use them to clarify questions, search for the evidence and appraise it, saving their time and adding rigour to the process. These benefits can highlight that there is a range of ways of getting answers to the evidence, and in the time-pressed world of the health practitioner, there needs to be the support to help them with these questions. In a climate of rationalisation of health services, questions of effectiveness will grow, at local and policy level. The intermediary has a key role to contribute to the understanding of the allocation of limited health care resources.

The community of practice in this project was part of a time-limited 'experiment' by their funders at state government level. By giving limited time to such an initiative, funders can demonstrate the benefits that specialist services have on health care. The impetus is on funders to take heed of key messages, some of which may be less politically appealing than others. An example of this is the funding of end user training in EBP, while being politically viewed as a positive thing to do, this study questions whether this is a viable way for clinicians to find the evidence.

One major benefit of highlighting the role of intermediaries in this research is to raise their profile as a unit that contributes to the wider health care organisation's effectiveness and quality improvement activities. A caveat is for intermediaries to realise the scope of this role in contributing to the core knowledge of the organisation. This contribution cannot be used as a replacement for proper support and funding of services. The recognition of politics and professional input needs to be acknowledged in making up the whole picture of decision-making at organisational level.

10.2.2.5 Time

Intermediaries saving health practitioner time was the most agreed on feature of this part of the research. In an environment where all health practitioners were under pressure to do more with less, to spend as much time in direct patient care, time was the resource that all of them lacked most. The realisation and benefit that intermediaries could add to the process was significant. This as a major benefit to practitioners is a way of marketing and selling the impact of the unit. A heightened awareness of the time required to invest in

rigorous searching the evidence is currently undervalued by government funding agencies and the hospital. Both of these groups have an expectation that all practitioners should be able to carry out this task within the course of their day-to-day work.

This expectation has meant an emphasis on putting time and resources into training health care practitioners how to search and appraise the evidence. While it is important for everyone to have an understanding of the rationale behind EBP and processes involved, it is not practical to ask all clinicians based in practice to take time out to do it for themselves. The findings of this research challenge the investment made in *ad hoc* and intermittent teaching of skills for EBP, where building of memory of the task and skill are limited to several times within a year. This has been supported by a recent systematic review on teaching critical appraisal to health care staff (Hyde et al., 2000) and a recognition that not all clinicians need to have all of the skills all of the time (Guyatt, Meade, Jaeschke, Cook & Haynes, 2000).

The time and investment that it takes to train many health care practitioners would be better spent on publicising and making effective use of intermediaries searching for the evidence. The appeal of empowering and teaching end users to carry out these tasks in detail needs to be balanced against giving them a broad understanding and appreciation of the EBP process. From the data collected in this study, this was only a small proportion of all the questions being asked, the 'on the run' questions that arise in day-to-day practice, requiring an instant answer. The majority of questions being asked were team oriented or organisational and strategic questions. These questions are longer term ones, where the implication for cost and impact on outcomes are potentially greater.

Lessons about the role of the intermediary and their potential for effective use of resources requires communication with EBP funders and policy-makers. Further writing about the role of intermediaries needs to take place in the mainstream medical literature so that alternative models for searching and appraising the evidence can be explained and debated within the health care community.

10.2.2.6 Impact on decision-making

Intermediaries' impact on decision-making and influencing clinical practice was complex. Their role in the decision-making process was one of adding credibility to the evidence-based process, making them a substantial influence within the context of Australian health care services. This interpretation of influence by health practitioners as end users did, however, vary. This is not surprising as informants had variable and complex experiences of the unit. This combined with health practitioner professional backgrounds and attitudes towards EBP shaped their response and interpretation of the intermediary role.

While some clinicians concluded that the evidence had an impact on decision-making, only a few could point to tangible outcomes of the evidence being used. There are several implications of this view. The first is that clinicians have a lack of awareness or disinclination to track what impact the evidence has on their own or team's behaviour. Until more explicit links are made between the resource intensive evidence reports and change in clinical practice, the unit will be unable to convince funders that they have an impact on hard measures such as patient outcomes. In the spirit of being 'evidence-based', the unit needs to provide their own evidence about how effective they are. Until this happens on a systematic level, units such as the one in this research will only have an impact on self-reported attitudes of clinicians rather than their behaviour.

There are however, limitations to what can be expected from the evidence and how much it can be used legitimately as a lever for change in health care. There was a difference in

expectations in what role evidence had to play in the scheme of decision-making within the health care organisation. To understand alternative worldviews of the role of evidence, intermediaries need to become more involved in clinical effectiveness projects from their inception. This will reveal the complexities of decision-making and the limited role that evidence sometimes plays (McInnes et al., 2001). In doing so they will see the complexities of team and organisational decision-making. This awareness and understanding could also be extended to funders at state and federal level. A simplistic expectation that evidence will have clear and definable impact on decisions and clinical practice requires challenging.

Developing new skills in understanding and liaising in clinical practice are outside those currently held by intermediaries, these are skills such as facilitation, change management and conflict resolution (Burrows, 1997; Kitson, Harvey & McCormack, 1998). If evidence units want to establish their effectiveness and continue their path on influencing decision-making they need to develop these skills to enable them to work alongside health practitioners where they are in clinical practice and when they ask the questions about effectiveness.

10.2.2.7 Quality of interaction

The quality of the interaction between intermediary and end users of the service varied. This perception of quality and care by the unit relied on how much interaction the user had with the individual intermediary, and how much common understanding was arrived at in relation to the evidence question being asked. Those end users who had more interaction and discussion about the evidence, focussing on their particular problem and the direction that the search should take were more satisfied with the evidence unit service. Those who only had a distanced interaction with the unit, such as submitting their questions via the Internet, were less satisfied and under-rated the skills and expertise of the intermediary. Having longer and more indepth interaction helped users realise the complexity of the evidence-seeking process and the raft of skills required to carry out the task.

The time and skill invested in these interactions depended greatly on the backgrounds of intermediaries, those with a service or information management background were more comfortable and willing to negotiate evidence questions with practitioners, they had already been instilled in this culture. Some intermediaries were uninterested in this aspect of the research, preferring to maintain a style of interaction that was comfortable for them. The end product of this dissonance was a tension between satisfying users and keeping intermediaries happy. A compromise needs to be found where intermediaries can improve their interpersonal and liaison skills to satisfy the needs of end users. This can be achieved through training and development, perhaps focussing on how such interactions can improve knowledge creation and sharing. The traditional reference interview from libraries is a good format to start with, skills in eliciting practitioner knowledge in what is needed is a skill that requires practice and structure.

An alternative suggestion during the research was to get health practitioners to be more self-dependent in relation to asking questions, this would lead to them arriving at the unit more prepared to hand over their questions, saving both user and intermediary time. This contrasting view would require greater investment in training of practitioners to the use the PICO (patient-intervention-comparison-outcome) format of asking questions, which implies greater instilling in the tenets of EBP.

10.2.2.8 Conclusions from this question

Intermediaries have several roles in the EBP and decision-making process. Their role allows health practitioners to pursue direct health care and research rather than spending

valuable work or leisure time searching, chasing and appraising the evidence. They contribute credibility to a complex decision-making process through their rigorous, complete and expert interpretation of the evidence. This is balanced with the local situation, the experience of the health care professional and can be viewed as an unbiased and transparent part of the decision-making process.

Resources spent on intermediaries could be preferable to teaching all health practitioners the same skills, through repetition of the task and through tackling new questions they build their expert knowledge of EBP and metaknowledge, becoming more efficient and effective as they go.

Intermediaries from other work contexts need to decide for themselves whether some of these lessons are transferable to their own environment. The amount of detailed description about the research environment will help them to decide whether they can do this.

10.2.3 How can a knowledge management system be identified that will match the requirements of the intermediaries within the project?

When taking a holistic view of KM, technology has a role to play in knowledge sharing, but is in fact dependent on a range of organisational issues that influence the pathway to even identifying which system is the most appropriate to use. This question recognised that KM systems can help in improving the effectiveness and delivery of knowledge management initiatives, but selecting such systems requires a deep understanding of KM systems, and of the research search environment for which is being selected

The politics and social values within the research environment created complex challenges that made a significant impact on considering KM systems. This data was collected from many data sources throughout the research and further develops the theory that KM success or failure is dependent on culture and context. Without an understanding of these, the selection and possible introduction of technology cannot happen. Once again systems thinking enabled me to view the knowledge sharing cycle in its entirety to help with identifying and understanding the requirements of the organisation, and by linking them to Skyrme's framework. By doing so I could systematically work through the knowledge sharing cycle and link this to technical criteria and functionality for system selection.

By carrying out a political and social analysis and linking it to a KM framework I was able to cut through jargon and slick marketing is the only way of understanding and comparing products from a highly competitive shopping environment (Fennessy, 2002).

Developing comprehensive KMS selection criteria is an explicit and pragmatic contribution to the field of KM, and goes a long way to expel many of the myths created in the literature and by providers that asking explicit and detailed questions about systems is easy.

The skills required to select and shop for a KMS were beyond the core competencies of those working in the community of practice. Researchers and consultants have a role to play in enabling communities like this to select systems. Communities without access to help will do less well in system selection; the time required to seek out suppliers and read system literature, correspond and test systems is prohibitive.

10.2.3.1 Knowledge of community

The explicit mapping of the community's activities to the knowledge sharing cycle has created an easy to understand link between technology and knowledge management. To be able to achieve this an understanding of the community of practice was essential. To gain an understanding of community required more than a cursory tour around the organisation, it took months of being embedded in the community, working alongside them to understand the politics, infrastructure and work processes. This investment in time to gain an understanding of the community created a view that would not have been achieved if as a researcher I had relied on community communicating with me as an outsider. If this had been done I would have gathered only explicit knowledge about how the community wanted to be viewed and the public face of the organisation. The best example of externalised knowledge about the organisation that contradicts the tacit knowledge collected about the community in relation to KM systems is that of money. This community was ill prepared to spend resources on a system that did not bear short-term savings or benefits, they were unable to justify finite resources on something that was perceived as far removed from the business of seeking evidence.

The context and mindset of these views could be seen as ludicrous by KM or information systems researchers, and illustrates the stark difference in worldviews or expectations between those working within a health care context and myself working in information systems. Without this insight into community it is easy to dismiss the community as short-

sighted and ill-informed about the potential of KM and KM systems. The depth and richness that is afforded to us through interpretive research helps us to understand that a simplistic approach to selecting KMS may not offer the best result. It is unsurprising that criteria as detailed and as tailored to this specific community of practice cannot be found in the literature, the work is arduous, the time-frames involved are not realistic for most people consulting organisations on the use of KM systems.

From an information system perspective, the strength of the criteria lies in explicitly linking a theoretical framework to a tangible outcome (Fennessy, 2002) and could be used in future studies into KMS selection.

10.2.3.2 Knowledge of KMS

Administering a questionnaire on KMS was a revealing exercise. The responses to it were varied, and it showed that there were different understandings of the language of KM. The implications for the industry are far reaching. Until there is a common understanding of what KM is about, it will be difficult for consumers to get full and useful information from providers. Different terminology is confusing to consumers, the lack of technical or functionality information available in the public domain is also poor, meaning that potential customers cannot shop from a distance, but need to get into contact with the provider and work through their needs and required functionality. This current state of the industry excludes a large amount of potential customers, and leaves these tools only available to consultants or organisations that want a bespoke system designed for them. This in turn limits the number of people who can gain access to KM systems when wanting to resolve their KM problems with information technology.

10.2.3.3 Power

What I anticipated to be a simple process of identifying KMS selection criteria became a process charged with emotive and political perspectives. The use of SISTeM and the analysis of social and political processes revealed that selecting IT systems has often less to do with process and technology and more to do with the power and culture. This research revealed that power of individuals and the maintenance of hierarchies played a role in 'who knows best' about technology. Despite what I perceived as a rational and systemic approach to developing selection criteria, much of this was overshadowed by the prevailing social factors within the organisation that could potentially sideline even the most rigorously developed criteria. Paternalistic patterns of decision-making saved time and effort within the organisation when it came to IT, instead of having a participative approach to decision-making, management made decisions without consultation. These values worked against my participative, inclusive approach to decision-making, where change was generated and owned by the whole organisation.

To some extent the intermediaries and the community that they worked within were victims of circumstance. They were constrained by a large parent organisation in the form of the university. Negotiation with such a large and unyielding organisation led to lack of flexibility and the potential for innovation as far as IT was concerned. Ironically because the community of practice was physically separated from the university there was a prevailing attitude of 'what the university doesn't know won't hurt them'. This attitude meant that despite feelings of being constrained, there was in fact room to manoeuvre and to some extent act as freer agents compared to university departments that were based onsite with university IT support.

Power relationships within the organisation studied illustrated that there were closed attitudes towards people beyond traditional management making decisions about IT. To enable more open attitudes about what advice or expertise staff beyond high level

management has to offer, there needs to be a raised awareness of what skills and expertise can be offered in relation to IT. There was a breadth of skills and expertise within the community that were not being utilised, but could have possibly created timely and context-relevant solutions to many of the community's KM problems.

To create greater acceptance and ownership of decisions made in relation to IT, there needs to be more transparency by management and the parent organisation about how IT decisions are made. This would lead to greater acceptance and uptake of changes in technology. With such trust and transparency the implementation of KM systems would be easier and more acceptable to a wider range of participants within the community.

10.2.3.4 Technical infrastructure

Developing selection criteria KMS needs to set within the context of IT infrastructure. The organisation studied did not have adequate infrastructure to create the full support or implementation of a KMS. There were differing views about the adequacy of infrastructure, meaning that despite being a tangible item within the organisation, it was open to a range of interpretations and worldviews. The interpretation of this adequacy relied on participant's previous exposure and experience of IT and the quality of support that they had had in past work environments. Participants from a medical background vastly underestimated the support and infrastructure required to support a KMS and trivialised the needs of IT support staff. The irony being that these interpretations of IT infrastructure drove the organisation. This dissonance between management and IT support staff created an environment of inaction and dissatisfaction that prevented innovation and change taking place. The emotion and power linked to this situation made it an explosive area to discuss and approach by me as a researcher.

Education about the requirements of quality infrastructure needed to be impressed on the organisation, without this, they would continue in a climate of dissonance and one where initiatives such as improving KM through the use of KMS was bound to have only limited success.

Budgeting and investment in IT infrastructure needed to be made beyond classifying it as an 'overhead' within the hospital or university. A longer term view of the benefits and outcomes of proper infrastructure need to take place if the community is to utilise properly any KMS that is recommended.

10.2.3.5 Conclusions from this question

Developing KMS selection criteria that reflected knowledge sharing and innovation and the research environment was achieved through using SSM and SISTeM. By this I gained an understanding of the community, processes, tacit and explicit knowledge and also developed criteria that reflected the wide-ranging needs of the organisation. This understanding cannot be achieved through cursory investigation, but through having sensitivity to the community of practice, achieved through being embedded in the research environment.

Piloting the selection criteria was a success in this project. Suppliers who answered the questionnaire were challenged to move beyond their usual marketing approach to uncover answers that were meaningful to the community of practice and me. Each KMS reviewed would have been appropriate for this community of practice, although price was a restricting factor in considering some of the products.

10.3 Contribution to knowledge

There have been some specific and significant contributions to practice and theory from the research.

10.3.1 Contribution to practice

A range of practical outcomes has been identified through this research. Culture, politics and environment are key features that need to be recognised in the analysis of knowledge management problem-solving in complex organisations. Taking these factors into consideration is essential if KM is to be taken seriously and given the support that is required for successful implementation.

Using a range of techniques to map and understand knowledge management enabled participants to question and reflect on their own knowledge work. Other communities that have a lack of experience in turning conceptual ideas such as knowledge innovation and sharing into structured methods explaining what is taking place can use these methods. This research opened lines of communication and challenged thinking within a hierarchical and medically dominated organisation. To this end the action researcher has the role of facilitator and problem solver, the lessons learned from this research make public the skills and challenges required by those investigating and consulting in KM.

Methods for developing selection criteria have created a practical outcome for people shopping for KM systems. These criteria can be generalised and used beyond the life of this project to help organisations with a minimal understanding of KMS to articulate their KMS needs and priorities. The selection criteria are also helpful to suppliers of KM systems, where they could be used to articulate more clearly their functionality so that shoppers can make informed decisions beyond platform and cost.

Exposing and understanding the specific processes and steps that are involved in searching for the evidence highlighted the level of sophistication and skills required within the field. The research has made public the idea that EBP is a knowledge-rich activity through mapping the process and publishing the findings. This helps intermediaries and knowledge services sell their value-added activities to health care organisations that wish to move decision-making towards EBP. This also highlights that *ad hoc* training of practitioners is not a useful way of spending health resources, that the use of intermediaries can add rigour and timeliness to a process that is resource intensive.

10.3.2 Contribution to theory

An outcome of applying action research in this study has been the reinterpretation of action research as strategy for investigation with a raft of underlying techniques. This way of applying action research has been a significant contribution to the field. This has been useful in bringing together several stakeholders views into the same research questions, highlighting dissonance and convergence of views on themes throughout the research.

This application of methodology has created a range of benefits that can be used beyond the scope of this research. This application can be used as a solution where there are a range of research questions and stakeholders who hold different worldviews. This reinterpretation encourages the use of many cycles and challenges the usual notion of only carrying out one or two iterations. These multiple iterations demonstrate richness and diversity within the research environment, this lends itself well to an interpretive research approach.

A useful and added bonus of using this new interpretation of action research was triangulation being built into the process. Exploring a variety of issues during the life of one project can enable participants to look at several issues for improvement and can give the researcher an opportunity to generate theory in a range of topic areas.

The application of SSM and SISTeM to explore KM has added insight into the way in which these methods can be used to understand the world. To date there has been little application of these methods in exploring KM, this new knowledge moves the application of these methods and presents new opportunities for their utilisation.

Through detailed explanation and mapping, the research has created some rationale in linking the conceptual model to practice, this is despite the lack of guidance in the literature on this issue. Through doing this, a template for how to make the leap from systems modelling to solving real world problems has been made more transparent and accessible.

Using an interpretive approach to KM was an alternative to some of the more prescriptive approaches to investigating the organisation, and thus taking into consideration the context and peculiarities of the organisation. This approach was inclusive, holistic and focussed on individuals being a core component of the success or failure of the knowledge management initiatives and technology.

As well as developing practical selection criteria for the knowledge management systems, a contribution to theory has been made by linking the criteria to a theoretical framework. To date this has only been done in an *ad hoc* way, where there has often been a lack of rationale or transparency behind the development of criteria. Through linking KMS selection to theory I have been able to produce inclusive and thorough criteria that have been trialled in industry. Linking the criteria to theory has created transparency and understandability of a difficult process. The depth and theoretical underpinning of criteria means that they can be taken and reinterpreted in order to be applied to other work place contexts.

Developing conceptual models as defined by Checkland and Scholes (1990) were a way of structuring and understanding the KM phenomena within a specialised workplace. Despite health care systems being modelled, the environment and process of providing evidence-based practice information had not been modelled. This project provides new knowledge about understanding the scope and complexity of EBP environment. Looking at EBP from an information systems perspective offers an alternative and refreshing view of a complex issue. Modelling within a KM context has added clarity and ease of explanation about what is often considered an abstract. This has led to dispelling some myths about the process and will improve that way in which EBP can be explained to the uninitiated.

10.4 Future research

This research has informed many aspects of knowledge management within a specific community of practice. The research also raised many issues that require further investigation, the following section describes five further research questions that could be built upon from the findings of this research.

10.4.1 Can an evidence-based approach be applied to other fields beyond health care?

The notion of using evidence based decision making is one that can move beyond the scope of health care to areas where there is a desire and need to justify decision making, this includes fields of public spending such as education and social services. Attempting to transfer these ideas have even been proposed by Atkins & Louw (2001) in the field of information systems. So far this has been from a theoretical perspective, rather than a practical one. This research provides a useful methodology for exploring stakeholder views of what 'evidence' is and how it can contribute to decision-making. By transferring this methodology to fields such as education or information systems, rationale and the use of evidence to underpin decision making could be disentangled from opinion. By doing so, the decision making process and credibility of such decision making could be justified, strengthened and questioned in a systematic way.

By using this approach in other fields of professional practice, the opportunity to further test the methodology could be made, approaches put forward through this research could be further validated and the transferability of theory could be explored.

10.4.2 Can the model be applied to other evidence-based information providers?

The community of practice and the role of intermediaries, whilst being studied in-depth was only studied within one health care organisation. While this is a useful approach for both action research and interpretive research, it would be useful to explore whether different health care organisations, or indeed different health care systems, created similar pictures and stories. Other people working in the field of evidence based practice during the lifetime of the project expressed an interest in using approaches and models created from this research, transferring them into their own area of evidence based practice information provision. Taking modelling and ideas generated from this project and applying them to other information services will create more evidence and be used to strengthen the role of the intermediary and further highlight knowledge work in searching and appraising the evidence. The application of models and data collection techniques can be further refined by applying them to a health care setting in an international context and in the primary care sector. This adds weight to both their transferability and validity outside such a small community of practice.

Discovering whether many of the constraints and issues highlighted during this project also arise outside the Australian health care system would provide useful pointers as to whether the KM problems are generic or specific to the context alone. Such issues to be tested could include:

- Does the funding or restriction on funding for IT happen in all health contexts, and thus limit the opportunity for supporting KMS?
- How do different health care systems value the role of intermediaries and other support staff who contribute to evidence-based decision making?
- Do different intermediaries within an EB environment operate in the same way, thus supporting generic or differentiated models of KM for EBP?
- Do health care practitioners in different health systems view the roles of intermediaries differently and therefore their own role in gathering the evidence?

10.4.3 Can we test the impact that intermediaries make on decision-making?

By further exploring the extent to which intermediaries do have an impact on decision-making is an important question for those working in EBP and to funders of such services.

In exploring this issue, we can investigate whether there is a cost-benefit to having intermediaries operate within the organisation, or whether it is more effective to have end users carry out the work themselves. By exploring the impact or contribution to decision making, the time intensive task and the skills required in being evidence based can be better understood. If the role is proven to be ineffective in overall practitioner decision-making, then more training and resources need to be invested in end user skills and decision-making processes. If it is proven to have a positive impact on decision making, then more resources could possibly be diverted away from direct practitioner investment to the role.

Testing the role of the intermediary more broadly could be done in a positivist, quantitative way to compare and contrast the impact of intermediaries from a range of research viewpoints. Using an array of research approaches to test the same role will strengthen findings and influence the generalisability of the intermediary impact beyond the scope of this research.

10.4.4 Can we measure the cost effectiveness of implementing knowledge management compared to not implementing it?

Challenges in justifying, explaining and presenting an appealing case to both research participants and the wider organisation were highlighted during this research. Applying a cost benefit analysis to implementing KM initiatives can further help researchers and communities of practice make informed decisions about whether changing work will be a worthwhile and useful activity from a financial perspective. Within the community of practice studied and in areas of practice where spending is questioned often, providing the benefits of KM in clear cost terms would strengthen the case of implementing changes and the purchase of KM systems. To create such evidence, there needs to be an investigation of what costs are involved in implementing KM initiatives.

Taking this type of cost benefit information and further linking it to long-term outcomes, would specifically link the costs to what ultimate benefits the organisation could expect from the implementation of a successful KM project. Further research in this area would be to develop meaningful outcomes and ways of framing cost-benefit that were relevant to health care providers. Such meaningful information has been scarce, to date, many of the claims of benefits of KM have been anecdotal without empirical evidence to support claims of improvement.

Applying notions of cost-benefit to the public sector are just as important as the private sector, funds are being squeezed and the demands on value for money from taxpayer investments are imperative. To achieve the aims of this research agenda, cost measures would need to be developed around a range of complex topics. Understanding and exploring how to model and apply costs to intangible concepts such as knowledge transfer, what the real reduced costs could be from not 'reinventing the wheel' or from loss of organisational memory would add weight to the argument that KM is a useful initiative.

10.4.5 Can we implement a KMS within the community of practice?

Through this project I was able to apply and explain the knowledge sharing and knowledge innovation cycles as a mechanism for selecting KM systems. Following the development of selection criteria, further research could explore the tasks of purchasing and implementing a KM system within the community of practice.

This would include topics such as:

- What are the barriers to setting up and implementing a KM system within a community that sits within a health or university context?

- How much marketing and training needs to be done to encourage uptake and use of a KM system?
- How much of the systems is being utilised to forward KM? Who within the community of practice is using the system and for what are they using it?
- What are the traits of successful KMS implementation?

One way of achieving such system implementation would be through the application of SISTeM Cycle 2 (Atkinson, 2000a). A further investigation of a technological approach to KM would identify what role this had in improving the knowledge sharing and innovation and whether a KM system makes a significant impact compared to non-technological approaches and solutions. Further research would confirm factors influencing the success or failure of KM initiatives or may serve to highlight new issues that have not been covered by this research.

10.5 Conclusion

This thesis has described an investigation into knowledge management within a community of practice in health care. This has been done through using action research as an investigative framework, helping to answer three specific questions that relate to the KM environment and the role that intermediaries play within this environment.

The thesis makes contribution to the theory of knowledge management in four specific areas:

- the building and development of a theory that recognises the role and opportunities that KM presents to the organisation in helping the organisation achieve their aims. Through this people are the most important factor in influencing the success or failure of KM initiatives
- the development and refinement of a conceptual model that brings together the evidence-seeking process and knowledge management, representing the core steps of EBP and reflecting the knowledge sharing cycle. This model was based on user requirements and later refined through external validation.
- an example of clear and transparent reporting in action research that takes into consideration a broad range of stakeholders and explores KM issues through a range of lenses or worldviews
- a forum for recommending further research programmes in the area of KM and EBP, which are directly linked to the work of this project or stem from the findings associated with it

11. References

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Appendix 1

Unit service information

Mission statement:

To enhance patient outcomes through the clinical application of the best available evidence. We undertake teaching and research, and answer requests for evidence from staff of Southern Health.

Our Services

The Centre for Clinical Effectiveness currently offers the following services to the staff of the Southern Health:

- An Evidence Centre that provides evidence to clinical questions from staff in the form of individualised literature reviews, critical appraisal and systematic reviews
- Seminars, workshops and training sessions on theories and skills such as evidence based health care, database and Internet searching, and the critical appraisal of research
- Links to web-based resources to enable health care providers to search for evidence
- A consultancy service that focuses on the access and evaluation of the best available evidence, and the implementation of treatments of proven efficacy
- Links to web-based health information for health consumers and for health personnel to provide to health consumers (particularly those without access to the Internet)

Our current projects are described in more detail [here](#). Please [contact](#) us if you have any questions about what we can do for you.

December 2001 - Caution ▶

DIRECTORY  SEARCH 

CURRENT SERVICES, AUGUST 2001

Introduction

The Centre is a component centre of the Institute of Health Services Research. Clinical effectiveness is about getting research into practice to improve health outcomes. uses three approaches to do this:

- An evidence centre that identifies, evaluates and prepares reports on research evidence relevant to clinical questions submitted by Southern Health staff.
- An education program that provides teaching and training to staff about aspects of evidence based healthcare and changing clinical practice.
- An implementation program that assists staff to introduce changes to organisational and clinical practices that are known to improve health outcomes.

The accompanying documents show examples of the work undertaken by the Centre and some of our recent achievements.

The external and internal policy environments relevant both to and the have changed recently. This description of our current services illustrates how the has responded to them.

Developments

Changes in the external environment

- Release of Patient Management Task Force reports.
- Integrated Quality Improvement and Best Practice Funding program.
- Creation of DHS Policy and Strategic Projects Division.
- Introduction of NHMRC Strategic Research Development Committee and Priority Driven Research programs.

Changes in the internal environment

- Southern Health *Strategic Directions* document and revised organisational structure.
- Strategic Plan.
- Success of in obtaining external research contracts.
- DHS review of funding due December 2001.

Structure

To respond to these changes has reformed into two units:

- The Effectiveness Unit will undertake general evidence evaluation and implementation projects, primarily for but also for external clients.
- The Health Technology Unit will undertake specialised evidence evaluation in new medical technologies and pharmaceuticals, specifically for external clients.

A centralised management structure will support service components like teaching and training, budgeting, human resources, committee work, marketing and planning.

Cost

internally-funded projects

will provide free of charge all services that relate to activities funded through routine service budgets.

externally-funded projects

will charge an hourly or daily rate for services that relate to sponsored activities funded by external sources (e.g. DHS, DHAC, NHMRC) for specific projects. This rate will be less than that charged to external projects. In some cases it may be possible to identify a total project cost by incorporating as a collaborator at an early stage in project development.

External projects

will charge an hourly or daily rate for services to projects funded by external sources that are not sponsored by . In some cases it may be possible to arrange a total project cost by incorporating as a collaborator at an early stage in project development.

Potential issues

Communication

Routine evidence requests should be sent to the Administrator, . All other requests should go to . Director.

Project development

welcomes early involvement in collaborative project development, particularly projects that have resource implications. We prefer to have a clear, documented, understanding of the expectations of our service before the submission of expressions of interest, project tenders or funding applications. Experience suggests that this approach predicts successful outcomes. is the appropriate initial contact point for new proposals.

Clinical input to evidence evaluation

The available research evidence on particular clinical questions may have limitations. Sometimes all that is available is less methodologically rigorous research that is highly susceptible to bias and unhelpful to decision making on the basis of the results alone. In these circumstances the best can provide is identification of the research material. The plausibility of the results cannot be tested empirically, and assessment relies on the consensus of clinical opinion.

Publication, authorship, acknowledgement

When work is used in presentations we request acknowledgement of our contribution. When our work is used in reports or publications we request that authors ask staff whether joint authorship is appropriate. We use the JAMA "Instruction to Authors" guidelines as our preferred reference in this regard.

Contacts

Appendix 2

Initial interview schedule for intermediaries

Semi Structured Interview Schedule

This interview is intended to last for approximately one hour, to gain background information relating to the context in which information is provided within the Centre.

Please describe the process of answering a clinical effectiveness enquiry.

When a topic is new to you or the Centre what do you do to find out more about the topic?

When searching for the topic how far are you prepared to search for the information?

Please describe what you do when you find the information

What do you do with useful information that you discover which does not go into your report?

What do you do with information that cannot be found when searching for the evidence?

Please describe what happens when you hand over the evidence to requestors and what happens after this?

What other useful things would you like to tell me about the way in which information is acquired, stored or moved within your workplace?

Appendix 3

Evidence request form

Evidence Request Form

For staff of the ONLY

Please send completed form to information must relate to -related work only. Requests will be processed in order.

If you prefer download the [printable](#) version.



Your Details

Name:

Position:

Campus:

Email:

Date:

Dept. / Program:

Phone:

Fax:

Please tell us if you wish to publish some of the information we provide because: the retains copyright over material and we publish completed Evidence Reports on our website.

Request Details

The **CLINICAL QUESTION** I would like answered:

The **PURPOSE** to which I wish to put this information:

The **TYPE** of service I require:

- ☒ A. **Literature search.** Original articles not retrieved. Citations with abstracts if available. Quality of evidence assigned. * 2-4 wks
- ☐ B. **Literature search plus critical appraisal.** Original articles retrieved. * 4-8 wks
- ☐ C. **Evidence Report.** Complete summary of critical appraisal, systematic search strategy, general findings. * 8-12 wks

The **CONDITION** in which I am interested:

The **PATIENTS/CLIENTS** in which I am interested:

► Any specific age range?

The **TREATMENT/THERAPY/INTERVENTION/EXPOSURE** in which I am interested:

The **OUTCOME/S** in which I am interested:

COMPARISONS in which I am interested:

PARTICULAR CLINICAL ENVIRONMENT?

I wish to restrict my search by:

► Language:

► Year of publication:

Other Requirement: Please provide us with any information which may assist us to

answer your request, including synonyms, authors, institutions etc.

[Click here to send](#)

Thank you for your request.
You will be contacted soon by a staff member from the

[\[Previous Page \]](#)

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HELP ?	CONTACTS 	SITEMAP 	STAFF DIRECTORY 	SEARCH 
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Appendix 4

Evidence report

SUMMARY STATEMENT:

Copyright – please refer to Appendix for information.

Form Version – C.2001.03.16.1

Disclaimer – please refer to Appendix for information.

Publication of materials – please use the following format when citing this article:

The effectiveness of below knee thrombo-embolic deterrent garments compared to full length garments in preventing deep vein thrombosis. .

2001.

[http://www.:](http://www.)

REQUEST:

Are below knee thrombo-embolic deterrent garments as effective as full length garments in preventing deep vein thrombosis in orthopaedic and stroke patients?

REQUESTED BY:

SUMMARY OF FINDINGS:

- Two articles met inclusion criteria for critical appraisal, one systematic review and one randomised controlled trial.
- Both studies reported that knee-length compression stockings were equally effective as thigh-length compression stockings in the prevention of deep vein thrombosis in hospitalised surgical and medical patients.
- The methodology of both studies failed to adequately meet most validity criteria, thus interpretation of results should be made with caution.

Search Strategy

First we search for systematic reviews, evidence-based clinical practice guidelines, or health technology assessments, and randomized controlled trials. If we identify sound, relevant material of this type, the search stops. Otherwise, our search strategy broadens to include studies that are more prone to bias, less generalizable, or have other methodologic difficulties. We include case-control and longitudinal cohort studies in our critical appraisal reports. While we cite observational and case series studies, and narrative reviews and consensus statements, in our reports we do not critically appraise them. Some studies can produce accurate results but they are generally too prone to bias to allow determination of their validity beyond their immediate setting.

Patients	Post hip or knee surgery, or stroke patients
Interventions	Below knee thrombo-embolic deterrent (TED) garments
Comparisons	Full length thrombo-embolic deterrent (TED) garments
Outcomes	Incidence of deep vein thrombosis (DVT)

Patient terms:	none applied
Intervention terms:	stocking\$, bandage\$, thrombo-embolic deterrent, compression garment/stocking/bandage, TED
Outcome terms:	thromboembolism, thrombophlebitis, venous thromb\$, DVT, primary prevention, prophylaxis, prevention

Resources Searched

Bandolier

Refinements, Searching & Reporting Constraints

Our electronic searching was completed on March 16 2001. The following inclusion and exclusion criteria were applied:

Inclusion Criteria

- Randomised controlled trials or systematic reviews of randomised controlled trials comparing knee-length thrombo-embolic deterrent compression stockings to thigh-length stockings for the prevention of deep vein thrombosis (DVT) in hospitalised adults undergoing surgery or suffering a stroke.

Exclusion Criteria

- Study was in abstract form only (e.g. conference proceedings);
- study was published in a language other than English; or
- non-randomised comparative studies, case-control studies, case series or case reports.

RESULTS:

The search strategy and perusal of abstracts yielded a total of six articles warranting assessment in full-text. After retrieval of the full-text articles were retrieved and reviewed. Application of the inclusion and exclusion criteria left two studies for critical appraisal. The remaining four studies were excluded for the following reasons:

Reason	Number of studies
Abstracts	2
Not knee vs. thigh comparison	1
Survey (not an RCT)	1
Total	4

One systematic review and one randomised controlled trial met inclusion criteria. We are reasonably confident these studies represent the most important findings published to date.

EVIDENCE SUMMARIES

Evidence summaries are in the form of spreadsheets reproduced at the end of this report. Each spreadsheet contains the article citation, the study design with level of evidence available according to NHMRC guidelines (1998), patient description, scientific validity of the article, results, and pertinent remarks from the authors and Centre for Clinical Effectiveness reviewer.

Findings

One systematic review and one randomised controlled trial (RCT) assessed the effectiveness of knee-length compared to thigh-length stockings in the prevention of DVT. Both studies concluded that knee-length stockings were as effective as thigh-length stockings. However, overall the validity of these results was questionable due to methodological and reporting flaws noted in the evidence summary spreadsheets at the end of this report and summarised below.

Research Methodology

The systematic review (Agu *et al.* 1999) and the RCT (Porteous *et al.* 1989) both described a well-defined patient population. Agu *et al.* (1999) examined all medical and surgical hospitalised patients while Porteous *et al.* (1989) examined hospitalised patients undergoing major abdominal surgery.

Systematic review

Agu *et al.* (1999) reviewed all types of thrombo-prophylaxis for both medical and surgical patients. They found one study comparing thigh-length and knee-length stockings. However, the quality of their reporting was poor. They failed to describe their search strategy adequately, little attempt was made to uncover unpublished literature and it is unclear whether any language restrictions were placed on the search. The authors did not state inclusion and exclusion criteria for papers or how many authors selected the papers. Furthermore, the authors did not report a method for assessing validity of included papers or how data was extracted from the papers. The review failed to report if studies for assessed for heterogeneity (similarity between results). Thus, the review failed to adequately meet most of the criteria for validity outlined in the evidence summary spreadsheets at the end of this report.

Randomised controlled trial

Porteous *et al.* (1989) compared knee-length and thigh-length compression stockings for the prevention of DVT in patients undergoing major abdominal surgery. The patient group and inclusion and exclusion criteria were clearly defined. However, the study failed to adequately meet the validity criteria outlined in the evidence summary spreadsheet. Although the authors stated the study was randomised, the method of randomisation was not stated, nor was it stated if the allocation sequence was concealed from investigators and patients. Although it would not be possible to blind patients to their treatment allocation (whether they were wearing knee-length or thigh-length stockings), the assessors of the outcome (DVT) could have been kept blinded to the patients' treatment group, but it was not reported if this was the case. Ten patients withdrew from the RCT but their results were not included in an intention-to-treat analysis. These shortcomings potentially could have biased the results. Furthermore, as the outcome (incidence of DVT) is quite a rare occurrence, large numbers of patients would be needed to accurately detect a significant difference between the treatments. A power analysis, which would estimate the minimum number of patients required to detect a significant effect, was not performed.

ARTICLES CRITICALLY APPRAISED FOR THIS REPORT

Agu, O., Hamilton, G. & Baker, D. (1999). Graduated compression stockings in the prevention of venous thromboembolism. *British Journal of Surgery* 86(8): 992-1004.

Porteous, M. J., Nicholson, E. A., Morris, L. T. *et al.* (1989). Thigh length versus knee length stockings in the prevention of deep vein thrombosis. *British Journal of Surgery* 76(3): 296-297.

ARTICLES EXCLUDED FROM CRITICAL APPRAISAL

Hui, A. C., Heras-Palou, C., Dunn, I. *et al.* (1996). Graded compression stockings for prevention of deep-vein thrombosis after hip and knee replacement [see comments]. *Journal of Bone & Joint Surgery - British Volume* 78(4): 550-554.

Hui, A., Gregg, P., Triffitt, P., Armstrong, L., Sinclair, M, & Mitchell, V. (1993). Graded compression stockings in the prevention of deep vein thrombosis. *Journal of Bone and Joint Surgery* 75-B(Suppl II): 111.

Williams, J. T. & Palfrey, S. M. (1988). Cost effectiveness and efficacy of below knee against above knee graduated compression stockings in the prevention of deep vein thrombosis. *Phlebologie* 41(4): 809-811.

Williams, A. M., Davies, P.R., Sweetnam, D., Harper, G., Pusey, R., & Lightowler, C. D. R. (1996). Knee-length versus thigh-length graduated compression stockings in the prevention of deep vein thrombosis. *British Journal of Surgery* 83: 1553.

Appendix 5

Critical appraisal sheets

CRITICAL APPRAISAL SKILLS PROGRAMME

making sense of evidence

10 questions to help you make sense of a review

General comments

- Three broad issues need to be considered when appraising research.

A/ Are the results of the study valid?

B/ What are the results?

C/ Will the results help locally?

The questions on the following pages are designed to help you think about these issues systematically.

- The first two questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.
- There is a fair degree of overlap between several of the questions.
- You are asked to record a "yes", "no" or "can't tell" to most of the questions.
- A number of italicised hints are given after each question. These are designed to remind you why the question is important.
- These questions are adapted from: Oxman AD et al. Users' Guides to The Medical Literature, VI How to use an overview. JAMA 1994; 272 (17): 1367-1371.

A/ Are the results of the study valid?

Screening Questions

<p>1. Did the review address a clearly focused research question?</p> <p><i>HINT: A research question should be 'focused' in terms of:</i></p> <ul style="list-style-type: none"> - the population studied - the intervention given or exposure - the outcomes considered 	<p>Yes</p> <p><input type="checkbox"/></p>	<p>Can't tell</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>
<p>2 Did the review include the right type of studies?</p> <p><i>HINT: These would:</i></p> <ul style="list-style-type: none"> - address the review's research question - have an appropriate study design 	<p>Yes</p> <p><input type="checkbox"/></p>	<p>Can't tell</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>

Is it worth continuing?

Detailed Questions

<p>3 Did the reviewers try to identify all relevant studies?</p> <p><i>HINT: Look for:</i></p> <ul style="list-style-type: none"> - which bibliographic databases were used - follow-up from reference lists - personal contact with experts - search for unpublished studies - search for non-English language studies 	<p>Yes</p> <p><input type="checkbox"/></p>	<p>Can't tell</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>
<p>4 Did the reviewers assess the quality of the included studies?</p> <p><i>HINT: A clear, pre-determined strategy should be used to determine which studies are included. Look for:</i></p> <ul style="list-style-type: none"> - a scoring system - more than one assessor 	<p>Yes</p> <p><input type="checkbox"/></p>	<p>Can't tell</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>
<p>5 If the results of the studies have been combined, was it reasonable to do so?</p> <p><i>HINT: Consider whether:</i></p> <ul style="list-style-type: none"> - the results of each study are clearly displayed - the results were similar from study to study (look for tests of heterogeneity) - the reasons for any variations in results are discussed 	<p>Yes</p> <p><input type="checkbox"/></p>	<p>Can't tell</p> <p><input type="checkbox"/></p>	<p>No</p> <p><input type="checkbox"/></p>

B/ What are the results?

<p>6 What are the main results of the review?</p> <p><i>HINT: Consider:</i></p> <ul style="list-style-type: none"> - how the results are expressed (eg odds ratio, relative risk etc.) - what the results are 	
<p>7 Could these results be due to chance?</p> <p><i>HINT: Look for tests of statistical significance (p-values) and confidence intervals (CIs)</i></p>	

C/ Will the results help locally?

<p>8 Can the results be applied to the local population?</p> <p><i>HINT: Consider whether:</i></p> <ul style="list-style-type: none"> - the population sample covered by the review could be sufficiently different from your population to cause concern. - your local setting is likely to differ much from that of the review 	<p>Yes <input type="checkbox"/></p> <p>Can't tell <input type="checkbox"/></p> <p>No <input type="checkbox"/></p>
<p>9 Were all important outcomes considered?</p> <p><i>HINT: Consider outcomes from the point of view of the:</i></p> <ul style="list-style-type: none"> - individual - policy makers and practitioners - family / carers - wider community 	<p>Yes <input type="checkbox"/></p> <p>Can't tell <input type="checkbox"/></p> <p>No <input type="checkbox"/></p>
<p>10 Should policy or practice change as a result of the evidence contained in this review?</p> <p><i>HINT: Consider whether the benefits are worth the harms and costs</i></p>	<p>Yes <input type="checkbox"/></p> <p>No <input type="checkbox"/></p>

Appendix 6

Levels of evidence



Levels of Evidence and Grades of Recommendations

[Levels of Evidence](#)
[Footnotes & References](#)
[Recent Comments](#)
[Related materi
and Q](#)

Introduction

What are we to do when the irresistible force of the need to offer clinical advice meets with the immovable object of flawed evidence? All we can do is our best: give the advice, but alert the advisees to the flaws in the evidence on which it is based.

The ancestor of this set of pages was created by Suzanne Fletcher and Dave Sackett 20 years ago when they were working for the Canadian Task Force on the Periodic Health Examination [1]. They generated "levels of evidence" for ranking the validity of evidence about the value of preventive manoeuvres, and then tied them as "grades of recommendations" to the advice given in the report.

The levels have evolved over the ensuing years, most notably as the basis for recommendations about the use of anti-thrombotic agents [2], have grown increasingly sophisticated [3], and have even started to appear in a new generation of evidence-based textbooks that announce, in bold marginal icons, the grade of each recommendation that appears in the texts [4] in bold icons.

However, their orientation remained therapeutic/preventive, and when a group of members of the Centre embarked on creating a new-wave house officers' manual (see the EBOC page), the need for levels and grades for diagnosis, prognosis, and harm became overwhelming and the current version of their efforts appears here. They are the work of Chris Ball, Dave Sackett, Bob Phillips, Brian Haynes, Sharon Straus, and Martin Dawes with lots of encouragement and advice from their colleagues.

Comments to this latest version are available. More are welcome as these continue to develop.

Periodic updates will appear here, and surfers are invited to suggest ways that they might be improved or further developed.

A final, cautionary note: these levels and grades speak only to the validity of evidence about prevention, diagnosis, prognosis, therapy, and harm. Other strategies, described elsewhere in the Centre's pages, must be applied to the evidence in order to generate clinically useful measures of its potential clinical implications and to incorporate vital patient-values into the ultimate decisions.

Oxford Centre for Evidence-based Medicine Levels of Evidence (May 2001)

Level	Therapy/Prevention, Aetiology/Harm	Prognosis	Diagnosis	Differential diagnosis/symptom prevalence study	Economic and decision analyses
1a	SR (with <u>homogeneity</u> *) of RCTs	SR (with <u>homogeneity</u> *) of inception cohort studies; CDR† validated in different populations	SR (with homogeneity*) of Level 1 diagnostic studies; CDR† with 1b studies from different clinical centres	SR (with homogeneity*) of prospective cohort studies	SR (with homogeneity*) of Level 1 economic studies
1b	Individual RCT (with narrow Confidence Interval†)	Individual inception cohort study with ≥ 80% follow-up; CDR† validated in a single population	Validating** cohort study with good††† reference standards; or CDR† tested within one clinical centre	Prospective cohort study with good follow-up****	Analysis based on clinically sensible costs or alternatives; systematic review(s) of the evidence; and including multi-way sensitivity analyses
1c	All or none§	All or none case-series	Absolute SpPins and SnNouts††	All or none case-series	Absolute better-value or worse-value analyses ††††
2a	SR (with <u>homogeneity</u> *) of	SR (with <u>homogeneity</u> *) of either retrospective	SR (with homogeneity*) of Level >2 diagnostic studies	SR (with homogeneity*) of 2b and better studies	SR (with homogeneity*) of Level >2 economic

	cohort studies	cohort studies or untreated control groups in RCTs			studies
2b	Individual cohort study (including low quality RCT; e.g., <80% follow-up)	Retrospective cohort study or follow-up of untreated control patients in an RCT; Derivation of CDR† or validated on split-sample§§§ only	Exploratory** cohort study with good††† reference standards; CDR† after derivation, or validated only on split-sample§§§ or databases	Retrospective cohort study, or poor follow-up	Analysis based on clinically sensible costs or alternatives; limited review(s) of the evidence, or single studies; and including multi-way sensitivity analyses
2c	"Outcomes" Research; Ecological studies	"Outcomes" Research		Ecological studies	Audit or outcomes research
3a	SR (with homogeneity*) of case-control studies		SR (with homogeneity*) of 3b and better studies	SR (with homogeneity*) of 3b and better studies	SR (with homogeneity*) of 3b and better studies
3b	Individual Case-Control Study		Non-consecutive study; or without consistently applied reference standards	Non-consecutive cohort study, or very limited population	Analysis based on limited alternatives or costs, poor quality estimates of data, but including sensitivity analyses incorporating clinically sensible variations.
4	Case-series (and poor quality cohort and case-control studies§§)	Case-series (and poor quality prognostic cohort studies***)	Case-control study, poor or non-independent reference standard	Case-series or superseded reference standards	Analysis with no sensitivity analysis
5	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on economic theory or "first principles"

Produced by Bob Phillips, Chris Ball, Dave Sackett, Doug Badenoch, Sharon Straus, Brian Haynes, Martin Dawes since November 1998.

Notes

Users can add a minus-sign "-" to denote the level of that fails to provide a conclusive answer because of:

- EITHER a single result with a wide Confidence Interval (such that, for example, an ARR in an RCT is not statistically significant but whose confidence intervals fail to exclude clinically important benefit or harm)
- OR a Systematic Review with troublesome (and statistically significant) heterogeneity.
- Such evidence is inconclusive, and therefore can only generate Grade D recommendations.

*	By homogeneity we mean a systematic review that is free of worrisome variations (heterogeneity) in the directions and degrees of results between individual studies. Not all systematic reviews with statistically significant heterogeneity need be worrisome, and not all worrisome heterogeneity need be statistically significant. As noted above, studies displaying worrisome heterogeneity should be tagged with a "-" at the end of their designated level.
†	Clinical Decision Rule. (These are algorithms or scoring systems which lead to a prognostic estimation or a diagnostic category.)
‡	See note #2 for advice on how to understand, rate and use trials or other studies with wide confidence intervals.
§	Met when <u>all</u> patients died before the Rx became available, but some now survive on it; or when some patients died before the Rx became available, but <u>none</u> now die on it.
§§	By poor quality <u>cohort</u> study we mean one that failed to clearly define comparison groups and/or failed to measure exposures and outcomes in the same (preferably blinded), objective way in both exposed and non-exposed individuals and/or failed to identify or appropriately control known confounders and/or failed to carry out a sufficiently long and complete follow-up of patients. By poor quality <u>case-control</u> study we mean one that failed to clearly define comparison groups and/or failed to measure exposures and outcomes in the same (preferably blinded), objective way in both cases and controls and/or failed to identify or appropriately control known confounders.
§§§	Split-sample validation is achieved by collecting all the information in a single tranche, then artificially dividing this into "derivation" and "validation" samples.
††	An "Absolute SpPin" is a diagnostic finding whose Specificity is so high that a Positive result rules-in the diagnosis. An "Absolute SnNout" is a diagnostic finding whose Sensitivity is so high that a Negative result rules-out the diagnosis.
‡‡	Good, better, bad and worse refer to the comparisons between treatments in terms of their clinical risks and benefits.
†††	Good reference standards are independent of the test, and applied blindly or objectively to applied to all patients. Poor reference standards are haphazardly applied, but still independent of the test. Use of a non-independent reference standard (where the 'test' is included in the 'reference', or where the 'testing' affects the 'reference') implies a level 4 study.
††††	Better-value treatments are clearly as good but cheaper, or better at the same or reduced cost. Worse-value treatments are as good and more expensive, or worse and the equally or more expensive.
**	Validating studies test the quality of a specific diagnostic test, based on prior evidence. An exploratory study collects information and trawls the data (e.g. using a regression analysis) to find which factors are 'significant'.
***	By poor quality prognostic cohort study we mean one in which sampling was biased in favour of patients who already had the target outcome, or the measurement of outcomes was accomplished in <80% of study patients, or outcomes were determined in an unblinded, non-objective way, or there was no correction for confounding factors.
****	Good follow-up in a differential diagnosis study is >80%, with adequate time for alternative diagnoses to emerge (eg 1-6 months acute, 1 - 5 years chronic)

Grades of Recommendation

A	consistent level 1 studies
B	consistent level 2 or 3 studies or extrapolations from level 1 studies
C	level 4 studies or extrapolations from level 2 or 3 studies
D	level 5 evidence or troublingly inconsistent or inconclusive studies of any level

"Extrapolations" are where data is used in a situation which has potentially clinically important differences the original study situation.

"Extrapolations" are where data is used in a situation which has potentially clinically important differences the original study situation.



References

1. Canadian Task Force on the Periodic Health Examination: The periodic health examination. CMAJ 1979;121:1193-1254.
2. Sackett DL. Rules of evidence and clinical recommendations on use of antithrombotic agents. Chest 1986 Feb; 89

(2 suppl.):2S-3S.

3. Cook DJ, Guyatt GH, Laupacis A, Sackett DL, Goldberg RJ. Clinical recommendations using levels of evidence for antithrombotic agents. *Chest* 1995 Oct; 108(4 Suppl):227S-230S.
 4. Yusuf S, Cairns JA, Camm AJ, Fallen EL, Gersh BJ. *Evidence-Based Cardiology*. London: BMJ Publishing Group, 1998.
-



[Click here to comment on Levels of Evidence](#)



search

Practising EBM

Syllabi For
Practising EBM

Teaching EBM

Teaching Materials

Presentations

Workshops on
Teaching EBM

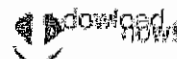
Evidence
Resources

Glossary of EBM
Terms

Teaching EBM > Teaching Materials > Critical appraisal worksheets > Therapy worksheets

Therapy worksheet

Citation



Are the results of this single preventive or therapeutic trial valid?

Was the assignment of patients to treatments randomised? Was the randomisation list concealed?	<input type="text"/>
Was follow-up of patients sufficiently long and complete?	<input type="text"/>
Were all patients analysed in the groups to which they were randomised?	<input type="text"/>
Were patients and clinicians kept "blind" to treatment?	<input type="text"/>
Were the groups treated equally, apart from the experimental treatment?	<input type="text"/>
Were the groups similar at the start of the trial?	<input type="text"/>

Are the valid results of this randomised trial important?

Sample calculations

Your calculations

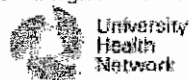
Occurrence of diabetic neuropathy at 5 years among insulin-dependent diabetics in the DCCT trial		Relative risk reduction (RRR)	Absolute risk reduction (ARR)	Number needed to treat (NNT)
CER	EER	(CER-EER)/CER	CER-EER	1/ARR
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
		95% CI*=>	<input type="text"/>	<input type="text"/>

Can you apply this valid, important evidence about therapy in caring for your p

Do these results apply to your patient?	
Is your patient so different from those in the study that its results cannot apply?	<input type="checkbox"/>
Is the treatment feasible in your setting?	<input type="checkbox"/>
What are your patient's potential benefits and harms from the therapy?	
<i>Method I: f</i>	Risk of the outcome in your patient, relative to patients in the trial Expressed as a decimal: _____ NNT/f = _____ / _____ = _____ (NNT for patients like yours)
<i>Method II: 1/(PEER x RRR)</i>	Your patient's expected event rate if they received the control treatment (PEER) = _____ 1/(PEER x RRR) = 1 / _____ = _____ (NNT for patients like yours)
Are your patient's values and preferences satisfied by the regimen and its consequences?	
Do your patient and you have a clear assessment of their values and preferences?	<input type="checkbox"/>
Are they met by this regimen and its consequences?	<input type="checkbox"/>

Additional Notes

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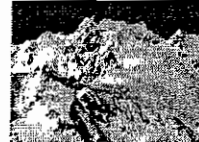
Appendix 7

Web based diary



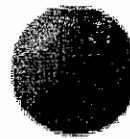
KNOWLEDGE MANAGEMENT FOR EVIDENCE BASED PRACTICE RESEARCH PROJECT

Investigation of knowledge management within
the context of evidence based health care



This research aims to explore how knowledge is managed within the context of evidence based practice in health care. Providing information to support evidence based decision making is a complex and complicated process, where information is acquired, retrieved, sifted and appraised before being handed on to practitioners so that decisions can be informed. This process can be classified as knowledge management.

Data for this project will be collected over six months, employing a range of methods. During this time participants will be asked to complete diaries for several weeks e.g. 3 weeks. After this time you will be given feedback on the data collection, this process may be repeated several times during the data collection period. This diary will collect your thoughts about working at the Centre.



**Knowledge
Management
Program**

Subject's right to privacy

Records of research, interviews, diaries, etc. will only be accessed by the researcher. Data will be retained in the be stored at the School of Information Management and Systems for five years and original data or electronically stored copies of the original data, may be destroyed after five years.

Publication

Any results of this research that are published will be anonymised so that participants will not be identified.

Participation

Participation in this research is voluntary; subject may withdraw at any stage or avoid answering questions, which are felt too personal or intrusive.

University complaints

Should you have any complaint concerning the manner in which this research project number: - is conducted, please do not hesitate to contact the Standing Committee on Ethics in Research on Humans at the following address:

The Secretary,
The Standing Committee on Ethics in Research on
Humans

Monash University,
Wellington Road

Diaries

Explanation: These diaries aim to collect a detailed narration of some specific and limited events (in this case searching and sifting information), followed by a written reflection the thought and feelings that arise after the event. Structured diaries aim to overcome too few details and make explicit the type of information needed.

Web based diary data collection form:

"This form is a way of collecting your thoughts and experience of searching, sifting and providing the evidence. All information collected will be kept anonymous and confidential."

How did you go in searching and sifting the evidence this week?

Did you get what you wanted? What are your thoughts?

Did you find out new things?

How did you share and store the knowledge?

Do you have any other thoughts and comments about this week's work?

Appendix 8

Group interview with intermediaries

Focus group protocol

Aim of the is event:

1. To give participants feedback on findings from data collection
2. To prioritise issues with the group, so that these can be dealt with in a problem solving

Stage One

Presentation: Feedback from diaries by Gabby

Overheads and explanation of re-occurring themes

List the issues

Stage Two

Discussion of Issues raised by the diaries

Do these issues confirm or contradict what you wrote in the diaries

What are other knowledge sharing issues would you like to raise?

Appendix 9

Rich picture interview schedule

Rich Picture Semi Structured Interviews

Prior to this interview, participants would have received a copy of the rich picture, the conceptual model and an explanation of what we might discuss

Looking at the rich picture and conceptual model what do you think?

How do you think you work in relation to the picture and model?

Does it accurately reflect what's going on in the unit and with the users?

Is there anything you might change?

What parts do you think could be improved?

Do you think you have shared understanding of what the question is because you choose or get specific types of questions?

Do you think you need to understand the context of health care delivery in order to provide relevant knowledge?

Appendix 10

Health practitioner interview schedule

Interview Schedule for Health Care Practitioners

Describe the process of coming to the unit

What interaction did you have with them?

What did you bring to the encounter?

Did you feel that you had a shared understanding of the problem at hand?

Did the unit increase your knowledge about how to ask a question?

Do you need to go back to clarify things with them e.g. your understanding of the situation/context/ subject

What did you do with the evidence report that you received?

Did you provide feedback to unit in relation to usability and relevance?

Do you have any other comments to add about the unit or your evidence needs?

Appendix 11

Feedback forms

Request for Feedback

The Evidence Centre at the Centre for Clinical Effectiveness is very interested in your evaluation of the service we recently provided to you. Please complete BOTH sides of this form and return to the

Alternatively, you can fax us on

Subject of evidence request: _____

	Very satisfied		Neutral		Very dissatisfied
How satisfied are you with:					
the information provided in the report?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
the timeliness of the report?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
your contact with Centre staff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments: _____

What is the purpose to which you wish to put the information you requested?

How well did the report answer the question you asked?

☐ very well ☐ moderately well ☐ not as well as you would have liked

Comments: _____

How likely is it that the evidence in the report will influence your clinical practice?

☐ very likely ☐ likely ☐ unlikely ☐ not sure

Comments: _____

Do you have any comments or suggestions for improving our service?

Please Turn Over

ERNum:

Report ☐

CA ☐

LS ☐

Think about WHY you needed the report. The report was needed for ... (tick all that apply):

- ☐ Patient care
- ☐ Teaching
- ☐ Personal continuing education
- ☐ Publication (report / peer-reviewed paper)
- ☐ Research
- ☐ Other (please specify) _____

Think about HOW the report was used. (tick all that apply):

- | | |
|--|--|
| <p>I ...</p> <ul style="list-style-type: none"><input type="checkbox"/> kept the information to myself<input type="checkbox"/> shared the information with colleagues<input type="checkbox"/> other (please specify) _____ | <p>I also ...</p> <ul style="list-style-type: none"><input type="checkbox"/> added the report to my personal information collection<input type="checkbox"/> added the report to the departmental files / databases<input type="checkbox"/> used a reference database |
|--|--|

Think about the information you were EXPECTING to receive. I was hoping to get ... (tick all that apply):

- | | |
|---|--|
| <ul style="list-style-type: none"><input type="checkbox"/> information on methods/ interventions used<input type="checkbox"/> information on results obtained<input type="checkbox"/> background information on the topic<input type="checkbox"/> most recent information on a topic<input type="checkbox"/> other (please specify) _____ | <ul style="list-style-type: none"><input type="checkbox"/> a good review article or two<input type="checkbox"/> alternative lines of research<input type="checkbox"/> best practice on the topic |
|---|--|

Think about the IMMEDIATE IMPACT of the information on your knowledge of the topic. (tick all that apply):

- | | |
|--|---|
| <p>The report ...</p> <ul style="list-style-type: none"><input type="checkbox"/> refreshed my memory of details or facts<input type="checkbox"/> confirmed what I already knew about the topic.<input type="checkbox"/> other (please specify) _____ | <ul style="list-style-type: none"><input type="checkbox"/> contained some information that was new to me.<input type="checkbox"/> contained a lot of information that was new to me.<input type="checkbox"/> uncovered unexpected information |
|--|---|

Think about how the information will contribute to your FUTURE DECISIONS. The report will affect the ... (tick all that apply):

- | | |
|---|---|
| <ul style="list-style-type: none"><input type="checkbox"/> choice of diagnostic test<input type="checkbox"/> recognition of abnormal or normal condition<input type="checkbox"/> differential diagnosis<input type="checkbox"/> confirmation of proposed therapy<input type="checkbox"/> identification / evaluation of alternative therapies<input type="checkbox"/> other (please specify) _____ | <ul style="list-style-type: none"><input type="checkbox"/> minimisation of risks of treatment<ul style="list-style-type: none"><input type="checkbox"/> revision of treatment plan<input type="checkbox"/> guidelines, audit or standards of care<input type="checkbox"/> improvement of quality of life<input type="checkbox"/> legal or ethical issues |
|---|---|

Thank you for your time.

Please post to:

or fax to

Appendix 12

Unit standard operating procedure

Evidence Unit				
Policy: EU001			Page: 1 of 5	
Next Review date: December 2001			Version No: 001b	
TITLE: GUIDELINE FOR PREPARING POLICY DOCUMENTS AND STANDARD OPERATING PROCEDURES FOR THE EVIDENCE UNIT				
Original Prepared by:			Signature:	Date: 06/09/01
*Authorized by: Director, Evidence Unit			Signature:	Date:
Revision No.	Reason for Revision	Reviewed by	Signature	Revision Date:
Electronic file location and name:		EU J Drive A:\SOPCCE00101b - Guideline for Preparing Policies and SOPs.doc		

CONTENTS:

1. Background
2. Objectives
3. Responsibilities
4. Policy and Procedure
5. Limitations
6. Relevant Documents and References
7. Appendix: Checklist for staff preparing, modifying or reviewing SOPs/Policies

Any revised versions of this policy MUST be authorized by the Director of the EU. This policy is subject to DOCUMENT CONTROL.

Evidence Unit	
Policy: EU001	Page: 2 of 5
Next Review date: December 2001	Version No: 001b
TITLE: GUIDELINE FOR PREPARING POLICY DOCUMENTS AND STANDARD OPERATING PROCEDURES FOR THE EVIDENCE UNIT	

1. BACKGROUND

Documents outlining the policies and standard operating procedures (SOPs) of the Evidence Unit (EU) are developed in order to provide guidance to staff on administrative and operational matters. New policies and procedures will be developed in response to the perceived need and in cognizance of the EU's Strategic Plan. All the SOPs and policies will be reviewed on regular basis.

2. OBJECTIVES

This document was created with the following objectives:

- To document the procedure for development and implementation of SOPs and policies directly relevant to the EU.
- To document the control procedures for SOPs and policy developed.
- To provide guidelines for staff involved in the development and implementation of SOPs and policies

3. RESPONSIBILITIES

The Director of the EU

- Authorizes the development, revision, and implementation of policies and SOPs pertinent to the EU and its component Units

The Director and Deputy Director of the Health Technology and Effectiveness Units and the Business Manager

- Authorizes the development, revision, review, and implementation of policies and SOPs pertinent to their respective Units
 - The Director and Deputy Director of the Health Technology Unit are responsible for policies and SOPs relating to the administrative, organizational, fiscal, and procedural aspects of the Health Technology Unit.
 - The Director and Deputy Director of the Effectiveness Unit are responsible for policies and SOPs relating to the administrative, organizational, fiscal, and procedural aspects of the Effectiveness Unit.
 - The Business Manager is responsible for policies and SOPs relating to the administrative and fiscal aspects of the EU.
 - Responsible for keeping and archiving all versions of policies and SOPs.
 - Responsible for keeping and archiving all documents related to the development of policies and SOPs
 - Responsible for ensuring that one authorized copy of each policy or SOP is held in a central filing system with limited access.
 - Responsible for ensuring that electronic access to the most recent version of all policies and SOPs are available to general staff
- Advises the Director of the EU on the development of policies and SOPs for the EU and its component Units

The Staff of the EU

- Advises the Director of the EU, the Directors and Deputy Directors of the Units, and the Business Manager on the development of policies and SOPs.
- If involved in the development of policies and SOPs, is responsible for compliance with these guidelines.

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Evidence Unit	
Policy: EU001	Page: 3 of 5
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TITLE: GUIDELINE FOR PREPARING POLICY DOCUMENTS AND STANDARD OPERATING PROCEDURES FOR THE EVIDENCE UNIT	

4. POLICY and PROCEDURE

1. General instructions

- a. All SOPs and policies are to be written on a standard template.
 - i. The template is available from the Business Manager.
 - ii. This document was prepared using the standard template.
- b. The history of each SOP or policy must be recorded on the front page of the document.
- c. Staff members involved in the preparation and/or revision of SOPs/Policy must follow the checklist given in Appendix A of this procedure.

2. Naming conventions and electronic access

- a. Guidelines will be numbered sequentially in this format:
 - i. SOPUUUxxxyz – [Title].doc
 1. The prefix "SOP" is used to call attention to the nature of the document
 2. The place marker "UUU" refers to a three-letter uppercase code assigned by the Business Manager.
 - a. The code reflects the Unit within the EU to which the SOP or policy will refer.
 - b. The following conventions will be applied:
 - i. UUU=EU for those SOPs or policies that relate to general EU matters.
 - ii. UUU=HTA for those SOPs or policies that relate to general matters of the Health Technology Unit.
 - iii. UUU=EFF for those SOPs or policies that relate to general matters of the Effectiveness Unit.
 - iv. UUU=BUS for those SOPs or policies that relate to general matters of the Business Unit
 - v. Other three-letter uppercase codes may be assigned in the future, as long as these new codes are different from those currently in use.
 3. The place marker "xxx" refers to a three-digit numerical code assigned by the Business Manager using a standard unit increment.
 - a. The code is applied from 001, 002, 003... and so on.
 - b. No two SOPs or policies must possess the same xxx code, unless one is a revision of another.
 - c. A code of a lower absolute value may not be assigned.
 4. The place marker "yy" refers to a two-digit numerical code assigned by the developers of the specific SOP or policy.
 - a. The code uses a standard unit increment to refer to major versions or revisions of the SOP or policy.
 - b. The code is applied from 01, 02, 03... and so on.
 - c. A "major version or revision" is one that is deemed by two independent reviewers to require the approval of the Director of the EU or one of the Unit Directors.
 - d. No two SOPs or policies must possess the same yy code.
 5. The place marker "z" refers to an alphabetic code assigned by developers of the specific SOP or policy
 - a. The code uses an incrementing alphabetic sequence to refer to minor versions or revisions of the SOP or policy.
 - b. The code is applied from a, b, c... and so on.
 - c. A "minor version or revision" is one that is deemed by two independent reviewers to not require the approval of the Director of the EU or one of the Unit Directors. These include such revisions as changes to grammar, cosmetic adjustments, and the like.
 - d. No two SOPs or policies must possess the same z code, unless they are identical.

Any revised versions of this policy **MUST** be authorized by the Director of the EU. This policy is subject to DOCUMENT CONTROL.

Evidence Unit	
Policy: EU001	Page: 4 of 5
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TITLE: GUIDELINE FOR PREPARING POLICY DOCUMENTS AND STANDARD OPERATING PROCEDURES FOR THE EVIDENCE UNIT	

6. The dash "-" separates the assigned code from the title of the SOP or policy.
7. The title of the SOP or policy should be summarized descriptively so as to leave no doubt about the document's main theme.
8. The suffix ".doc" implies that all policies must be created in Word format in a version that is accessible to all staff members. A copy of the document in PDF format should be available, too.

ii. Examples

1. SOPCCE00101a – Guideline for Preparing Policies and SOPs.doc
 - a. This is the name of the original version of this document.
 2. SOPCCE00104a – Guideline for Preparing Policies and SOPs.doc
 - a. This implies that four major revisions have taken place that required the approval of the Director of the EU or one of the Directors of its Units.
 3. SOPEU00105c – Guidelines for Preparing Policies and SOPs.doc
 - a. This implies that five major revisions have taken place that required the approval of the Director of the EU or one of the Directors of its Units. Moreover, there were three previous minor revisions.
 4. SOPHTA00101a – Fake Title.doc
 - a. This is an SOP or policy that relates to matters within the Health Technology Unit. The particular SOP or policy has no previous versions on record.
- b. All policies and SOPs will be stored in a folder on the J: drive created by the Business Manager.
- i. Folder naming conventions
 1. Three levels of folders will be created
 - a. The first level takes the UUU code
 - b. The second level takes the UUUxxx code
 - c. The third level takes is a storage area for all previous version of the current SOP or policy
 - ii. Storage conventions
 1. A list of all policies and SOPs will be created in the first level folder.
 2. The most recent version of the SOP or policy will reside in the second level folder.
 3. All previous versions of the SOP or policy will be kept in the third level folder.
 - iii. Access privileges
 1. The folder containing all policies and SOPs will have limited writing privileges to prevent unauthorized deletion or modification. Privileges will be given to the Director of the EU and the Directors of the component Units.
 2. The folder containing all policies and SOPs will have unlimited reading privileges to staff affiliated with the EU.
3. Availability of SOPs and policies and document control
- a. The current version of each SOP/Policy must be made available to staff in electronic format on the EU (J:).
 - b. Staff must be notified of revisions to SOPs and Policies via an email message from the Business Manager.
 - c. For document control purposes hard copies of SOPs/Policy's (new or revised) will not be distributed. Staff members are advised to refer to the EU drive (J:) for the most recent version.

5. LIMITATIONS

1. This guideline does not seek to stipulate the intellectual process and consultative activities used to develop particular SOPs and policies.

Any revised versions of this policy MUST be authorized by the Director of the EU. This policy is subject to DOCUMENT CONTROL.

Evidence Unit	
Policy: EU001	Page: 5 of 5
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TITLE: GUIDELINE FOR PREPARING POLICY DOCUMENTS AND STANDARD OPERATING PROCEDURES FOR THE EVIDENCE UNIT	

6. RELEVANT DOCUMENTS AND REFERENCES

The standard templates for SOP's and policy are on the public drive (J:).
MIHSR SOP template.dot

All queries regarding development and implementation of policy and procedure should be directed to the Business Manager as a first point of contact or to the Director of the EU.

7. APPENDIX

Checklist for staff who are preparing, modifying or reviewing an SOP/policy

- Each version of an SOP/policy should be saved electronically as a separate version. Before making any changes to the document, open the file then select 'save as' and modify the version number in the file name.
- The complete history of each SOP/policy is documented on the front page of the SOP/policy. A header table is provided for this purpose. Ensure all details are completed, even for minor revisions such as spelling/grammar corrections, so that the most recent version can always be identified.
- The header table on subsequent pages provides a summary of the SOP/policy details. These details must be updated in the header on the second page of the SOP/policy. All subsequent pages will automatically be updated.
- Do not over write the revision history of an SOP/Policy (in header table).
- One authorized hard copy of each revision must be held in the central filing system.
- The current version must be made available to staff on the public drive (J:).

Action	Tick when complete
1. Have you saved the electronic file as a separate version (do this before making changes)?	
2. Have you completed all details in the header table on the front page?	
3. Have you updated details in the header table on page 2?	
4. Have you included a revision number and reason for revision?	
5. Have you updated the SOP/Policy number in the footer of the front and second page?	
6. Have you included the name of the reviewer? (The name must be that of the person who updated the electronic copy of the SOP/Policy. If you updated under instruction from some one else, include that persons name in the reason for review)	
7. Have you updated the version number in the header table on page one and two?	
8. Have you updated the electronic file name?	
9. Have you updated the electronic file location details?	
10. Have you dated and signed the revision?	
11. Has the new version been authorised by the Business Manager?	
12. Has the new version been authorised by the Director?	
13. Have you emailed the new version to the Business Manager for updating public drive (J:) and central records?	
14. Has the new version been uploaded onto public drive (J:)?	
15. Have all EU staff and students been notified of the revision by email?	
16. Has an authorised hard copy been filed in the EU filing system?	
17. Has the filing system database* been updated to include the revision?	

* Database still under development. List of files should be updated and circulated as indicated on list in interim.

Any revised versions of this policy **MUST** be authorized by the Director of the EU. This policy is subject to DOCUMENT CONTROL.

Appendix 13

KMS Survey

The Monash Knowledge Management Laboratory (KM Lab) KM Lab is a Virtual Laboratory operating under the Enterprise Information Research Group at the School of Information Management and Systems, Monash University. The laboratory holds and has access to a variety of KM systems, which we use, for teaching, comparative analysis and as sources for recommendations in our industry collaborative projects. The laboratory is becoming a common resource for people looking for a suitable KM product both in Australia and internationally.

We would like to include your KM system in the list of resources on the KM Lab database. You are invited to complete a short questionnaire outlining the specific functionality of your system in relation to general classification of knowledge processes suggested in the literature.

We will be happy to share our findings with you. You can access the KM Lab website at <http://km-svr.sims.monash.edu.au/> We are interested in any other comments or suggestions you may have for the future development of this resource.

We look forward to hearing from you.

Gabby Fennessy, PhD candidate of the KM Program and
Assoc. Prof. Frada Burstein KM Laboratory Director

=====

Questionnaire

Questions can be answered by placing an 'x' next to either NO or YES or next to the option that is your response. Some questions will ask you 'to what extent?' please indicate to what extent your product carries out the function by indicating with:

- N/A not applicable
- 0% not at all
- 50% to some extent
- 100% completely
- or somewhere in between, choosing your own %score

Product and Platform

1. Name of Product

2. Do you consider this to be a Knowledge Management System?

No, go to question 3

Yes, go to question 4

3. If your product is not a knowledge management system, what do you consider it?

Thank for answering the questions, please return your answers by return email

4. What operating system does your product work on? Please state ...

5. Is it Web enabled or Web usable?

No

Yes, to what extent %

Functionality

Knowledge creation

6. Does the file structure need to be set up by the users?

No

Yes, to what extent %

7. Does your application support importing from other standard files?

No

Yes, to what extent %

8. From non-standard files?

No

Yes, to what extent %

9. Does the system co-ordinate and/ or interact with existing applications?

No

Yes, to what extent %

10. How much new keying in is required to add new knowledge? Please state ...

11. List all the features of your KM product that support application co-ordination/application

Knowledge Identification and Collection

12. Does a current awareness or alerting function monitor content and activities of Web sites (web crawler) and notify users about updates?

No

Yes, to what extent %

13. Can the search results combine information from both internal and external environments?

No

Yes, to what extent %

14. Is there an audit trail created for tasks carried out?

No

Yes, to what extent %

15. Does the product facilitate intelligent searching by using Metadata

Indexing

16. Any other features supporting the knowledge identification and collection function?

Knowledge Classification

17. What type of search capabilities does the software have?

- Keyword match
- Attribute based input
- Context sensitive
- Analogical searching

18. Is the taxonomy or thesaurus

- Manually created
- Automatically discovered

19. Any other features supporting this function? Please state ...

Knowledge representation.

20. How many graphical models does your application use?

21. What types of graphical models are these?

- No
- Yes, to what extent %

22. Does the software create concept maps?

- No
- Yes, to what extent %

23. Can knowledge be exported to other applications?

- No
- Yes, to what extent %

24. Any other features supporting the Knowledge Classification function? Please state ...

Knowledge organisation and storage

25. How does your product store its data? Please state ...

26. Any other features supporting this function? Please state ...

Knowledge sharing and dissemination

27. Does the software support

- Newsgroups
- Discussion databases
- Listserves

28. Is communication between users supported

Online

Offline

Collaborative filtering

29. Can search patterns, ideas and results be

Shared

Reused

Groupware

30. Does the software create virtual communities?

No

Yes, to what extent %

31. Does the software support co-operative working?

No

Yes, to what extent %

32. What groupware does your application link to

Lotus Notes

Intranet

Other, please state ...

33. Does the groupware track group interest in topics?

No

Yes, to what extent %

34. Any other features supporting this function? Please state ...

Knowledge Access

35. Can users access the application off site?

No

Yes, to what extent %

36. Can access rights be limited?

No

Yes, to what extent %

37. Does the software use

Push capabilities

Pull capabilities

38. What level of security is available at

Document Level

Application Level

Group administration level

39. Any other features supporting this function? Please state ...

Administration and Support

40. How hardware resource intensive is your product?

41. How much server space is required for the system? Please state ...

42. How many different administration roles are needed to support this product?

43. What ratio of users to support personnel would you anticipate for your product?

44. What training do you offer? Please state ...

45. Duration of training? Please state ...

Charges for training

46. Is training included with the product?

No

Yes

47. Do we have to pay for training?

No

Yes

How much does this cost? US\$

48. Are there any other issues relevant to support and administration you would like to mention?

Other

49. Is there any other function that your product does well that has not been covered by this questionnaire? Please state ...

Cost

50. Can this product be tailored?

No

Yes

51. Do you supply after sales support to tailored systems?

No

Yes

52. Can we buy modules?

No

Yes

If so, what are they?

53. How much does it cost to purchase?

Demonstration model US\$

Education model US\$

Full system US\$

54. Would you like to receive a copy of the collated results of this questionnaire?

No

Yes, please provide an email address?

55. Would you like to contribute to the laboratory by donating a version of your system?

No

Yes

Thank for answering the questions, please return your answers by return email

Appendix 14

KMS providers sent questionnaires

List of KMS vendors questionnaires were sent to.

This list is a compilation of web searching and the literature, compiled in 2001

Allaire
American Management Systems, Inc.
Andersen Consulting
Apple Computer, Inc.
Arthur Andersen
Aurigin Systems, Inc.
Autonomy Inc.
Baan
BackWeb Technologies
Bain & Company
Bantu
Brio Technology, Inc.
BroadVision, Inc.
Business Objects
Cambridge Technology Partners
Centrinity, Inc.
Changepoint Corporation
Cognos Corporation
Compaq
Computer Associates International, Inc.
CUseeME Networks, Inc.
Dataware Technologies, Inc.
Deloitte & Touche Consulting Group
Delphi Consulting Group
DocuLabs
Documentum
Eastman Software
Emerging Technology Solutions International
Enigma, Inc.
Epicentric, Inc.
Ernst & Young LLP
eRoom Technology Inc.
Excalibur Technologies Corp.
FileNET Corporation
Forrester Research, Inc.
Hewlett Packard
Hummingbird
Hyperion Software Solutions
IBM Global Services
IBM Knowledge Management
IDC
Intel Corporation
Intranets.com, Inc.
IntraNet Solutions
Intraspect

Inxight Software, Inc.
KnowledgeTrack
KOZ.com
KPMG
Lawson Software
Lighthouse Consulting Group LLC
Lotus
McKinsey & Company
MeansBusiness
Meta4, Inc.
META Group
Microsoft
MicroStrategy
Northern Light Technology, Inc.
Novell, Inc.
Open Text Corporation
Opus360
Oracle
PeopleSoft
Pivotal Software, Inc.
Plumtree Software, Inc.
Portera
Practicity, Inc.
PricewaterhouseCoopers
Primus
Ptech, Inc.
Red Hat, Inc.
RoweCom, Inc.
Saba Learning
Worldfree Corporation

Providers listed by the Delphi Group

Aeneid Corporation
Autonomy
Brain Ranger
Bright Station PLC
Brio Technology
Concord USA
Concur
Corechange
Cornus Corporation, Inc.
Documentum
elantix
Eliance Corporation
Enterworks, Inc.
Epicentric

Global Recall
Hewlett-Packard Company
Hotlens.com Inc.
Hummingbird
Hyperwave Information Management
IBM
Infolmage
Inxight
IONA Technologies
KnowledgeTrack
Linq Systems Svenska AB
Mediapps
Mesa Systems Guild
Mongoose Technology
NextPage
Oracle
Plumtree
Portal Wave, Inc.
Portalprise, Ltd.
Radnet
SageMaker
Semio
Sequoia Software
SiteScape
Smartlogik
Sybase
Synergistics, Inc.
TopTier Software
Tower Technology
Twirlix Internet Technologies, Inc.
Viador
Visual Mining
ZAP Business Communication Systems

Knowledge Management Covered Vendors

Abuzz
Advantagekbs
Aeneid Corporation
Arthur Andersen
Aurigin
Autonomy
Blue Angel Technologies
Bright Station PLC
BroadVision
Cartia

Chrystal Software
Cogito
CompassWare Development
Copernic.com
Dataware Technologies
Digital Knowledge Assets
Documentum
EasyAsk
Enigma
Excalibur Technologies
Fujitsu Software
grapeVINE Technologies
Hyperknowledge Corporation
IBM/Lotus
Inference
InfoMation Publishing Corporation
Insight Technologies
InSystems Technologies
Invention Machine
Inxight
J-Space
Kanisa
Keymage
Knowledge Discovery Systems
KNOWLIX
KTI
LexiQuest (ERLI)
Molloy Group
noHold
Open Text
Orbital Software
PC DOCS/Fulcrum
Pensare
Perspecta
PolyDoc
Powerize.com
Primus
Ptech
Sageware
Semio
Servicesoft Technologies
ServiceWare
SiteScape
Softlab
Tacit Knowledge Systems
Verano

Verge Software
Verity
WisdomWare

Content/Document Management Covered Vendors

80-20 Software
Abuzz
Bytequest Technologies
Chrystal Software
Content Management Solutions
Dataware Technologies
DocuCorp International
Documentum
Eastman Software
Enigma
FileNet Corporation
Hyland Software
Hynet
IBM/Lotus
icomXpress
Identitech
iManage
Infodata
Insight Technologies
Inso EBT
InSystems Technologies
Interleaf
Intranet Solutions
Keymage
LexiQuest (ERLI)
Mindwrap
Novasoft Systems
Open Market
Open Text
PC DOCS/Fulcrum
Provenance Systems
PSSoftware
QUMAS
Uniplex
Xerox
XyEnterprise

InSystems Technologies
Intraspect

Insight technologies
Inxight
IONA
J-Space
Kangaroo net
Kanisa
Keymage
Knowledgetrack
Knowledge Discovery Systems
Knowledge farm
Knowledge management software
KNOWLIX
Avantesolutions
KTI
LexiQuest (ERLI)
Linq systems
Mediapps
Mesa Systems
Meta4
Mohomine
Mongoose technolgoies C/- Frontstep
Molloy Group
Part of Service ware
Netsys
Nextpage
NoHold
Open Text
Orbital Software
Parnterware
PC DOCS/Fulcrum (now Hummingbird)
Pensare
Perspecta
Plumtree
PolyDoc
(now Sopheon)
Portalprise now Enformia
Port
Portal wave
Powerize.com
(now Hoover's media technologies)
Practicity
Primus
Ptech
Radnet
Now epiphany
Sagemaker

Sageware
Sequoia software
Semio
Servicesoft Technologies (aka Broadbase software)
ServiceWare
SiteScape
Smartlogik
Softlab
Sybase
Synergistics
Tacit Knowledge Systems
Toptier
Tower software
Twirlix intenelr technologies
Verano
Verge Software
Verity
Viador
Visual Mining
WisdomWare
Wordware
Zap BCS