An Operations Management Perspective of Knowledge Management: Towards a Knowledge Management Assessment and Improvement Tool

By

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Declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other University, or other institution of learning.

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Abstract

This thesis describes the development of a Knowledge Management (KM) Assessment tool for the Operational level of the organisation. Its main focus is to help organisations to identify the KM activities and mechanisms that they could improve in order to improve their operational efficiency. Current KM literature is lacking in guiding organisations in what they need to do in order to implement and formalise KM in their operations with a view to improving operational efficiency. Therefore the aim of this thesis is to fill this gap in the literature and also to influence the manner in which KM is practiced.

The research project has three distinct stages: the model development, modification and testing stages. The model development stage synthesises KM literature and a pilot study in order to develop a conceptual model of the KM assessment tool. The second stage of the research project describes the application of the tool in three organisations and details the modifications that were made as a result. Finally, the third stage tests the final version of the KM Assessment tool using four case organisations.

The KM Assessment tool presented in this thesis is not a prescriptive KM solution; it emphasises the need to approach KM from a process and task specific perspective. Put another way, KM improvements should be implemented to reflect the processes and task charactaristics of each individual organisation. However, the thesis presents a method of evaluation of such that is unform across organisational types.

Keywords: Knowledge, Management, Operations, Assessment, QFD, Operational, KM categories, KM mechanisms

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1.1 Introduction

Organisations manage knowledge in one way or another. Whether the management of knowledge is formalised or not, a close analysis or operational activities indicates that operational knowledge necessarily flows across processes as organisations produce goods and/or services and that organisations have mechanisms that ensure the continued flow of this knowledge in support of processes. The manner in which the key operational knowledge is managed is important for the efficiency of operations and the competitive position of the organisation (Wiig, 1997). Consequently, Knowledge Management (KM) has been emerging as a very important management philosophy in making organisations aware of benefits of formalising and improving the management of knowledge. Although problems in the distinction between "knowledge" and "information" have triggered questions on the difference between information management and KM (for example, Wilson, 2002), it is noted that KM is rooted in well-established management paradigms. For example, the Resource-based view (RBV) of the organisation is viewed as the accumulation of unique resources of a diverse nature, how they are applied and combined, and the nature of rents they generate (see, Prahalad and Hamel, 1990; Wenerfelt, 1995). Further, it has been noted that tangible assets no longer provide sustainable competitive advantages; as such, knowledge management literature highlights the fact that in the new economy, the achievement of sustained competitive advantage depends on an organisation's capacity to develop and deploy its knowledge-based resources (Rodriguez Perez and de Pablos, 2003). On that basis, the focus on knowledge and KM as a strategic resource is important if not inevitable. This has been evidenced by

the increase in research and publications in KM-related subject areas. Furthermore, as will be demonstrated in this thesis (Chapter 5), information and knowledge are inseparably connected; therefore KM invariably covers aspects of information management, albeit extending its focus beyond information to knowledge, skills and organisational competencies. Given these facts, the focus on KM is set to continue growing with an increase in research, and reciprocated by a growing number of organisations implementing KM programmes. This thesis explores the various mechanisms that are used by organisations to manage their knowledge assets with a view of establishing a mechanism/tool that could be used to represent, assess and improve KM practice (and operational efficiency) in the organisation.

1.2 Motivation for Research

The realisation of the importance of KM has resulted in a proliferation of research and publications in KM-related subject areas. The KM landscape is broad and multi-faceted with research initiatives ranging from knowledge creation (Nonaka and Takeuchi, 1995; Cook and Brown, 1999; Brown and Duguid, 1999), knowledge sharing and transfer (Handzic, 2003; Handzic and Chaikumngalanont, 2005; Alavi and Leidner, 2001), knowledge management strategies (Haggie and Knox, 2003), etc. Likewise, KM "solutions" span a continuum from technological to human; referred to in KM literature as cognitive and social approaches to KM respectively. Despite this increase in alternative KM "solutions" there is currently little interaction between research and practice which indicates a need for close collaboration between academics and industry

(Truch, 2000). Consequentially, when practitioners consider implementing KM their operations, not only do they have to contend with the scope and breadth of the subject area, but also the wide variety of KM "solutions" as well as the lack of alignment between research and practice. With this challenge in mind, it becomes imperative for academics to establish consensus on the conceptualisations of "knowledge" and to further propose ways of evaluating the manner in which this knowledge is managed within the organisation. It is submitted that this would enable organisations to subsequently assess the alignment of their KM practices and their operational strategy and objectives. It is argued that such an assessment could be the trigger for KM practice improvements which result in operational efficiency and improved competitiveness. As such, the main motivation of this research project is to help organisations and practitioners to evaluate their KM practices in a manner that enables them to improve operational efficiency and to enhance the competitive position of the organisation. To this end, a pragmatic conceptualisation of knowledge is proposed. It is this conceptualisation that becomes the basis for a framework for KM in the organisation, a KM assessment tool and assessment methodology. It is submitted that the KM assessment tool presented in this thesis can help to evaluate and improve KM practices in organisations therefore the research has both academic and practical relevance.

1.3 Contributions to knowledge

- The thesis proposes a conceptualisation of knowledge that has implications for the manner in which organisations view and manage knowledge. The definition of

knowledge and the implications thereof are embodied in the Operations perspective of Knowledge Management (OKM) presented in chapter 5

- The OKM leads to the proposal of a framework of Knowledge Management activities (referred to as a categorisation). The categorisation of Knowledge Management activities makes an incremental contribution to previous work (for example, Wiig, 1997; Alavi and Leidner, 1999; Teece, 1998; DeLong, 1997). The OKM framework proposes knowledge management activities that are essential for effective management of knowledge; that is, identification, creation, development, access, sharing, retention and integration.
- The thesis proposes a tool that could be used to illustrate KM practices with a view to assessing their effectiveness in meeting organisational requirements. KM literature does not currently have any such tool that can provide a holistic visual representation of an organisation's KM practices and in that sense this research project makes a significant contribution. The KM assessment tool presented is rooted in QFD methodology although changes have been made to reflect the dimensions of KM. This variation in the applications of traditional QFD represents incremental contributions to QFD knowledge and literature. The thesis further provides a detailed guideline for the use of the KM assessment tool and the process of assessing KM practices.

1.4 Research Approach and Outline

The research project has three distinct stages; the assessment tool development, modification and testing stages. The start of the research project was exploratory; seeking

to establish what knowledge and KM mean to organisations in order to develop ideas on how KM could be assessed. The development stage of the KM assessment tool took the form of a literature review and a pilot study which established the KM mechanisms that organisations use on a daily basis to manage knowledge in their operations. The accumulation and juxtaposition of findings from the review of literature and the pilot study revealed patterns that made it possible to create a complete picture of the dimensions of KM in the organisation. This enabled the research project to reach a stage where it was possible to propose a framework (and subsequently a tool) for evaluating and improving KM practices in the organisation. The modification stage was the initial application of the KM assessment tool in organisations. The primary purpose of this stage was to establish whether the initial design of the KM assessment tool was robust. At this stage, aspects of the tool were modified to reflect the requirements of the organisations and research objectives. As a result, a KM assessment guide was produced to help organisations to complete the KM assessment exercise. The final stage was the testing of the modified KM assessment tool in order to establish the value of the tool.

Chapter 2 discusses the research methodology adopted for the research project. It describes the factors contributing to the decision to adopt a Soft Systems Methodology (SSM). The nature of the research "problem" is such that it does not fit any of the traditional research strategies (case study, survey or experiment). However, elements of case study methodology have been adopted to operationalise particular stages within the SSM.

Chapters 3 and 4 review relevant KM literature. The chapters focus on the extant conceptualisations of knowledge and knowledge management; in the process highlighting the difficulties associated with the lack of consensus in defining what knowledge is. Likewise, the multiplicity of KM approaches and KM mechanisms is noted.

Chapter 5 is an outline of the conceptualisation of knowledge and KM adopted in this research project. It defines knowledge and KM from a pragmatic point of view and goes further to propose a framework of KM activities: the Operations Knowledge Management framework (OKM). It is argued that a conceptualisation of knowledge as the know-how and know-what that drives an organisation's processes might be seen as a starting point towards identifying the knowledge management approach that best leverages an organisation's knowledge assets. Moreover, it concludes that the operations perspective encapsulated both the "hard" and "soft" conceptualisations of knowledge suggesting that they are both correct but partial views of reality and that the operations perspective provides a holistic perspective KM requires.

Despite the establishment of an OKM framework, it was found that a tool that can illustrate KM practices more explicitly was essential. It was argued that the OKM framework allows for an "aggregate" representation of organisational reality. Therefore it was suggested that a tool that illustrates KM mechanisms and relationships more explicitly has the potential to be the basis for KM system assessment, comparison and design. A literature review revealed that, at the time, no such tool had been proposed. A few illustrative tools were examined (Chapter 6) with the conclusion that aspects of the

OKM framework or KM dimensions were not fully addressed in order to portray a holistic view of reality.

Chapter 7 proposes a tool (KM Assessment tool) which is rooted in QFD methodology for the purposes of assessing an organisation's KM practices. The chapter provides details of the modifications made to the QFD tool in order for it to reflect dimensions of knowledge management as established from the literature review and pilot study and proposes it as a potential KM Assessment tool.

Chapter 8 outlines the specific characterisation of processes and tasks that the research project will focus on. It is argued that characterisation of tasks coupled with a description of the task domain provides a clear understanding of the organisational context which aids the appraisal of an organisation's KM practices. Therefore characterising processes and tasks is an integral part of assessing KM practices.

Chapters 9, 10 and 11 describe the application of the KM Assessment tool in three different organisations. The findings of the application are presented in these three chapters. More importantly, it was possible to identify aspects of the tool that worked well while acknowledging the limitations of its use (see Chapter 12); the culmination of which was a modified and improved tool with a set of guidelines on how to use the tool for assessing and improving KM practices. The KM assessment guide is presented in Appendix 8.

Chapter 13 presents findings from further testing of the modified tool in four other organisations. Finally, Chapter 14 presents discussion of the project, conclusions and recommendations for further work. Figure 1.1 outlines the progression of the research project.

Figure 1.1: Thesis Outline

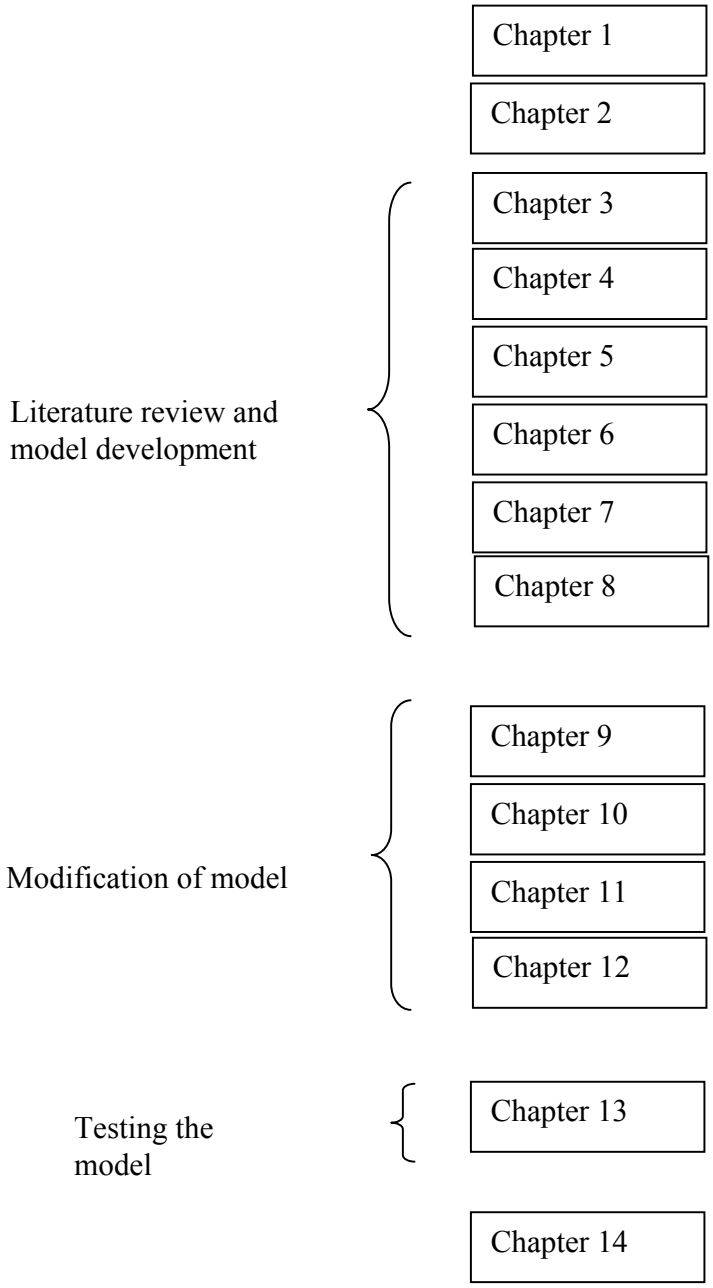


Figure 1.1: Thesis Outline

1.5 Conclusion

This Chapter has given an overview of the of the research project. It has focused on the main motivation for undertaking the research project and its main contributions to KM literature and practice. The thesis structure has been outlined providing an introduction to the following chapters. The following chapters will also provide evidence that the contribution to knowledge claimed in this chapter has truly been delivered.

2 Methodology

2.1 Introduction

This chapter describes the research methodology that was used in this project and the rationale behind the research design. The selection of an appropriate research methodology is a function of general planning /design of how a research will go about achieving the research objectives and answering the research question(s). The primary objective is to determine a methodology that is manageable in respect of size, quantity, environment, control or difficulty in access. As Silverman (1993) states, methodologies are much like theories; they cannot be true or false, only more or less useful. Section 2.2 outlines the research aims and objectives.

2.2 Research Aims and objectives

2.2.1 Aim

The aim of this research is to help organisations to improve the efficiency of their daily operations and strengthen their competitiveness in the market by harnessing the available knowledge assets and improving knowledge creation for new or improved goods and/or services and processes. The role of KM assessment in achieving this aim is to identify the key KM mechanisms, knowledge types and drivers in an organisation so that KM is aligned with corporate objectives and operations strategy.

2.2.2 Objectives

The research objectives are outlined as follows:

- To define a perspective of knowledge and KM that is relevant to organisations and KM practitioners.
- To identify the nature of knowledge and types of knowledge to be managed
- To identify the activities involved in managing knowledge and the knowledge management mechanisms organisations use.
- To develop a KM assessment tool that will facilitate the assessment of an organisation's KM capabilities and assist in aligning their KM activities with their corporate objectives leading to better use of their knowledge and operational efficiency.

The ultimate objective of this research is to develop a tool that can be applied for KM assessment. This objective is not expressed as a research question *per se,* but it represents an opportunity to advance KM practice in the organisation. The "problem" of KM assessment is complicated by the multiplicity of perspectives on knowledge and knowledge management. Organisations and practitioners are rarely sure of how to implement KM or improve KM practices primarily because there is limited consensus on views of knowledge (Dalmaris, 2005). Therefore a significant part of addressing the KM assessment "problem" is to define a perspective that not only encapsulates extant views of knowledge and KM, but one that is relevant to organisations and practitioners. This perspective should inform the development of a mechanism/tool that assists in KM

assessment. In order to achieve these objectives it is necessary to ask the following questions:

1. How do organisations manage knowledge; what type of activities do they undertake in order to manage operational knowledge?
2. What mechanism(s)/tool(s) could be used to represent operational KM practices in a manner that allows them to be analysed and improved?

The next section discusses the methodological alternatives available.

2.3 Methodological Alternatives

Robson (1993) states that there are three traditional research strategies for real world social research: experiment, survey and case study. The merits of each are discussed in this section in relation to the aims of the research. It seems unlikely that experimentation is appropriate for investigating complex and multi-faceted phenomena (Barnes, 2001). The main problem with conducting the experimental standard in social science research is that it is impossible to sufficiently control the variables in a natural setting (Hussey and Hussey, 1997). Artificial environments do not, in addition, reflect the actual world. Therefore, use of experimentation to study a complex and multi-faceted phenomenon such as knowledge would be difficult if not impossible. As such experimentation is excluded as a methodological alternative.

2.3.1 Survey Methodology

Survey methodology uses large scale data gathering techniques such as questionnaires administered from a distance, typically by post (Barnes, 2001). Survey methods such as the structured interview and questionnaires are associated with the quantitative approach whose analysis employs statistical techniques often imported from the natural sciences (May, 1993). These data are obtained by accessing a specific population, are standardised, providing easy comparisons, though a relatively small amount of information is collected, contrasting with case studies (Robson, 1999). Given the nature of research question one, it can be argued that a survey methodology is relevant to provide the answers to this question. A large amount of data generated using this methodology can be used to establish *what* organisations are doing to manage their knowledge. This position is supported by Robson (1999) who argued that among other types of questions, surveys are suitable to answer *what* type research questions. A number of surveys have been conducted specifically to establish KM activities in the organisation (KPMG, 2000 and 2003; OECD, 2001) and are proof that survey methodology is a viable option. These surveys are recent, multi-sectoral and international, mainly addressing KM in large companies. The position taken for this research project is that a "survey of surveys" is sufficient to answer research question one. This is tantamount to a literature review of the aforementioned surveys and is justified by the fact that conducting another survey would not have replicated the same scope and depth achieved in these surveys.

However, while providing useful insights on KM practices, there are difficulties arising with the interpretation of some of the results. For example, Foray and Gault (2003) argue that there is a considerable instability and ambiguity in the meaning of the various concepts dealing with knowledge such as the notions of tacit and codified knowledge, as well as knowledge and information. Indeed, some authors maintain that survey methodology is best suited to areas of study that have been thoroughly explored (Ritchie and Lewis, 2003); which is not the case with KM in general, though a number of frameworks have been proposed for the activities that constitute KM (see Chapter 3). Furthermore, survey research risks superficiality, and may be unreliable if reliant on a single respondent from one organisation (Bowman and Ambrosini, 1997). There is a risk that respondents might misinterpret the questions, given the many perspectives from which the knowledge and KM are approached. Moreover, as argued by Easterby-Smith et al., (1991), there is a risk that respondents may give politically inspired answers based on a desire to protect their own personal interest, or that of the organisation as a whole. Another noted weakness in the surveys is the absence of context-specific detail which is rich in description of organisational process and its links to the required knowledge and the management thereof.

Notwithstanding the possible weaknesses noted above, survey methodology has a contribution to make towards achieving the research objectives and it is argued that a "survey of surveys" is the best way to achieve this within the confines of this research project.

2.3.2 Case Study Methodology

A case study is an empirical inquiry that investigates a contemporary phenomenon within some real life context (Yin, 1994). Case studies involve in-depth, contextual examinations of similar phenomena through a variety of data (Yin, 2003). Also, case studies are suited to research areas for which existing theory seems inadequate (Eisenhardt, 1989, p. 548). The term "case study" is strongly associated with qualitative research although it is used in a variety of ways. Case studies are used where no single perspective can provide a full account or explanation of the research issue, and where understanding needs to be holistic, comprehensive and contextualised- a point relevant to research in KM. Furthermore, knowledge processes are prone to misinterpretation and may be too subtle to detect (Patriotta, 2004); and therefore require to be identified by the researcher "first hand". Yin's (2003) analysis suggests that explaining contemporary phenomena over which the researcher has no control, is best tackled via a case study. Beyond this, multiple case studies are to be preferred over single-case studies because of the requirement to be able to generalise findings. Generalisability and external validity concerns are a major issue in case study research because of the differences in setting and historical context of the studied organisations (LeCompte and Goetz, 1982). However, these concerns can be mitigated against in the selection of participants and reporting perspective adopted by the researcher.

It is acknowledged that case study research is particularly difficult when dealing with organisations that prefer to safeguard proprietary data and the process can be time-

consuming and requires difficult negotiations with those organisations (Sekaran, 2003). This is particularly pertinent in this research where good access to participants is required in order to fully explore the knowledge, knowledge mechanisms and KM practices at play. In spite of the difficulties involved with case study research it is argued that the methodology is suited to research question two as it provides a depth and richness of data and information that is required to fully explore the KM landscape and to validate the design of the KM assessment tool. Application of case study methodology was particularly useful after the initial design of the KM assessment tool. Its application in organisations and subsequent modification relied on the collection of context-specific and rich organisational data which would be reported on a case-by-case basis. Therefore case study methodology has merits in the context of the research but its main weakness is that is fails to address the first part of the research objectives adequately.

2.4 Discussion

Notwithstanding the merits of the research methodologies discussed above, none seems to provide a comprehensive solution for the research aim and objectives outlined above. It is fair to conclude that the research "problem" does not "fit" into traditional social science research strategies. While it is not imperative to categorise the methodological position for the research project (as either case study, survey or otherwise), it is important to identify a methodology that addresses the research objectives comprehensively. Indeed, the purpose of inquiry is to achieve agreement about what to do, to bring consensus on the end to be achieved and the means to be used to achieve those ends. A mixed-methodologies approach that satisfies the research objectives may be necessary.

As noted above, a survey of surveys is sufficient to establish *how* organisations manage knowledge. A survey of surveys provided a research scope and depth that would have been difficult to replicate considering the time and financial constraints of the project. In addition, a pilot study (observing and interviewing in various organisations) was employed to supplement findings of the previous main surveys in order to provide a more rounded, contextualised and complete understanding of KM practices in organisations. In the second stage of the research project a KM assessment tool was developed and modified. The stage required a gathering of in-depth information about an organisation and analysis of phenomena in context; a classic case study situation. The researcher assumed a passive role in the final stage of the research project; allowing organisations to interact with the KM assessment tool and obtaining feedback on its merits and value. Clearly the methodologies discussed were individually insufficient to address the research issues. The continued development of the research methodology and combination of methods of enquiry culminated in the research methodology that is presented in section 2.5.

2.5 Soft Systems Methodology

Soft Systems Methodology (SSM) was developed by Peter Checkland for the purpose of dealing with soft problem situations. The primary use of SSM is in the analysis of complex situations where there are divergent views about the definition of the problem- "soft problems". Checkland (1999) described soft problems as *"We know that things are not working as we want them to and we want to find out why and see if there is anything we can do about it. It is the classic situation of it being a "problem" but also an*

"opportunity". In the context of this research project, the aim is to help organisations to improve the efficiency of their daily operations and strengthen their competitiveness in the market by harnessing the available knowledge assets and improving knowledge creation for new or improved goods, services and processes. It is acknowledged that knowledge management can contribute to the competitive advantage of an organisation (Wiig, 1997). However, a fundamental problem in implementing KM is the lack of a clear and consistent understanding of knowledge, KM and methods of assessing KM systems. Currently, one of the problems associated with KM assessment is the multiple perspectives of knowledge and KM. Consequently, a key objective of the research project is to establish a perspective of knowledge and KM that would help to structure the KM landscape and provide a mechanism of assessing KM practices. Therefore the research "problem" is essentially a "soft problem" and it is appropriate that SSM is used.

At the heart of SSM is the comparison between the world as it is and some models of what the world might be; essentially a gap analysis between an "ideal" and actual reality of a phenomenon, which eventually leads to a better understanding of the world and some ideas for improvement (Checkland and Scholes, 1991). The debate regarding the gap between the relevant systems and models is fundamental to the SSM approach. The ideal of the model may never be achieved even though the gaps are reduced. This also shows that the systemic approach of SSM may also be cyclical.

Checkland (1999) divided the SSM into seven distinct stages:

1. The problem situation is first experienced by the researcher. The researcher finds out basic information about the problem including who the key players are and how the process works.
2. In this step the researcher develops a detailed description, a rich picture of the situation. This is done most often diagrammatically. In addition to the logic of the situation, the rich picture also tries to capture the relationships, the value judgements people make, and the "feel" of the situation. *(The use of rich pictures was excluded in the research project because they were not necessary to address the research problem).*
3. Selecting how to view the situation and producing root definitions. For the logical analysis, Checkland uses CATWOE as a checklist for ensuring that the important features of the root definitions are included:

Customers……who are the system beneficiaries

Actors……..who transform inputs to outputs

Transformation……from inputs to outputs

Weltanshaung……..the relevant world views

Owner……..the persons with power of veto

Environmental constraints……..that need to be considered

4. Building the conceptual models of what the system must do for each root definition. You have basic *"Whats"* from the root definitions. Now begin to define *"Hows"*.
5. Comparison of the conceptual models with the real world. Compare the results from step 2 and 4 and see where they differ and are similar. The purpose is not to

implement the conceptual model. Rather it is to use the differences as the basis for a discussion: how the relevant systems work, how they might work and what the implication of that might be.

6. Identify feasible and desirable changes. Are there ways of improving the situation
7. Recommendations for taking action to improve the problem situation. How would you implement the changes from step 6.

It is important to briefly illustrate how SSM aligns with the research project presented in this thesis. Chapter 1 noted the problems that face practitioners in implementing KM and outlined these as motivation for undertaking this research project. The subsequent chapters of the thesis shall expound the nature of this problem in a demonstration of the key issues and factors that impact the assessment of organisational KM practices; this represents stage (1) of SSM as outlined above. The "survey of surveys" and pilot study undertaken and described in this thesis develop the understanding of the KM landscape that is required to inform the initial design of the KM assessment tool; a stage that aligns with stage (2) of SSM. However, it was deemed unnecessary to use rich pictures in this research. The operations management perspective that is described in Chapter 5 aligns with stage (3) of the SSM. Chapter 6 explores the concepts of KM assessment and develops conceptual requirements of a KM assessment. A KM assessment design was proposed by chapter 7. These two chapters represent stage (4) of SSM. The modification of the initial design of the KM assessment tool was operationalised using a case study approach because of the requirement to gather detailed context-specific KM data about the organisations and to illustrate it on the KM assessment tool. In the event of problems

arising at this stage, modifications to the tool and/or assessment process were made in a spiralling process akin to, but not action research. This stage aligns with stage (5) of SSM and is similar to the cyclical pattern that is characteristic of research using SSM. Chapter 13 and 14 represent stages (6) and (7) of SSM as they discuss the feedback from testing of the KM assessment tool and make presentations for improving the process of KM assessment. A different view of these stages could also be the improvements and recommendations that are made to participant organisations with regards to their KM practices after undertaking the KM assessment exercise. Clearly there is an alignment between the research aims and objectives and SSM. It was therefore concluded that SSM was appropriate for the research project.

2.6 Discussion and Conclusion

This chapter has reviewed the merits of three traditional research methodologies for the development of a KM assessment tool. It was found that case study and survey methodologies both provided partial solutions to the research problem and objectives outlined. The research problem did not align with the classical research methodologies as described by Robson (1993) because of the divergent methods of inquiry required to address the individual research objectives which contribute to the research outcome. Soft Systems Methodology was found to align with the research project objectives and was therefore chosen for this project. It is important to note that certain stages of the research project were operationalised using methods that are associated with other research strategies. For example, the "survey of surveys" and case studies were important stages of the research, albeit undertaken within the broader framework of SSM. Research in KM

and KM assessment has been complicated by divergent views of knowledge and KM. Hence SSM seemed appropriate to first structure the problem area then to propose designs for a KM assessment tool, finally validating the design through practical application. It is however, important to note that the use of rich diagrams (an important stage in SSM) was not undertaken in this research as it was deemed as surplus to requirements of the research project.

3 Knowledge and Knowledge Management

3.1 Introduction

This chapter examines the conceptualisations of knowledge found in the extant KM literature. The chapter discusses the differences in conceptualisations with a focus on how these differences influence approaches to KM. It is concluded that the "hard" and "soft" conceptualisation of knowledge discussed here are both correct but partial views of reality, raising the need for a more holistic conceptualisation.

3.2 Defining knowledge

A fundamental problem for many knowledge management (KM) practitioners and researchers is that the discipline lacks a clear and consistent understanding of what constitutes "knowledge" (Dalmaris, 2005). A widely accepted theory is the natural progression from data-information–knowledge. This can be gathered from the following definitions:

Knowledge is information combined with experience, context, interpretation, and reflection. It is a high value form of information that is ready to apply to decisions and actions (Davenport, 1998).

Knowledge is information with process applied to it to give "value added" (Liebowitz, 1999).

Knowledge is information in context to produce an actionable understanding (Ruminez, 2002).

A commonly held view is that data is raw numbers and facts, information is processed data and knowledge is authenticated information (Dretske, 1981; Vance, 1997). The differences, relationships and interactions between the three entities may not have been sufficiently defined, which may explain the occasional confusion that appears to exist amongst the three as they are sometimes used interchangeably. Furthermore, there is a differing perspective on the progression offered by Tuomi (1999) who proposes that the relationship between data, information and knowledge needs to be reversed. He posits that we start with knowledge, and by articulating, verbalising, and adding structure, create information. By then fixing interpretations and representations to information, create data. In response to this lack of consensus, an alternative conceptualisation of knowledge which associates knowledge with processes is proposed *(ibid*).

Despite the lack of consensus on the direction of relationship between data, information and knowledge, the underlying implication of this conceptualisation is that knowledge can be an independent entity outside a "knower" (Dalmaris et al., 2005). Therefore, it is assumed that knowledge can be codified, formatted and stored for retrieval at a later time. The "hard" perspective, as this has come to be known, is the idea of human perception, cognition and structures of knowledge (Belkin, 1990). Knowledge is seen as being shaped by experience through interaction with the physical world and perceptions drawn

from verified phenomena and analysis. As such knowledge can be subjected to criticism (Popper, 1972). The quality of knowledge does not relate to its host or container, but to the degree by which it has been tested and verified (Dalmaris et al., 2005). According to this view, knowledge does not refer to "beliefs" (justified or not) but to claims about the world that can be tested- a position contrary to the "soft" perspective of knowledge. The "soft" perspective posits that knowledge is developed in social interaction with other people (Berger and Luckmann, 1966). It develops from experiences, beliefs, culture and social influences. According to this perspective, a person's knowledge is dependent on the social context where that person belongs and is perhaps rooted in post-modern thinking of social constructionism which argues that it is through the daily interactions of people in the course of social life that people's versions of knowledge become fabricated. An important facet of social construction is language use, culture and historical context within which the knowledge has been created. Therefore knowledge can be viewed as a "negotiated" understanding of a phenomenon which could take a variety of different forms from community to community and we can talk of numerous "social constructions" of the same phenomenon (Burr, 1995).

3.3 Types of Knowledge

Despite the differences in perspectives on knowledge, the two theories of knowledge discussed above implicitly acknowledge the existence of various forms of knowledge: externalised, internalised, personal and group knowledge. By arguing that knowledge can exist outside of a "knower", the "hard" perspective acknowledges that a dimension of

knowledge remains internal to the human brain. Therefore, KM literature makes the distinction between internalised non-encoded (tacit) and externalised encoded (explicit) knowledge (Polanyi, 1983). Furthermore, the "soft" perspective posits that knowledge is contextual; a shared belief amongst a community, shaped by experience, culture and historical context. Therefore, knowledge about a phenomenon is the result of dialectic processes of negotiation, discussion and compromise leading to common understanding (Nonaka and Toyama, 2003). However, if some knowledge remains internalised to the individual, it means there is always a lag between what the individual "knows" and what the community to which the individual belongs "knows." Therefore the literature makes a further distinction between individual and group knowledge.

Encoded knowledge is fully explicit, conveyed by signs and symbols and hence shareable. It has been defined as knowledge that is transmittable in formal languages, mathematical equations or symbols. It can be expressed in forms of documents, manuals, computer codes and verbal languages, etc. (see Boisot, 1998; Nonaka and Takeuchi, 1995). Tacit knowledge, understood as Polanyi's "people know more than they can say" (Polanyi, 1966; 1983) can not be easily articulated. Nonaka (1994) defined tacit knowledge as knowledge that is not expressed externally such as beliefs or experience. Polanyi (1983) elucidates the nature of tacit knowledge with his example of riding a bicycle. He postulates that while many people have the skill to stay upright on a bicycle, not everyone can articulate which way to turn in order to avoid a fall. The ability to stay upright demonstrates the tacit dimension of knowledge while the articulation represents the explicit dimension of knowledge.

The question of what exactly constitutes tacit knowledge is highly debatable and complex. One's beliefs and experiences can be externalised and hence cease to be tacit. However, there are some skills that are best expressed by demonstration i.e. they can not be expressed by words but can only be demonstrated through action. It can therefore be difficult to know what one means when referencing tacit knowledge hence we speak of implicit knowledge which is an intermediate between explicit and tacit and represents knowledge that has not yet been externalised (Beckman, 1999; Eppler, 2001).

A second distinction is that between collective/group and individual knowledge (Cook and Brown, 1999; Spender and Grant, 1996). While the concept of individual knowledge is clear, collective knowledge can be understood in different ways. Knowledge that is deposited in a knowledge repository has been considered to be collective or public (Duncan and Weiss, 1979). On the other hand, collective knowledge has often been associated with shared knowledge within communities, and is considered to be socially constructed. As discussed above, social constructionism argues that it is through the daily interactions of people in the course of social life that our versions of knowledge become fabricated. Therefore language use, culture and historical context take an important role in discourse analysis and interpretation of meaning.

The discussion above looks at the theories of knowledge dominating KM literature, however, with little consensus on what constitutes knowledge. As Foray and Gault (2003) duly noted, *"... there is a considerable instability and ambiguity in the meaning of concepts dealing with knowledge (consider for example the instability of the notions of*

tacit and codified knowledge, knowledge and information, knowledge and competence, and expert systems). As is to be expected, theories of knowledge influence the KM styles adopted and have the potential to inhibit genuine knowledge from being developed and leveraged. It is therefore imperative for a research project investigating the management of knowledge in any particular context to adopt a conceptualisation of knowledge that is understood in organisational settings and how that knowledge influences business processes. With this in mind, the contributions of the two theories discussed above offer unique but potentially complementary elements in terms of a KM approach if blended carefully. As a point of reflection the following questions can be posed: How is knowledge defined within the context of organisational settings? How is this knowledge identified?

The next section explores the influence of the knowledge theories on KM literature, research and practice.

3.4 Knowledge Management

This section presents an overview of Knowledge Management (KM) and describes the functions and application of KM in an organisation.

3.4.1 Definitions of Knowledge Management

Knowledge Management focuses on how an organisation identifies, creates, captures, acquires, shares and leverages knowledge. Systematic processes support these activities,

also enabling replication of successes. All of these are specific actions that an organisation takes to manage their knowledge (Ruminez, 2002).

Knowledge management can be viewed as strategies and methods of identifying, capturing, and leveraging knowledge to help the firm compete (Beckman, 1999)

Knowledge management concerns the formalisation of, and access to experiences, and expertise that creates new capabilities, enable superior performance, encourage innovation and enhance customer value (O'Dell, 1999; Wiig et al., 1999)

Davenport and Prusak take the approach that Knowledge Management is concerned with the exploitation and development of the knowledge assets of an organisation with a view of furthering the organisations objectives (Davenport and Prusak, 2000)

Bhatt refers to the process of knowledge management as knowledge creation, validation, presentation, distribution and application (Bhatt, 2001)

Knowledge Management is a collection of processes that govern the creation, dissemination and utilisation of knowledge to fulfil organisational objectives (Murray and Myers, 1997).

Knowledge Management comprises activities to discover, acquire, store, manage, develop, disseminate and use knowledge (Rademacher, 1999).

The Knowledge Management literature generally shows consensus on the understanding of the term knowledge management as evidenced by the foregoing definitions. However, some differences are worth taking notice of - these could be attributed to the differences in the hard/soft perspective of knowledge. For example, Swan et al, (2000) conducted two case studies that investigated what they term the cognitive and community styles of knowledge management. As evidenced by their work, the knowledge perspective adopted affects the KM approach used by an organisation. Organisations that adopt a cognitive perspective on knowledge are biased towards KM initiatives driven by IT while those that adopt a social perspective focus more on the social processes of knowledge creation and sharing. The community model is formulated as a critique of the predominant technology–driven cognitive model. The cognitive model denotes a perspective where valuable knowledge is conceived as being captured and codified from individuals, packaged, transmitted and processed through the use of information and computer technology (ICT) and, hence, disseminated and used by other individuals in new contexts. In this perspective, knowledge can also be exploited through the recycling of existing knowledge that is possessed by individuals within a cognitive network. In contrast the community model portrays the management of knowledge as socially constructed through interaction within communities of practice. Communities of practice consist of individuals between whom there is collaboration and negotiation. Knowledge creation and learning are processes making sense of knowledge in social activities that are deeply rooted in daily practices. Though ICT plays a role in the community model, it is not seen as a critical factor. Table 3.1 summarizes their work.

Cognitive Model	Community Model
• Knowledge for innovation is equal to objectively defined concepts and facts • Knowledge can be codified and transferred through text: information systems have a crucial role • Gains from knowledge management include exploitation through existing knowledge • The primary function of knowledge management is to codify and capture knowledge • The critical success factor is technology	• Knowledge for innovation is socially constructed and based on experience. • Knowledge can be tacit and is transferred through participation in social networks including occupational groups and teams • Gains from knowledge management include the recycling of exploration through the sharing and synthesis of knowledge among different social groups and communities • The primary function of knowledge management is to encourage knowledge sharing through networking • The critical success factor is trust and collaboration

Table 3.1: Two contrasting views of the knowledge management process (from Swan et al, 1999)

There exists a general consensus amongst authors that KM consists of inter-connected and inter-dependent processes. Alavi and Leidner (2001) argue that KM consists of knowledge creation, storage and sharing, retrieval and application while Handzic (2003) posits that knowledge has three processes which are knowledge generation, transfer and application. The chapter will now closely examine these knowledge processes to gain a deeper understanding of knowledge management.

3.4.2 Knowledge Management Activities

A review of KM literature shows that there is a general consensus on the activities that constitute knowledge management. Despite the differing perspectives of what constitutes knowledge, there is agreement that knowledge processes include the following: creation, storage, transfer/sharing, and application (Handzic, 2003; Alavi and Leidner, 2001; Nonaka and Takeuchi, 1995; Cook and Brown, 1999). According to Teece (1998) the essence of the firm is its ability to create, transfer, assemble, integrate, and exploit knowledge assets.

3.4.2.1 Knowledge Creation

Cook and Brown (1999) introduced what they term the generative dance between knowledge and knowing. They argued that new knowledge is created during interaction with the physical and social world. They elucidate that as part of this interaction which they term knowing, new ways of interaction can be discovered. Their argument is a suggestion that knowledge creation happens as one exercises existing knowledge to enhance it or create new knowledge i.e. learning by doing.

3.4.2.2 Knowledge Creation and the SECI Model

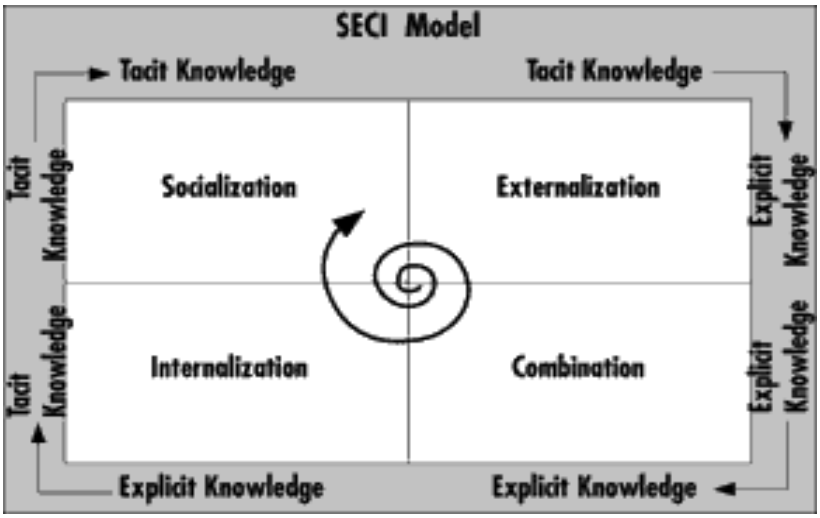


Figure 3.1: SECI model (Nonaka and Takeuchi, 1995)

Nonaka and Takeuchi (1995) identified four modes of knowledge creation which are socialization, externalization, internalization and combination. The socialization mode involves conversion of tacit to tacit through social interactions and shared experience among organisational members. The combination mode refers to the creation of new explicit knowledge by merging, categorizing, reclassifying and synthesizing existing explicit knowledge. Externalization refers to converting tacit to explicit knowledge while internalization refers to explicit converting to tacit knowledge.

The SECI model has generally been accepted in KM literature in the field of knowledge creation and management and is now adopted into a variety of research spectrum including social disciplines (Van Krogh, Ichijo and Nonaka, 2000). In the SECI model the spiral illustrates the relationship between tacit and explicit knowledge; "*this spiral*

illustrates the creation of a new concept in terms of a continual dialogue between tacit and explicit knowledge. As the concept resonates around an expanding community of individuals, it is developed and clarified" Nonaka, 1994 p.16). The knowledge creation process is initiated by the enlargement of the individuals' knowledge within the organisation where personal subjective knowledge is validated, connected to, and synthesised with others' knowledge (Nonaka and Takeuchi, 1995). This perception of knowledge creation has been widely accepted. However, Cook and Brown's (1999) point out that Nonaka and Takeuchi's (1995) reference to knowledge being "converted" from one form to another is not entirely correct. Their contention is that there is actually no "conversion" that takes place but a creation of new knowledge due to the interaction of the tacit and explicit forms of knowledge. Where a "conversion" takes place, there is the total transformation of knowledge from one form to another. However, as knowledge is externalised from tacit to explicit, for example skill, it does not imply that the possessor of the tacit knowledge loses it to another form of knowledge.

3.4.2.3 Knowledge Sharing

Argote (2003) defined knowledge sharing as the process through which one unit is affected by the experience of another. Mohannak (2007) went further to differentiate between knowledge transfer and knowledge sharing; while transfer is largely a one-way process, knowledge sharing is more optimal because it focuses on a two way process, in which each partner has access to skills and competencies of their partners and suggests an equally beneficial flow of information. This two way process triggers the dialectic

thinking and acting referred to by Nonaka and Toyama (2003, p.3) *"dialectic thinking and acting, which transcends and synthesises such contradictions. Synthesis is not compromise. Rather, it is the integration of opposing aspects through a dynamic process of dialogue and practice"*.

According to O'Dell and Grayson (1998), identifying, managing, and transferring knowledge and best practices has worked for some companies, sometimes saving or earning them literally billions. Given that the value of knowledge in an organisation may not be converted to "added value" by the simple act of possessing that knowledge (Teece, 1998), and may also be lost as individuals move between firms taking the knowledge with them (Grant, 1996), the value of knowledge sharing to overcome these problems and gain maximum value added cannot be overstated. On an individual level, Obermayer-Kovacs and Csepregi (2007) posit that if people understand that knowledge sharing can support them to do their jobs more effectively, to retain their jobs and can help them in their personal development, then sharing will become more realistic. Hence the value of knowledge is recognised at an organisational and individual level.

Communication processes and information flows drive knowledge sharing and transfer in organisations and this can largely depend on existing cultures and structures within an organisation. According to Spekman et al., (1998), an increasingly competitive environment where global trading has required a restructuring of organisations and extension of organisational boundaries, the challenges to knowledge sharing have never been greater. An effective organisational structure is suggested as fundamental to

knowledge creation and to support collaboration and knowledge sharing. They argue that networked organisations are likely to become learning organisations. A networked structure with modern technology encourages open communication and acquisition of knowledge globally (*ibid*). Spekman et al go on to argue that organisations which exhibit individualistic cultures generally experience knowledge hoarding as opposed to organisations that encourage teamwork and cooperation. Meanwhile hierarchical organisations generally take longer to communicate knowledge as opposed to flat organisations. An effective organisational structure is suggested as fundamental to knowledge creation and to support collaboration and knowledge sharing. Networked organisations are likely to become learning organisations. A networked structure with modern technology encourages open communication and acquisition of knowledge globally *(ibid)*. Naaranoja and Uden (2007) found that knowledge sharing becomes more difficult in unique projects that differ from previous projects in size, type, customers, suppliers, volume, price and so on. Knowledge sharing also becomes more difficult in complex projects that entail intricate technical, financial, political, and social factors. This work recognises the impact of other factors other than those widely accepted in KM literature on knowledge sharing. More importantly, in the context of this research, it is interesting to investigate the differences in knowledge sharing mechanisms as a result of these factors.

The view of hard or explicit knowledge as being capable of being codified has led to attempts to extract and store knowledge from one group of experts so that it can be used to increase the knowledge of others in a similar area of use (Eardley and Uden, 2008). As

such the use of databases and repositories, internet, intranets, and groupware has been viewed as a key element of knowledge sharing. For example, Alavi and Leidner (2001) focus more on the technological channel of knowledge sharing. They discuss the functionality and merits of using such knowledge sharing technology as groupware, video conferencing, intranets and knowledge maps. The effect of such technology is that it can increase knowledge transfer by extending the individuals search beyond formal communication lines and communities. The search for knowledge can be extended beyond immediate co-workers who tend to possess similar information (Robertson et al, 1996). Expanding the individual network to more extended although weaker connections is central to the knowledge diffusion process because such networks expose individuals to more new ideas *(ibid).*

Sharing tacit knowledge is, however, much more problematic. Tacit knowledge is difficult to articulate and may be difficult to communicate and therefore share. Hansen et al., (1999) used this as the basis to differentiate between codification and personalisation strategies of KM. Whereas personalisation emphasises knowledge on a person to person basis where the sharing of tacit knowledge can be achieved through informal networks, communities of practice or use of HR interventions such as mentoring, coaching and apprenticeships, codification emphasises storing knowledge in databases in order to transfer it to other persons at a later time.

A study by Pan and Leidner (2003) discussed the problems associated with sharing knowledge in multi-national organisations. Their study emphasised the barriers that exist

between communities of practice operating in different regions of the world. The study also highlighted the importance of a shared language and context in knowledge sharing. A major contribution of the research was that it highlighted the requirement for multiple channels for knowledge sharing. This view was supported by Gupta and Govindarajan (2000) who conceptualised knowledge transfer in terms of five elements, one of which is the existence and richness of transmission channels. They posited that organisations should make deliberate efforts to establish relevant knowledge transmission channels and not assume that these occur naturally. An aid to this is the flexibility that IT provides through a variety of knowledge management mechanisms.

3.4.2.4 Knowledge Storage

Organisations have the capacity to learn, but they also forget (O'Dell, 1998). Also, as noted above employees may leave the organisation and take their expertise and knowledge with them (Grant, 1996). Hence a need arises to store and safeguard the knowledge of an organisation. The cognitive approach uses information systems that support the cognitive abilities of a person and the basic problems of bounded rationality (Simon, 1982). The advantages of using databases and repositories are their accessibility and ease with which they can be updated.

Conversely, the social perspective considers the community as the repository of knowledge. Cook and Brown (1999) aimed to integrate the concern for the individual possessive perspective with a collective in terms of communities of practice. They argued

that practice is distinct from both action and behaviour and defined practice as "action informed by meaning drawn from a particular group context" (Cook and Brown, 1999, p. 387). However, challenges to knowledge storage based on communities of practice start with establishing common discourse and knowledge, facilitating its updating and renewal through formal and informal means. A link between storage and transfer can be established in the two approaches described. It follows that the manner in which knowledge is stored determines its accessibility and the manner in which it is subsequently transferred to other people and perhaps extends to how it is exploited.

3.4.2.5 Knowledge Application

Application of knowledge is evident in the introduction of new products and services, and/or improved business processes. Knowledge is embodied in the state-of-the-art products and services and, as such, organisations thrive on their abilities to bring new ideas to the market quickly. Also, knowledge is frequently seen as the product, therefore its usefulness is realised upon its sale (Wiig, 1997). An important aspect of the knowledge-based theory of the firm is that the source of competitive advantage resides in the application of the knowledge rather than the knowledge itself. Knowledge can be integrated into organisational capabilities through routines, directives and self contained teams (Grant, 1996). Directives refer to the specific rules, standards, procedures and instructions developed through the externalisation of specialists' tacit knowledge while routines refer to the development of task performance and coordination patterns, interaction protocols, and process specifications that allow individuals to apply their

knowledge without the need to articulate what they know to others. It may also be used to encourage and support individual employees to develop their skills or to develop an understanding of customers and their needs (Manasco, 1996).

From the foregoing discussion of knowledge management activities, it can be concluded that KM has its underpinnings in knowledge perspectives; how it is created or comes to being. It follows that the manner in which knowledge is produced determines its form/structure and hence influences the way in which it is manipulated in the organisation in terms of its storage, transfer/sharing and application. However, a review of KM literature does not identify research which presents and discusses the various KM mechanisms in a structured way that provides a holistic illustration of the choices available. This exercise is important as it more clearly illustrates the diversity of practices in KM. Ultimately, the manner in which organisations approach KM is influenced by knowledge types and organisational competence (Bohn, 1994). For example, knowledge sharing mechanisms vary depending on the type of knowledge, how frequently it has to be shared, how many recipients there are, and the form or structure of the knowledge that is required when it is received.

In spite of the foregoing discussion, questions still remain on whether the list of KM processes is comprehensive. This question has ramifications for the manner in which organisations assess their KM processes. A close analysis of the knowledge processes yields a major shortcoming -there is an assumption that shared or transferred knowledge will be used in business processes without due consideration for how it will be received,

interpreted and subsequently integrated into the process. In light of Nonaka and Toyama's (2003) contribution, the process of sharing knowledge involves discussion, contradiction and integration. From a theoretical standpoint, for the reason just mentioned, it is logical to posit that knowledge integration activities are an essential component of KM. This viewpoint is supported by application of the SECI model which suggests that a combination of new and existing knowledge takes place in knowledge creation. It is submitted that it is necessary to explore the intricacies of knowledge integration as a knowledge process. In the final analysis, it is noted that the knowledge management activities discussed are interwoven and should not be considered as activities that are independent of each other. In fact, KM activities have been illustrated as a cycle of interconnected processes with no start or finish (e.g. Wiig, 1997).

3.4.3 Knowledge Management Drivers

A Knowledge Management (KM) driver is a factor influencing the decision to implement a Knowledge Management system in an organisation. From the literature review conducted, the drivers identified for a Knowledge Management system to be implemented within an organisation include:

1) The progress and evolution of information and communication technology such as web-based technologies, databases and local area network (Armistead, 1999; Bixler, 2000; Tiwana, 2000)
2) Global economy and competition (Baladi, 1999; Tiwana, 2000)

3) The need to retain, generate and utilize knowledge from intellectual capital within the organisation (Wiig, 1997)
4) The need to comply with new legislation (OECD, 2001)

According to Jimes and Lucardie (2005), KM initiatives need to be tied to measurable strategic objectives in order for them to be of real value to the organisation. The ultimate goals for embarking on KM initiatives are primarily competitive advantage leading to increased profitability. Therefore KM drivers need to have explicit links to how an organisation intends to improve its bottom line performance through KM. A link is thus established between the operational strategy of an organisation and its KM drivers. It is concluded that KM drivers are indirectly influenced by the business environment and that a logical path can be traced from business environment to KM drivers. The idea of KM drivers suggests that organisations have particular priorities and activities where they place greater importance over others. As such an organisation may engage in all the KM activities, i.e. creation, application, integration, sharing and storage, but will inevitably devote more resources towards one or more selected activities which reflect the KM driver(s). The challenge is for organisations to devote their resources towards activities that provide the greatest benefit for the organisation or represent the greatest risk to the organisation.

3.5 Knowledge Management and Organisational Learning

Space precludes the full discussion of the most fundamental basics of organisational learning, however, it is important that some of the main concepts are addressed and linked to the concept of KM. KM is related to the concept of learning organisations in the sense that the undertaking of KM activities should ultimately result in a more knowledgeable and competent workforce. Through learning, organisations can increase their knowledge and skills base in order to improve their ability to assimilate and use information (Leonard-Barton, 1992). Organisational learning literature makes the distinction between higher order or double-loop and lower order or single-loop learning (Argyris and Schon, 1978; Senge, 1992). Single loop learning is engaging with the demands of the internal or external environment by using or modifying current organisational practices but leaving the basic assumptions about the organisation and its environment intact. Double loop learning goes beyond adaptation by questioning basic assumptions and developing new insights that may lead to a change in long-standing organisational routines. Spicer and Sadler-Smith (2006) found that the active approach to learning associated with double-loop learning requires *"firms to continually challenge, review and revise or renew their routines in response to change. Underlying this there needs to be an appropriate and supportive culture that provides systems and procedures to facilitate information flows, advances appropriate employee development, and encourages risk-taking, experimentation and a genuine entrepreneurial orientation"* (Spicer and Sadler-Smith, 2006 p. 152). Hence organisational learning represents attempts to theorise ways in which organisational knowledge assets may be created

Nonaka et al., 2000). Knowledge management literature highlights the fact that in the new economy, the achievement of sustained competitive advantage depends on an organisation's capacity to develop and deploy its knowledge-based resources (Rodriguez Perez and de Pablos, 2003). This relationship between knowledge, organisational learning and performance was investigated by Spicer and Sadler-Smith (Spicer and Sadler-Smith, 2006) who found that a relationship exists between small-firm performance (both financial and non-financial) and organisational learning indeed exists.

Traditionally, organisations speak of "skills" development, acquisition or formation when referring to the development of the knowledge. Regardless of the terminology used, organisations have a significant challenge of getting the right knowledge to the right people at the right time and place. There is also a growing school of thought that seeks the development of new skills: learning to work with others and share knowledge, learning about self and also receiving visibility and recognition for new knowledge acquired. In addition to acquiring new skills and knowledge, employees can learn about themselves and how to interact with people or what are now called "soft" skills (Grugulis, 1999).

Ellinger (2004) argues that employees learn best when it is done in an informal setting, through various employee interactions. In a study to establish key facilitators and inhibitors of organisational learning, he found that learning is best done under conditions initiated by the learner including:

- One to one coaching from a colleague or a manager

- Observing other employees at work or in meetings
- Using e-tutorials, internet surfing or informal employee forums.

Further to this, Ellinger *(ibid*) describes "contextual facilitators" such as organisational structure, culture, and leadership commitments and argues that these have a positive influence on how well organisational learning takes place –factors identified as necessary for KM activities to be implemented successfully within an organisation. Learning must transfer from individuals to collective to organizational to inter-organizational, and vice-versa and it must result in changes in behaviour. According to the literature, the basic concept of organisational learning is concerned with the development of new knowledge or reflections that have potential to influence behaviour (Garavan, 1997). This requires the development of new ways of looking at the organisation and its environment based on an understanding of the system and relationships which link key issues and activities. For this to be successful, it is necessary for individuals to embed their knowledge into the organisation's memory, which encodes the theory-in-use (experiences). In this context, the knowledge management area plays a significant role in establishing platforms for the development of organisational memory.

3.6 Knowledge Management Mechanisms

The chapter has discussed KM activities without exploring the KM mechanisms that organisations are currently employing. KM mechanisms are defined as the means by which organisations satisfy their KM needs. For example, for knowledge sharing

activities, an organisation may choose from e-mails, meetings, discussion forums, etc as its knowledge sharing mechanisms. There is a proliferation of KM literature that proposes a variety of KM mechanisms. For example, having loosely referred to KM as "a broad collection of organisational practices related to generating, capturing, disseminating know-how and promoting knowledge sharing within the organisation and with the outside world", an OECD survey identified the following knowledge processes and associated mechanisms as key to the KM process within organisations (OECD, 2001):

- personnel development (mentoring and training practices),
- transfer of competencies (databases of staff competencies, outlines of good practices)
- managerial changes and incentives for staff to share knowledge (staff performance assessment and promotion linked to knowledge sharing and evolution of the role of managers, etc)

Additionally, a KPMG survey offers an insight into the initiatives organisations are undertaking as part of their KM programmes (KPMG, 2003). Figure 2 is an illustration of some of the survey findings.

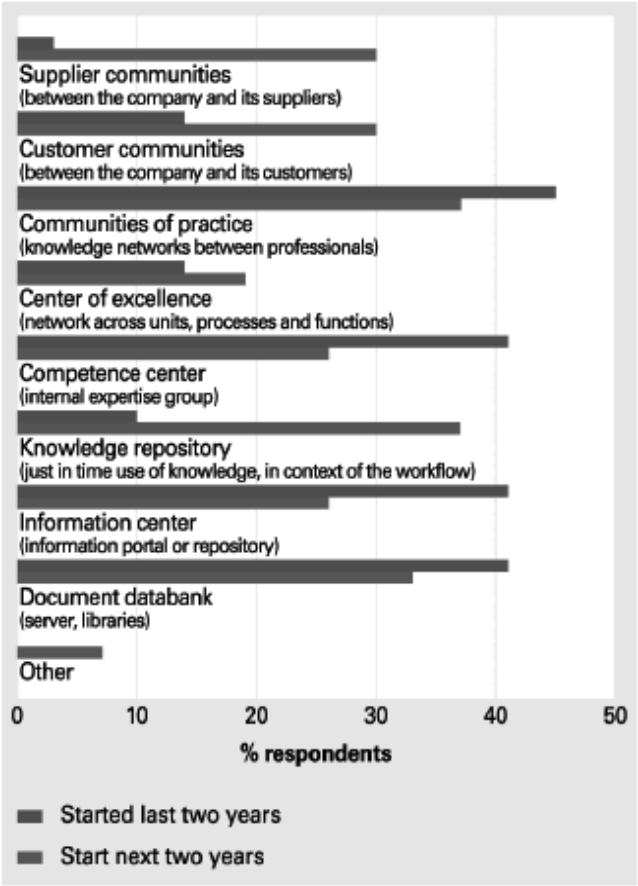


Figure 3.2: Illustration of KM Initiatives in Organisations (KPMG, 2003).

Mechanisms suggested by KM literature are often technology-based. Davenport & Voelpel (2001) give a brief overview of the various technologies that are currently being used for knowledge management.

- *Repository and access technology*: This is the most common type of knowledge management project and involves building repositories of codified knowledge. This allows firms to build repositories, provide broad access, and allow users to find the knowledge objects that meet their needs (Lotus Notes, Web-based intranets, and Microsoft's Exchange). These are usually supplemented with search

engines, document creation and management tools, automated tools for editing and pruning knowledge bases, tools for capturing and managing expert biographies.

- *Structured knowledge representation tools*: When knowledge is used in real time the knowledge base has to be structured for rapid and precise access. Rule-based systems and, more commonly, case-based systems are used. This is a labour intensive activity to create a structured knowledge base but it has the advantage of faster responses to customers, lower cost per knowledge transaction, and lessened requirements for experienced, expert personnel.
- *Knowledge management e-commerce tools*: These provide functionality for customising the menu of available knowledge to individual customers allowing the sampling of knowledge before buying, and carrying out sales transactions for knowledge purchases.

The following are common non-technological KM mechanisms:

3.6.1 Apprenticeships

Modern apprenticeships are about learning and applying skills and knowledge in work. They are about achieving competence. From a KM perspective, apprenticeships are viewed as a knowledge development initiative. A recent publication by the British Chamber of Commerce (2004) revealed that employers are increasingly finding it difficult to find employees with the required skills to complete their tasks. The Director

of Furniture Design Company, a Coventry and Warwickshire Chamber Member was quoted as saying *"schools and colleges are not producing the skills we need to operate a productive and successful business. We have to spend a long time teaching the basics which 15 years ago staff would already have. There has been a steady decline in the quality of recruits available. There is a lack of core skills, quality is not up to standard and there is not enough emphasis on practical skills. We spend two years training an 18 year old with skills a 16 year old used to have. This problem has added costs and slowed down our productivity. Action must be taken or businesses such as mine will suffer"* (Skills in Business: Report of the British Chamber of Commerce Skills Taskforce, 2004). The quote underlines the importance of apprenticeships as a knowledge development mechanism in organisations. Interestingly, KM literature does not adequately acknowledge the contribution of such traditional mechanisms to the development of an organisation's knowledge base.

3.6.2 Formal Training

Training courses are perceived by both academics and policy makers to be the manifestation of organisation and individual investment in human capital. A survey of organisations established that as organisations grow, there is a need to establish explicit systems and plans which make it easier to communicate to a large workforce as well as facilitating delegation of the various functions (IFF, 2002). It was observed that there was an emergence and the use of written training plans in the identification of training needs,

in the use of formal qualifications and in the evaluation of the effectiveness of training *(ibid).*

The Learning and Training at Work Survey in Britain 2002 found that in 2001 only 27% of employers with 1-4 employees had a training plan, but this rose to 55% of employers with 5-24 employees and jumped again to 76% for those in the 25-99 category. These results are shown by the table shown below.

The existence of a training plan UK sample

Number of Employees	Existence of training plan % (2001)
1-4	27
5-24	55
25-99	76
200-499	86
500+	91

Table 3.2: Learning and Training at Work (IFF, 2002 pp. 59& 115)

The same report found that few organisations use formalised mentoring practices or coaching methods. Indeed, they remain occasional for one third of organisations and rare or non-existent for another third. The lack of formal training among SMEs has been documented extensively in the UK Learning and Training at Work surveys. At the operational level, as the size of a small organisation grows, there is a need to collect the

relevant training and learning needs from an increasingly complex productive system. Ashton et al (2005) observe the emergence of a range of information mechanisms designed to establish learning and training needs in a growing organisation. These are business plans, personal development plans, training needs analysis, appraisal, discussion with supervisors and team meetings. In larger organisations the process becomes more systematised and "objective" in appearance, involving a series of steps or stages between the initial identification of training needs and their translation into a formal training course. Formal techniques for training needs analysis are developed and become part of the specialist knowledge of the trainer (Ashton et al, 2005).

In the UK in 2002, 48% of enterprises with 5-24 employees offered training leading to a formal qualification, a figure that increased to 60% for organisations with 25-99 employees, 74% for those with 100-199 and 80% for those with 200-499 employees (IFF, 2002 pg. 72). The same pattern followed for other forms of off the job training, most of which do not lead to formal qualifications.

The recognised trend is that as the training needs become more formalised for larger organisations, the organisation splits into departments or functions- a possible barrier to knowledge transfer. For example, the emergence of separate training departments and staff devoted to the training function and the use of specialist training courses may differ. A survey by Ashton et al (2001) revealed that the items included in the training budget of medium to large organisations varied from the use of external courses, books, technology and outside consultants.

3.6.3 Informal Training

Despite the apparent lack of formal training in SMEs (Small and Medium sized organisations), a case study by Sung et al (2000) suggests that there is a considerable amount of learning taking place in smaller enterprises that is essentially informal in character. This led Ashton and Sung (2001) to argue that small firms have unique training and learning needs which differ from those in medium and large organisations, an argument supported by further research (Hughes et al., 2002; Doyle and Hughes 2004). This trend is highly associated with the cost of formal training and also the fact that small organisations (some with as small a number of employees as 1-4) can not afford to have a single member absent from work because of training commitments. Therefore, generally learning becomes informal and on the job for small organisation employees.

From the foregoing discussion, it is possible to establish various types of KM mechanisms: formal and informal; on-the-job and off-the-job; technological and non-technological. These are related to the knowledge management activities/process identified in section 2.6. From the analysis of KM mechanisms such as formalised training and apprenticeships, it is notable that the concept of knowledge development is fundamentally different from knowledge creation since it involves the transfer of existing explicit knowledge and skill as opposed to the introduction of new ideas, innovative knowledge and paradigms. As such, a case for the inclusion of knowledge development as a key knowledge process can be made; further strengthening doubts about the completeness of the knowledge processes identified in section 2.6. There is need to ask

more fundamental questions about how these knowledge processes could be observed in real life organisations. This would be the first step towards an assessment exercise which could assist organisations to determine how well their knowledge management practices cater to their organisational knowledge needs. This position suggests a process-based view of knowledge management. Chapter 4 performs an in-depth discussion of process-based Knowledge Management.

In light of the variety of KM mechanisms, it is it important to determine how organisations can move ahead with implementing KM. KM implementation strategy has attracted input from various authors. The next section reviews the literature on KM strategies.

3.7 Knowledge Management Implementation Strategies

It is noted that once organisations have embraced the concept that knowledge could make a difference to performance and that it should be better managed, they often have not known where to start (Earl, 2001). As duly noted by Binney (2001, p.33): " *the question is rarely, should I be making KM investments?, but rather given the range of KM options available, where should I be making my KM investments, balancing the options presented to me in literature?"* Therefore various attempts have been made in order to model KM implementation.

Binney (2001) proposed the knowledge management spectrum which strongly mirrors Earl's (Earl, 2001) work. In his spectrum, the following are suggested as elements:

- Analytical KM
- Transactional KM
- Asset management KM
- Process KM
- Developmental KM
- Innovation and creation KM

Binney further outlined the enabling technologies for each of the elements on the KM spectrum adding that *"these technologies continue to evolve rapidly, especially in the areas of collaboration and search engines. This revolution combined with the pervasive nature of and access to web-based technologies is "enabling" the KM applications…"* (Binney, 2001, p.37). It is acknowledged that the KM spectrum does not encompass all the elements, KM applications and enabling technologies but simply reflects those identified in the literature. Binney's work is illustrated by Table 3.3.

	Transactional	Analytical	Asset Management	Process	Developmental	Innovation and Creation
Knowledge Management Applications	Case-based reasoning (CBR). Help desk application. Customer Service Applications. Order Entry Applications. Service Agent Applications.	Data warehousing. Data mining. Business Intelligence Management Information systems. Decision support systems. Customer relationship management (CRM). *Competitive Intelligence*	Intellectual Property. Document Management. Knowledge valuation. Knowledge repositories. *Content management*	TQM. Benchmarking Best practices. Quality Management. Business Process (Re)Engineering Process Improvement Process Automation. Lessons learned. Methodology. *SEI/ISO9XXX, Six Sigma*	Skills Development. Staff Competencies. Learning Teaching Training	Communities Collaborations Discussion Forums Networking Virtual Teams Research and Development *Multi-disciplined teams*
Enabling Technologies	Expert Systems. Cognitive technologies. Semantic networks Rule-based Expert systems Probability networks Rule Induction, Decision trees *Geospatial information systems*	Intelligent Agents Web crawlers. Relational and Object DBMS. Neural computing Push Technologies Data Analysis and Reporting Tools	Document Management tools Search Engines Knowledge maps Library systems	Workflow Management Process modelling tools	Computer based training Online training	Groupware e-mail Chat rooms Video-conferencing Search engines Voicemail Bulletin boards Push technologies Simulation technologies

Table 3.3: Enabling technologies mapped to the KM spectrum (Binney, 2001)

Binney argued that the most significant use of the KM spectrum is that it can be applied as a tool to inventory and position current KM-related activities in organisations. He noted that most organisations have existing KM-related activities and investments that are not thought of as KM investments. Therefore, these can be identified from the

spectrum and used to help position and inventory the current position of an organisation (Binney, 2001). This approach is not prescriptive; it allows organisations to appraise the available alternatives and to make informed decisions. However, its value could be enhanced if it was possible to use the tool to illustrate the level of use of each of the identified technologies and applications but more importantly to evaluate how relevant and effective they are for organisational operations. It is averred that this is where organisations require guidance. This research fills this gap by proposing a tool and method by which organisations can critically examine their processes and the KM mechanisms that are associated with those processes in order determine their relevance and suitability for their operations. It is averred that the correct match between KM mechanisms and organisational operations will significantly improve operational efficiency.

Haggie and Kingston (2003) surveyed different KM strategies and a range of different driving forces for KM activities. Among the reviewed strategies, was Binney's work (Binney, 2001); they concluded that the KM spectrum should also have included asset improvement. The technologies that might be used for Asset Improvement include:

- Linear Programming
- Genetic Algorithms
- Ant colony programming
- Operational Research techniques

Further to this, Haggie and Kingston (2003) provided an overview of the categories of questions that need to be asked where an organisation is keen to select a knowledge management approach. The following table highlights a number of factors that contribute to the selection of a KM strategy.

Table 3.4: Factors Influencing KM Strategy

Factor	Examples
Current/Planned Knowledge Management Strategy	Goals, desired applications, technology capabilities, analytic/synthetic approach
Business Sector Characteristics	Highly regulated, Innovative, Risk factors, Competitiveness, Globalisation, etc.
Strengths, Weaknesses, Opportunities and Threats (SWOT)	Reputation, Leading product, Changing regulations, Acquisitions and Mergers, Globalisation, etc.
Value Focus	Operational Excellence, Product Leadership or Customer Intimacy
Organisational Structure	Hierarchical, Loose
Organisational Culture	Team spirit, Individualistic, Sharing, Learning
Nature of Knowledge	Explicit, Implicit or Tacit; Task Type; Symbolic/Numeric/Geometric/Perceptual

They proposed a series of activities to help identify an appropriate KM initiative:

1. List the external business drivers for your sector.

2. Perform an organisational SWOT analysis in the context of this environment, clearly identifying your product or service.

3. Identify the primary organisational Value Discipline, which represents how your organisation attracts its segment of the market.

4. Use these findings to identify the *primary* KM area to consider.

5. List the (major) knowledge-intensive or knowledge transfer activities undertaken by the organisation, looking initially for those that match the primary KM type identified above. Try to sort these into order of importance to the organisation's mission. Then, for each of these activities, identify:

   a. the Knowledge Assets used

   b. the nature of these Assets (explicit, implicit or tacit)

   c. the location, form and quality of these Assets

6. Make an assessment for each of the more important activities identified, as to how well it is being performed at present. Looking at the different applications in the KM Spectrum look for a KM approach that corresponds to the activity in question.

7. Carry out some feasibility checks on the proposed KM approach.

It is also noted that, "*for the most part, these factors should provide a focus so that any KM initiative is in line with reality. But, some of these factors may highlight a reality that an organisation wants to change. For example, the prevailing culture may lack a team spirit or a willingness to share knowledge. However, it must be stressed that simply introducing a KM system will not automatically change a culture in the way intended"* (Haggie and Kingston, 2003 p. 17).

This work makes two very important contributions: firstly it recognises that the implementation of KM initiatives requires an assessment of current KM performance;

this is an extension of Binney's (Binney, 2001) contribution that recognises that some KM applications are not actually viewed as such in the organisation but need to be considered. Secondly, it highlights the fact that other factors determine KM implementation and KM success other than technology. Early research into KM indicated that technology was the most important enabler for the successful implementation of a KM system. Earl (2001) labelled this technologically driven strategy as "technocratic". But technology-intensive KM initiatives have been noted to have shortcomings or that they are simply inadequate without other considerations. One example is described by (Spies et al, 2005) where an organisation was offered the support of an intelligent search engine prototype for their everyday business tasks during a limited time period. The focus here was less on cross-organisational integration but rather more on cross-resource integration. The overall objective of the project was to improve information integration in knowledge–intensive business tasks. The project characterises intelligent search engines as software products that are at least able to:

- index data repositories from heterogeneous sources
- offer a browser-based search interface with query processing and weighted query results lists
- organise document descriptors and free search terms in classification hierarchies (usually referred to as taxonomies)
- allow for personalised access permissions and personalised search interfaces using role profiles and personal preferences.

It was found that during the project, the search tool provider staff were more technology driven, focusing more on the features of the software while the organisation's knowledge workers focused more on the business benefits the software could provide. As a result, the project was a failure because of the following reasons:

- Integration difficulties like integration of access privileges or limitations from groupware products already in use
- User interface inconveniences (personalisation was possible but considered as too demanding by the business people involved in testing the prototype.

This example is typical of most "technocratic" implementation strategies. It is noted that the incompatibility of technological solutions and existing organisational systems can become a barrier to the successful implementation of KM. Also, as noted by (Slack et al, 1998) technological approaches tend to be narrow in scope. They tend to focus on continuous improvement (CI), knowledge sharing or knowledge search and retrieval. While perhaps justified for the purpose of addressing the individual situations in those companies, these solutions fail as KM solutions mainly because they have not catered to knowledge needs at a system level. According to Malhotra, (Malhotra, 1998) the confusion regarding KM technologies and the difficulties of distinguishing between information and knowledge has led to many unsuccessful and expensive investments in new information technologies related to KM, where dramatic improvements in business performance were expected. Hence, it is now widely agreed that although technology is an important factor in KM implementation, it must be balanced with the cultural aspect.

Referring to the influence of culture on KM, De Long (1997) argued that any knowledge management strategy designed to improve business performance must address three components:

1. the work processes or activities that create and leverage organisational knowledge;
2. a technology infrastructure to support knowledge capture, transfer, and use;
3. Behavioural norms and practices-often labelled "organisational culture" – that are essential to effective knowledge use.

Although organisational culture has been defined in many different ways, De Long (De Long, 1997) states that there is some consensus that organisational cultures can be described in terms of values, norms and practices. Values indicate what an organisation's members believe is worth doing or having. They indicate preferences for specific outcomes or behaviours, or what the organisation aspires to achieve. Norms are shared beliefs about how people in the organisation should behave, or what they should do to accomplish their work. Practices are the formal or informal routines used in the organisation to accomplish work. Practices include project implementation processes, team meetings, time sheets, career paths, compensation plans as well as afternoon beer blasts. Each practice-formal or informal-has specific rules and roles guiding how they are carried out (De Long, 1997, p. 6).

The culture of the organisation and the people usually determines the success of the KM implementation (Brand, 1998; KPMG, 2000; Ribiere, 2001; Lewis 2002). One of the barriers to the successful implementation of KM relates to the organisational culture since even if an advanced KM system with a successful track record is implemented in an organisation, for example, without a learning and sharing culture, the implementation would easily fail (Ribiere, 2001). Thus the type of technology to be used in KM should suit the culture and environment of the organisation: *"a sophisticated Knowledge Management System in the wrong environment will achieve little in the way of innovation…."* (Brand, 1998).

Indeed, it has been argued that the implementation of a successful KM initiative is dependent on three key factors (Wiig et al., 1999; Bixler, 2000; Ribiere, 2001). These factors are:

- Technology
- Organisational culture
- Leadership and strategy

In recognition of the leadership element in knowledge management, organisations now hire personnel specifically to manage knowledge in the organisation under titles such as Chief Knowledge Officer (CKO) (Wright, 2001).

3.8 KM Barriers

KM barriers are a recurring theme in KM literature, for example Alavi and Leidner, 1999; Handzic, 2003; KPMG, 2003; OECD, 2001. KM barriers are perceived obstacles to the embedding of KM practices into the day-to-day activities of an organisation. A barrier is considered to be anything related to human, organisational and or technological issues that obstruct the intra- or inter-organisational management of knowledge. These barriers are basically allocated to the TOP (Technology, Organisation, People) categories of socio-technical systems classification (Brandt and Hartmann, 1999). Table 3.5 shows the identified factors affecting KM implementation and development.

Table 3.5: KM Barriers

Time consuming
No incentives
Lack of top management support
Lack of infrastructure
Lack of time
Knowledge hoarding
Fear of job loss
Fear of penalty
Fear of idea robbery
Lack of IT skills
High cost of investment

3.9 Discussion and Conclusion

Given the benefits of managing knowledge, it is logical for any organisation, regardless of industry, size, scale of operation and product/service type to want to implement it and incorporate it into the daily activities of the organisation. The chapter has demonstrated the various approaches and conceptualisations of knowledge and the approaches to KM that emerge as a result. Despite the differing approaches to knowledge and KM, there is considerable consensus amongst authors on the types of KM activities that organisations should incorporate as part of their daily routines in order to maintain knowledge assets and create new capabilities and competencies through knowledge creation. The review of literature shows consensus on four main KM activities that have been reviewed in this chapter: knowledge sharing, creation, storage and application. However, it was averred that these activities may not be complete and require revisiting. A logical reason for this argument is the absence of knowledge integration as a KM activity. It seems KM literature assumes the automatic application of shared knowledge without due consideration for how it is combined with existing knowledge. Although it is acknowledged in the literature, (for example, Grant, 1996; Nonaka and Takeuchi, 1995), it has not been referred to in terms of critical KM activities along with sharing, creation, storage, etc. Integration of new and existing knowledge results in new knowledge being created in the organisation (Cook and Brown, 1999) thereby enhancing the knowledge base of the organisation. This idea of continuously enhancing the knowledge base of the organisation is a fundamental concept of organisational learning.

Notwithstanding the general increase of KM literature and the growing acceptance of KM models such as SECI, there is still a chasm between the literature and KM practice. Binney (2001) noted that organisations are still unclear as to how they should implement KM. His work provides a starting point towards identifying the best possible implementation methodologies by identifying categories of KM strategies and complementing technologies. Haggie and Knox (2003) furthered Binney's work, noting that implementation of KM initiatives requires an assessment of current KM performance; further pointing out that some KM applications are not actually viewed as such in the organisation but need to be considered. Another important observation made by Haggie and Kingston was that the recognised that other factors determine KM implementation and KM success other than technology. In their guide to KM implementation, Haggie and Knox (2003) made a very important reference to the importance of identifying key knowledge activities, assets and the location of such assets in the organisation. This suggests that a clear understanding of the operational strategy of the organisation, operational activities and key competencies is essential to KM assessment and the implementation of KM solutions. As noted earlier this viewpoint suggests that analysis of business/operational processes and approaches to KM from a process perspective that focus on key organisational processes is imperative (refer to Chapter 4 for an in-depth review of relevant literature). Meanwhile, it is important to outline the findings of this chapter with respect to the assessment of KM in organisations. It is noted that the assessment of KM in organisation is complicated by the different approaches to knowledge. The connection between perspectives of knowledge and KM has been demonstrated by the identification of "hard"/cognitive and "soft"/social

approaches to KM. By extension, KM solutions tend to reflect these perspectives on knowledge. Notwithstanding the fragmented approaches to KM, a growing body of literature shows that consensus on knowledge activities could be reached although differences may surface on the KM mechanisms to be used. It is noted that the two perspectives of knowledge represent approaches that together complete the conceptualisation of knowledge as demonstrated by the integrative approach taken by Pan and Scarborough (1999) which they called the "socio-technical" perspective. In essence, the "hard" and "soft" approaches are correct but fragment conceptualisations of knowledge-hence they are incomplete when considered separately. It is therefore important to find a third conceptualisation of knowledge which is not only relevant to academia but one that encapsulates the "hard" and "soft" perspectives and also reflects how knowledge is viewed in practical situations, i.e. the organisation. As noted in the discussion above, this entails observing the creation, sharing and use of knowledge in carrying out the daily operations of an organisation. Hence a link between knowledge and operational efficiency and effectiveness could be the key to conceptualising knowledge from an organisational perspective. It is submitted that there are three advantages to such a conceptualisation: first it encapsulates the hard and soft perspectives of knowledge; secondly it provides a step towards bridging the gap between KM literature and the practical conceptualisation of knowledge; thirdly it provides the foundation that is required to propose KM frameworks whereupon assessment of KM practices could be made.

KM barriers form an important part of any attempt to assess an organisational KM system. It is submitted that KM assessment should not be confined to KM mechanisms that enhance the ability of an organisation to create new capabilities but also the factors that inhibit the ability of the organisation to create these capabilities. In this respect, an organisation gathers "contextual" information about organisational culture, norms (relating to knowledge sharing practices, etc), and handicaps such (as IT illiteracy) that impact on the effective leveraging of knowledge.

Therefore while the ultimate goal is to develop a mechanism that could help to assess KM system effectiveness, the interim goals should aim to define knowledge as it is viewed and used, and to analyse the processes within the organisation where this knowledge is identified, created, stored, integrated and used. This would provide a clearer reality of the KM activities and mechanisms that are used to manage the knowledge.

4 Process-based Knowledge Management

4.1 Introduction

This chapter reviews the process-based approach to KM and builds on the discussion that was initiated in Chapter 3. In Chapter 2, it was found that a key aspect of developing a detailed picture of the situation requires the researcher to produce root definitions. An important part of this detailed picture is the transformation of inputs to outputs in the system. Chapter 3, section 3.10 put this point into the context of this research. It was suggested that the implementation of KM initiatives requires a consideration of the current KM mechanisms being applied in an organisation as well as the type of organisational processes that they are being applied to; i.e. to first analyse and describe the situation in terms of organisational process, knowledge and knowledge mechanisms. The process-based approach to KM is suggested as an appropriate approach for the sort of analysis required. This chapter focuses mainly on the techniques that are used to analyse organisational operations and how the knowledge assets associated with these operations can be identified. It is posited that the analysis of processes, while providing a detailed description of the organisational situation, also represents the first step towards specifying the KM requirements of organisations.

4.2 Defining processes

In the broadest sense, processes can be defined as a collection of tasks and activities and that together- and only together, transform inputs into outputs (Garvin, 1998 p.33).

Davenport *et al*. (1996) define a process as an ordering of activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action.

According to Davenport et al (1996), processes typically consist of dozens of activities, each with inputs and outputs. The inputs and outputs can take the form of materials, personnel, information, etc which vary according to the process and functional area. Although most literature focuses on operational processes, Garvin (1998) makes a distinction between operational and administrative processes. While the operational processes produce goods and services for the external customer, the administrative processes generate information and plans for internal groups.

Kiraka and Manning (2005) characterised processes as involving: obtaining from the external environment the necessary inputs so as to sustain the functioning of the organisation; focused on customer satisfaction; tied to strategic intent and actions; and involving cross-functional linkages that cut horizontally through the organisational structure. Furthermore, Naslund and Karlsson (2004) posit that organising operational work in end-to-end processes rather than as the sum of disjointed functions not only

changes the structure of an organisation, it potentially changes the mind-set of the employees. They argue that the true potential of process orientation may not be realized unless it is combined with systems thinking, resulting in process management. Systems thinking is by its very nature holistic and can be the basis for developing and managing organisations (Senge, 1990). It is concerned with wholes and their properties (Checkland, 1993). The focus is on optimising the system as opposed to optimising any component and provides a way of understanding how an organisation is structured internally and the relationships between the components of the system and its environment. As such Garvin (1998) argues that a process orientation should take into consideration both operational and administrative processes in order to realise its benefits.

4.3 Some techniques used in the Process-based approach to KM

The section of the chapter discusses how organisations study processes. It will describe techniques that fit the level of analysis required for the process-based approach to KM.

4.3.1 Process Mapping

A process map is considered to be a visual aid for picturing work processes which relate inputs, outputs and tasks (Anjard, 1998). Process mapping is similar to flow-charting; however, in the case of a business process map the participants in the process are usually identified as well. Process mapping, therefore, serves two purposes which are: to identify the different types of activities that take place during the process and to show the flow of

materials or people or information through the process (Slack et al, 2004). Figure 4.1 illustrates this point.

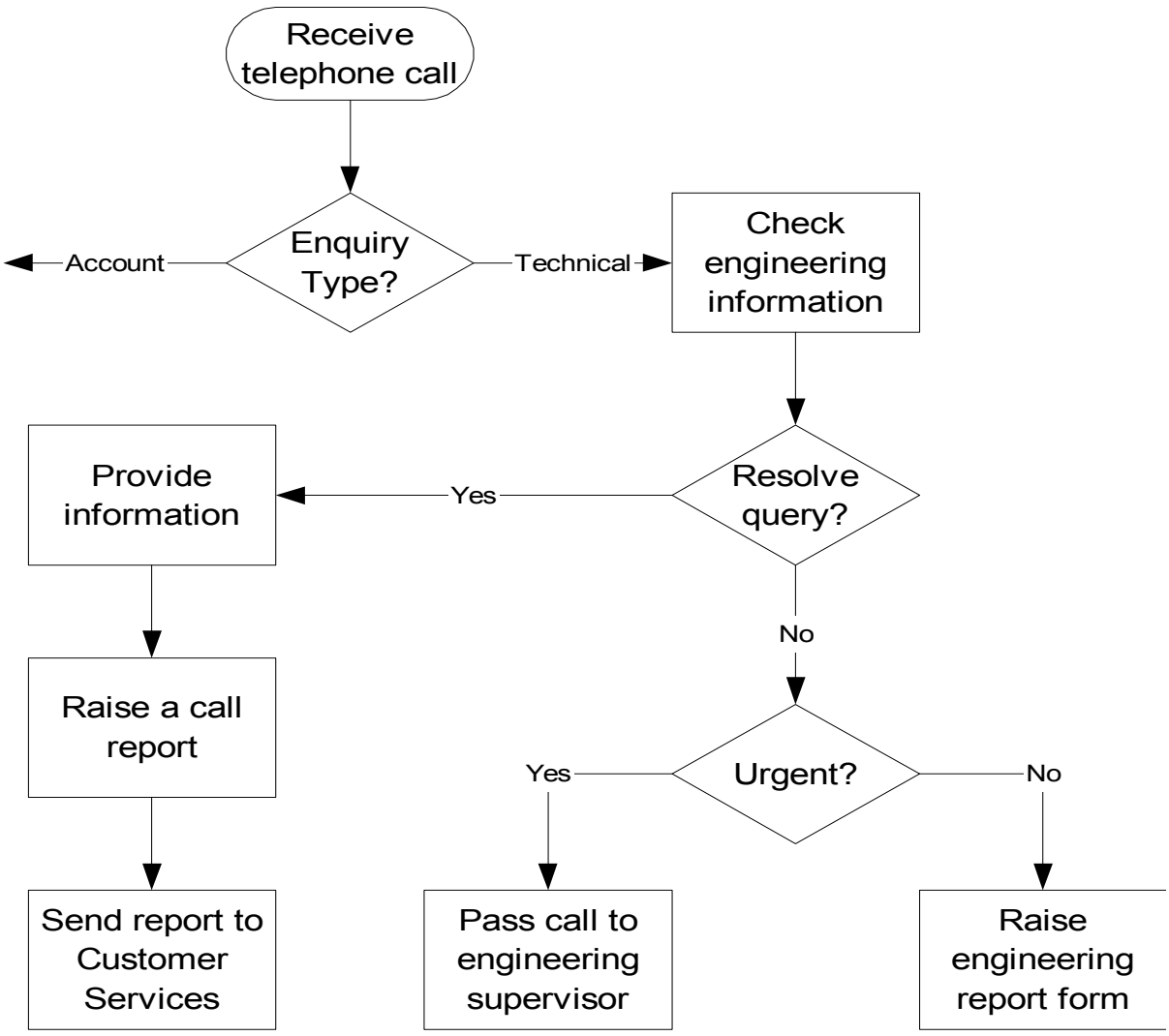


Figure 4.1: Flowchart for Customer Enquiries (adapted from slack et al, 1998)

According to Peppard et al, (1995) there are two advantages to process mapping. First they are deemed to be useful insofar as they give a clearer explanation of a process than words. Secondly, the mere fact that individuals are working on process maps means that a greater understanding is gained of the tasks and problems that are faced by an organisation. It is observed, at the risk of stating the obvious, that the above is true where process mapping is implemented well. Figure 4.1 shows some of the process mapping symbols that are used from the time a process is initiated and completed. The strength of this technique is in its intuitive simplicity, which is widely understood in business. It should be recognised, however, that the flows cannot represent data and material movements, only sequences of activities and decisions.

Process mapping is obviously a good method for better understanding a process that is being analysed and for visually communicating changes to existing processes in a very simple way. Process mapping is normally suitable for small processes that can be expressed on an A4 page. Processes larger than this quickly become confusing and overly complex. Also once a process has been mapped it is not always easy to drastically change the mapped process. Especially changes that involve greater detail and replacing activities that had originally been expressed as a single activity but now have to be drawn up as a process and a series of activities. Therefore, although process mapping is effective when applied to the correct subject it is also restrictive when applied to more complex processes.

4.3.2 Knowledge Mapping

Process mapping is considered a step towards a pictorial representation of the knowledge assets of an organisation. It provides a sequential representation of organisational processes. Once an understanding of processes and their relationship to each other is established, it becomes easier to understand the knowledge required to complete the processes; establish employees' roles in the organisation, the types of knowledge available to them, where this knowledge is located, what types of knowledge they use, where they get the knowledge from, where they pass it on, what types of barriers exist to its transfer, how it is maintained and stored, what it is used for and how relevant it is; analysis of knowledge flows in terms of people, processes and system; and the creation of a knowledge map (Burnett et al, 2004). As part of this process the knowledge map may provide organisations with a pictorial representation of the steps mentioned above.

Vail (1999) defines knowledge mapping as the process of associating items of information or knowledge in such a way that mapping itself creates additional knowledge "…the mapping process often creates intellectual capital value through the creation of new knowledge from discovering previously unknown relationships or gaps in expected ones". Knowledge maps take various forms:

4.3.2.1 Knowledge Map Types

There are many types of knowledge maps (K-maps) such as competency maps, concept maps, strategy maps, causal maps and cognitive maps. K-maps can be designed to be detailed or only to show relationships between key components of business thus facilitating faster and complete understanding, alignment and communication at all organisational levels. Eppler (2001) divided K-maps into five categories according to their function and use in the organisation. These are described briefly in the following paragraphs.

Knowledge source maps- maps that structure a population of an organisation's experts along a relevant search criteria, such as their domains of expertise, proximity or seniority. Knowledge source maps answer questions such as "where can I find someone who knows how to interpret SPC output charts?"

Knowledge asset maps- maps that visually show the existing stock of knowledge of an individual, team or a whole organisation. Knowledge asset maps answer questions such as "how many engineers do we have?"

Knowledge structure maps- maps that outline the global architecture of a knowledge domain and how its parts relate to each other. These types of maps assist a manager in comprehending and interpreting an expert domain. Knowledge structure maps answer

questions such as “which are the skills needed to run a project, how they relate to one another and what are the available courses for each skill?”

Knowledge application map- maps that show the types of knowledge that have to be applied at a certain process stage or in a specific business situation. They usually provide pointers to locate specific knowledge (documents, specialists, etc.). Knowledge application maps answer questions such as “what are our experiences in moving from a prototype to mass production?”

Knowledge development map- maps that depict the necessary stages to develop a certain competence, either individually, as a team or as an organisational entity. They serve as visualised learning or development roadmaps. They answer such questions as “how can we prepare for the entry into a new market?”

Beside these five types of maps, one can combine some of the above into one single map. Typically a knowledge application map is combined with a partial knowledge source map into a single image. Choice of map depends largely on the desired outcomes from an organisational perspective.

To conclude some advantages of knowledge mapping are discussed. Knowledge mapping helps identify what knowledge is needed to support overall organisational goals and individual and team activities. Knowledge maps therefore help in establishing explicit and measurable links between knowledge and organisational objectives and

giving a clearer understanding of the contribution of knowledge to organisational performance. Having completed the above, an organisation can be said to be in a position where it can intelligently make choices about its KM initiatives where KM objectives and activities are formulated around an organisation's practical requirements.

4.4 IDEF

The Integrated Definition (IDEF) methodology is used to model business processes. IDEF is a process mapping technique based on combining graphics and text that are then presented in an organised and systematic graphic presentation to gain understanding, support analysis, provide logic for potential changes, specify requirements, or support systems level design and integration activities (Hunt 1996). The IDEF methodology is a structured modelling technique primarily intended for representing manufacturing systems. Initially, it was developed as a set of four methodologies, IDEF0, IDEF1, IDEF2, and IDEF3, for functional, data, dynamic analysis, and process modelling respectively (Menzel, Mayer & Edwards 1994).

4.4.1 IDEF0 Methodology

The IDEF0 Function Modelling method is designed to model the decisions, actions, and activities of an organisation or system (Meyer 1992). IDEF0 allows the user to "tell the story" of what is happening in the system. The methodology permits the system to be described in as complete a level of detail as desired (Perera & Liyanage 2001). IDEF0

can be used to model a broad range of automated and non-automated systems or processes. When designing new systems, IDEF0 can be used to first define the requirements and specify the functions, and to then design an implementation that meets the requirements and performs the functions. For existing systems, IDEF0 can be used to analyse the functions the systems performs and to record the mechanisms (means) by which these are done in order to improve the process efficiency. The outcome of applying IDEF0 to a system is a model that consists of a hierarchical series of diagrams, text and supporting information. The two primary modelling components are functions, or activities and processes (represented by boxes on a diagram), and the data and objects that interrelate those functions or activities and processes (represented by arrows) (FIPS PUB 183, 1993). When using IDEF0 there are very rigorous guidelines that facilitate repeatability of model construction and ease of understanding. This has resulted in the ICOM (**I**nputs, **C**ontrols, **O**utputs, **M**echanisms) structure shown by the figure below

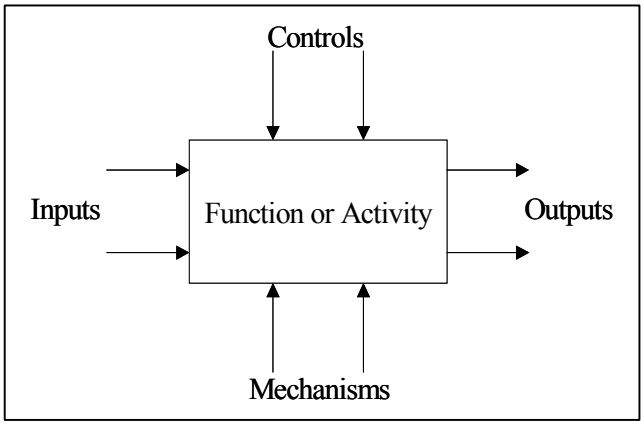
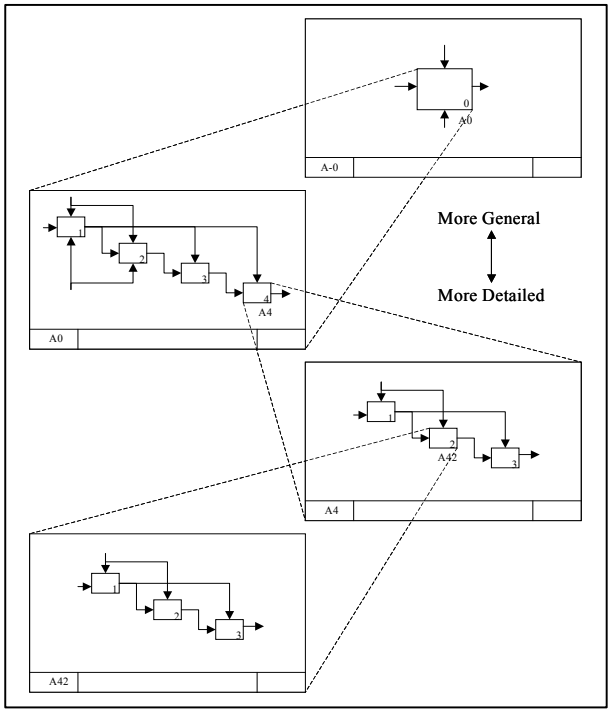


Figure 4.2: IDEFO Context Diagram

The ICOM structure ensures that each side of the activity box has a standard meaning in terms of box/arrow relationships. Arrows entering the left side of the box are inputs. Inputs are consumed or transformed by the activity to produce outputs. Outputs are the data or objects produced by the function. Outputs are either a desired state or aim of the whole system, or go on to be inputs or controls of another activity or process. Controls specify the conditions required for the activity to produce correct outputs. Mechanisms are the means by which the activity is done i.e. people, tools, equipment etc. The function or activity boxes are always denoted by a verb or verb phrase. Therefore by connecting two or more activities through outputs, processes can be represented in a structured manner. The position of arrows to boxes allows the flow of information, and the order in which the activities should be completed, to be represented. To enable a complete level of detail as required, IDEF0 uses a hierarchical structure and notation system. This is shown by the figure 4.3 below.

Figure 4.3: IDEFO Hierarchical Diagram (Hunt, 1996)



The above diagram demonstrates how activities in higher-level diagrams can be represented in more detail as processes in lower level diagrams. When an activity is shown in more detail as a process this is called the parent child relationship where the top-level diagram is the parent and the lower level diagram is the child of the parent diagram. IDEF0 methodology uses notation on each activity box. The numbering system cascades down through the model. This enables the user to cross reference parent child relationships when it is not obvious which process is relating to which activity. This is obviously necessary when referring to the models when printed out on paper, however, with the advent of modelling software the IDEF0 models may not need to use this numbering system. One of the most important features of the IDEF concept is the gradual introduction of greater and greater levels of detail through the process mapping diagram

structure. In this way, communication is enhanced by providing the user with a well-bounded topic, with a manageable amount of detail to learn from each process map diagram (Hunt 1996).

The methodology has the potential to be applied to various settings because it is comprehensive, expressive and generic since it is capable of graphically representing a broad range of businesses, systems or organisations, with different purposes, scopes and complexities, to any level of detail. The parent child-child relationship demonstrated through IDEF0 could be employed with any process or knowledge map. The IDEF0 structure could provide a framework for the mapping of knowledge about processes or an entire system. Knowledge artifacts could be inter-related, comparable to the relationships of parent and child processes which have produced those knowledge artifacts. Therefore, knowledge can also be accessed at upper levels or lower more detailed descriptions of knowledge relevant to sub-process or tasks. A user can therefore capture knowledge and navigate through the knowledge space in the context of business processes to the same level afforded by the IDEF0 methodology discussed above. This knowledge takes various forms i.e. the knowledge on the process itself, knowledge on business contents and methods, relationships of business and people, know where, know what, and know how, etc can be directly linked to the processes which they facilitate within the organisation. In other words, activities and their outcomes and "the in order to" knowledge are linked (see Heidegger, 1962).

4.5 The advantages of a Process-Based approach to KM

It is important that organisations identify the processes where their core competencies are applied and make these the focal point of their KM initiatives. Capabilities and competencies are considered as core if they differentiate a company strategically. The most important benefit of the process-based approach to KM is that it links knowledge to specific processes. The process-based approach is a pragmatic approach that places knowledge within the context of everyday activities and hence it should, in theory, become easier to isolate and measure the impact of knowledge application against the overall objectives of an organisation. Therefore, KM activities can become more targeted in line with the objectives and strategic goals of an organisation as argued for by Jimes and Lucardie (Jimes and Lucardie, 2005). Here again, it is emphasised that organisations only need to concentrate their KM initiatives on those processes that make them relevant to the external environment (i.e. those that they absolutely need in order to produce goods and services). For these processes, they need highly contextual and specific knowledge and skills which are unique to the organisation, hence the process-oriented approach towards KM.

The process-oriented view combines the task oriented view and knowledge-oriented view into a value chain-oriented perspective (Maier and Remus, 2002). Knowledge that contributes to value –creating activities can successfully be linked to business processes. A direct consequence of this is that the knowledge produced by analysis of processes is context relevant, not abstract and can readily be applied to day-to-day situations arising in

the organisation. Thus, knowledge can be offered to employees in a much more targeted way. Furthermore, the analysis of business processes can be a good starting point to design and introduce a KMS. Information derived from processes can be used to specify KMS more precisely (e.g. process-oriented navigation structure, process-oriented knowledge maps and knowledge structure diagrams) (Maier and Remus, 2002).

4.6 Examples of Process-based KM

A recent example of a process-based KM approach was proposed by Keane (Keane, 2002) whose proposal attempted to trigger improvement processes and guide users through the utilisation of available process data. The system proposed uses process models in a hierarchical arrangement to guide users through the process of analysing relevant information to highlight the need for improvement projects, then through the process of improvement, and finally recording the outcomes.

Buniyamin (2004) developed a framework for a process-based Knowledge Management System (KMS) at GFT. The framework proposed was similar to that of Keane's in that it was intranet-based but with a focus on knowledge mapping and ontology to try to control the amount and relevance of data in the KMS.

The work done by Keane (2002) and Buniyamin (2004) was developed as additional systems to be incorporated into the business operation. The design of both systems was such that they are called upon when problems require solving or solutions need to be

recorded. However, Rowlance (2007) attempted to go further by integrating the KMS into the daily operation of the manufacturing plant. The aim of his work was that the KMS should become an intrinsic part of the operation so that it is not perceived as a KMS but as a way of doing business.

In a project which was not technology-based Burnett et al (2004), used questionnaires, semi-structured interviews and focus groups with the employees of the tax department in a study aimed at establishing employees' roles in the department, what types of knowledge they use, where they get the knowledge from, where they pass it on, what types of barriers exist to its transfer etc. The case study achieved the development of a knowledge inventory mainly focusing on the types of knowledge available; where this knowledge is located; how it is maintained and stored, what it is used for and how relevant it is; analysis of knowledge flows in terms of people, processes and system; and the creation of a knowledge map (Burnett et al, 2004).

4.7 Discussion and Conclusion

Making judgements about the KM system of any organisation requires a thorough knowledge of the processes and patterns in which work is organised. Authors agree that the implementation of a KM initiative should be based on knowledge of operational practices and processes (e.g. Haggie and Kingston, 2003; Binney, 2001) and the types of knowledge and knowledge artefacts that are produced or used as a result of those processes (Nonaka, 1994; Nonaka and Takeuchi, 1995; Cook and Brown, 1999). The

relationship between operational processes and knowledge processes is therefore an important one where different operational processes require the integration of knowledge into practice using different mechanisms depending on knowledge type (explicit or tacit) (Andreu and Seiber, 2001) or whether the processes are routine standardised processes or not (Hansen et al, 1999). A process-based approach to KM provides the opportunity to specify these relationships more accurately. Knowledge about the relationships between organisational processes can be established as can the relationships between processes and the knowledge required to complete those processes. It therefore seems appropriate that a process-based approach be adopted within this research project given the research objectives.

A number of process analysis techniques have been described in this chapter. The process analysis techniques enable organisations to gain a deeper understanding of both organisation and KM processes. It is posited that the analysis helps a researcher to gain a detailed picture of transformation processes occurring in an organisation. It has also been argued that this analysis represents the first step towards identifying the people, knowledge, and knowledge mechanisms associated with transformation processes. Process analysis could provide the structure and framework to make this possible. The process-based approach is critical to this research project because it enables the analysis of organisational activity to be done at system or activity level- hence making a bottom-up or top-down assessment of KM possible. Chapter 5 elucidates on the perspective of knowledge adopted in this research project and how the process-based approach is relevant to this perspective.

5 An Operations Management Perspective of Knowledge Management

5.1 Introduction

This chapter introduces an alternative perspective of knowledge. It was noted from Chapter 3 that definitions and conceptualisations of knowledge have not yet reached consensus on what constitutes knowledge. While this in itself is not a major concern, it was noted that the theories of knowledge influence the KM styles adopted (i.e. hard and soft). It was also noted that these approaches to KM are incomplete when considered to be independent of each other and have the potential to inhibit genuine knowledge from being developed and leveraged. It was therefore averred that a conceptualisation of knowledge that is understood in organisational settings is required in order to answer two important questions: what constitutes knowledge within the context of organisational settings; and how is this knowledge identified? Moreover this conceptualisation has the potential to bridge the gap between academia and practice on the views of knowledge while at the same time proposing a conceptualisation of knowledge which encapsulates the hard and soft approaches.

An Operations KM (OKM) framework is proposed based on this conceptualisation of knowledge. It is averred that the OKM outlines categories of KM activities that organisations need to be engaging in to efficiently manage their knowledge resources.

5.2 An Operations Management Perspective of Knowledge

A pragmatic approach to defining knowledge attempts to identify useful knowledge to an organisation. Therefore a conceptualisation of knowledge as the know-how and know-what that drives an organisation's processes is a starting point towards identifying the knowledge management approach that best leverages an organisation's knowledge assets. The operations perspective put forward here is that: knowledge is what enables organisations to run the processes that transform inputs into finished goods and/or services; the smooth running of processes that transform inputs is dependent on the knowledge possessed by the employees tasked to complete the processes; that knowledge is continuously adapting to internal forces such as improvement drives or external forces such as demand shifts and market trends, and; therefore processes are continuously being monitored to check their effectiveness and efficiency –as illustrated by figure 5.1.

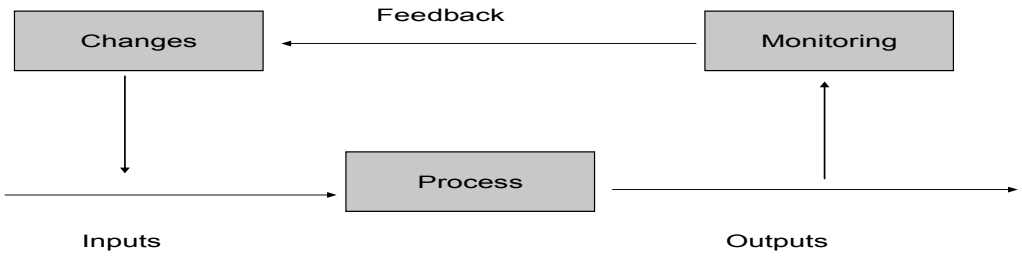


Figure 5.1: The feedback loop adapted from Beckett et al. (2000)

It is important to note that output such as data sometimes becomes an input upon which adjustments are made to the process. Adjustments to processes or inputs are based on the feedback from process monitoring. This is an evolutionary process that organisations go

through in order to find the best practices of producing goods and/or services. A continuous cycle of the process (shown in figure 5.2) produces process routines that sediment over time that are the artefacts of the evolutionary processes (Patriotta, 2004). What is produced during this evolutionary process is the know how, the know what and know why of service or product delivery; essentially the knowledge that drives an organisation. Each activity is tied to a desired outcome; the "in order to" knowledge (Heidegger, 1962).

Coupled with the skill and the experience to carry out the activity, it can be argued that an organisation has the necessary "knowledge" to accomplish its objectives (Polanyi, 1966). *Knowledge is therefore, the know what, know why and know how to manage organisational processes and procedures to transform inputs into goods and/or services and is embodied in the successful execution of processes, routines, directives and organisational practices that help to complete the transformation process.* The nature of this knowledge is constantly being enhanced as employees interact with the processes they manage. New knowledge is created, old knowledge is archived and there is a constant interplay between the tacit and explicit dimension of knowledge; the generative dance (Cook and Brown, 1999). It is important to note from the analysis of figure 5.1, that data and information produced as a result of process monitoring influences the decision to adjust or not to adjust the process controls or change the mechanisms to a process. In other words, knowledge and information are inseparably connected to each other hence the data-information-knowledge progression often referred to in KM literature.

Furthermore, it is notable that figure 5.1 can only account for *how* decisions about process control are reached and not so much about *what* decisions are actually made. The decision on *what* is actually adjusted within the process is largely dependent on the interpretation and experience of the decision-maker. Hence two engineers for example, could make two different decisions based on the same process output data. The differences in analysis could be attributed to differences in experiences and analytical knowledge. The experiential dimension of knowledge is largely emphasised by the community/social approach. However, this dimension of knowledge is just as important for the execution of organisational processes as the explicit knowledge i.e. the process data about which decisions need to be made. Further to this, satisfactory execution of the decision made is highly dependent on the skill of the employee tasked to the do the job. Based on the outcome of work carried out, it can be concluded that an engineer has the knowledge (know-how or skill) to maintain manufacturing equipment or not; much like one could critique the surgical skills of a surgeon. Their knowledge is judged by the outcome of the surgical procedure.

From the discussion so far, it can be ascertained that there exists reciprocity between the cognitive and community approaches to knowledge. An operations perspective considers the relationship between the explicit and tacit dimension without emphasis on either of them. The example of the two engineers demonstrates the link between data, information and knowledge-analytical knowledge and knowledge accumulated from experience in performing tasks-experiential knowledge. This is illustrated by figure 5.2.

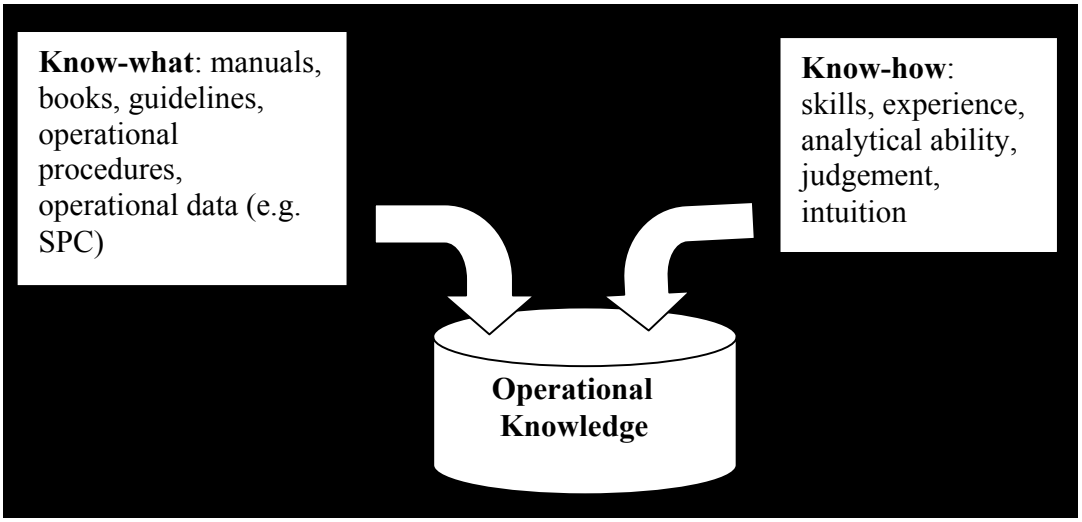


Figure 5.2: Illustrating an Operations perspective of knowledge

The operations perspective of KM is concerned with the development, retention, and accessibility of process-related knowledge as when and when it is required; i.e. just in time for application on a transformation process. The operations perspective of KM is not a prescriptive solution to the KM problem. It is a perspective that takes a considered approach to the manner in which task/process knowledge is managed based on the context of its use in the organisation. Therefore when considering the suitability of KM mechanisms, emphasis is placed on their applicability to an organisation's processes, and the situational analysis of the organisation. This perspective encapsulates the hard and soft perspectives of KM initiatives (see figure 5.2) which suggests that they are both correct but partial views of reality and that the operations perspective provides the holistic perspective KM requires. The key element of the operations management perspective is its focus on the relationship between task/ process knowledge of an organisation and the manner in which it is managed; therefore it is consistent with the

process-based approach to KM that was reviewed in Chapter 4. The flow of data, information and knowledge can be mapped; in effect linking process to process and identifying events such as bottlenecks, failures and inefficiencies in the whole system. Identification of such inefficiencies is relevant to KM because it becomes the trigger for knowledge creation. Moreover, information and knowledge can be provided where it is needed at the right time just in time.

From the above, some tenets of the operations perspective of KM can be outlined as follows:

- Make relevant knowledge available to the right people at the right time and place. Part of this requirement depends on the ability to identify key knowledge areas and knowledge assets as mentioned above. An effective KM initiative should provide knowledge that transforms inputs to goods and/or services just in time for its use. Therefore, considerations for KM activities should ensure knowledge dissemination in a targeted manner in order to reduce the risk of knowledge atrophy or information overload.

- Link KM activities to operational strategy, i.e. each KM activity should be explicitly linked to measurable strategic objectives of the organisation and make sure KM planning and implementation occurs at the system level (Senge, 1990). Knowledge is regarded as relevant on the basis of its overall contribution to an organisation's operational strategy. Therefore the link between knowledge, KM and operational strategy needs to be evident. A criticism of both the cognitive (hard) and community (soft) styles of KM is that they focus on generic knowledge

processes and how they can best be accomplished without due consideration for how they impact on the organisation's bottom line performance or strategy.

- Identify key knowledge areas and knowledge assets. This is largely dependent on the operational strategy of an organisation and what it intends to achieve. It is postulated that KM should focus on value-creating (or core business) activities only. KM systems that attempt to manage all knowledge within the organisation have been shown to fail when overwhelmed by a large amount of knowledge (Remus and Schub, 2003). Hence identifying value-creating processes and the associated knowledge assets should be a major part of a KM system.

The above tenets can be arranged into a logical chain of events, forming an activity flowchart which makes propositions on the types of knowledge activities that should be taking place in organisations for effective management of knowledge. It is assumed that key knowledge areas and core competencies depend on the operational processes of the organisation. These operational processes fulfil the strategic objectives of the organisation. Therefore, a link between knowledge identification and operational strategy can be established. An organisation should determine whether it has the required knowledge to fully implement its strategy, whereupon it has two options: pursue training alternatives and develop the knowledge or instigate research and development programmes to create the knowledge. In the event that an organisation possesses the required knowledge, incremental improvement programmes are required to maintain performance and improve.

Before knowledge is applied to a business process, it may need to be accessed/acquired from its source. This may be a repository, intranet or an expert. Questions relating to knowledge access include the manner and format in which organisational knowledge is retained; how this knowledge is subsequently transferred; to whom it is transferred, in what format or structure and how it is interpreted, integrated with existing knowledge and subsequently applied to a business processes. Consequently, an association between the activities of knowledge retention, access, sharing and integration can be established.

From the above discussion, the following are proposed as categories of KM activities:

- knowledge identification,
- knowledge development,
- knowledge creation,
- knowledge sharing/transfer,
- knowledge retention,
- knowledge access
- knowledge integration

Figure 5.3 illustrates how the proposed categories relate to each other. The figure represents a theoretical operational framework of knowledge management (OKM).

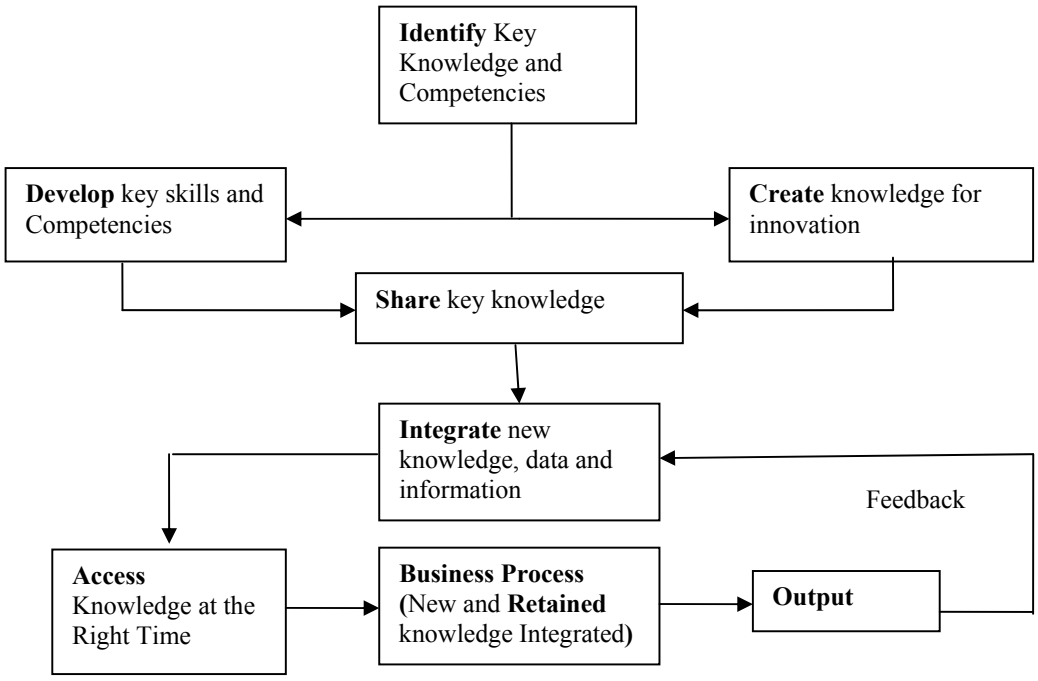


Figure 5.3: A Composite Illustration of knowledge Categories and their Relationships

Figure 3 illustrates how knowledge creation and/or knowledge development should follow the identification of knowledge assets which an organisation requires for its processes. Also, the illustration implies that retained knowledge is latent until it is applied to a business process, therefore suggesting that it is retained in the heads of individuals as tacit knowledge. However, the relationship between knowledge access and business processes suggests that knowledge can also be acquired from other sources i.e. repositories, databases, intranets or other individuals.

The operations KM (OKM) framework proposed clearly outlines categories of KM activities that organisations need to engage in to effectively manage their knowledge

resources. The proliferation of literature poses a problem for organisations wishing to implement KM; therefore a categorisation of KM activities is a sense-making exercise that shapes a multi-faceted subject area into a manageable set of objectives that makes assessment of an organisation's KM practices systematic. A categorisation can thus be perceived as a foundation for building KM systems. It provides specific KM areas that organisations can identify and assess with respect to operational efficiency.

The following section describes an exercise that attempts to predicate the OKM framework proposed above.

5.3 Mapping Organisations onto the OKM

To validate the OKM framework three case organisations were approached and their activities mapped onto the proposed framework. The organisations were chosen based on the contrasting nature of the processes they undertake in their daily operations. Psychiatric Ward* provides professional services; Call Centre Support provides mass services, and Manufacturing Co*. has continuous manufacturing processes. The chosen organisations represent a contrast that makes findings applicable across a range of organisational types (Eisenhardt, 1989).

A variety of KM mechanisms were identified in these organisations. The classification thereof produces categories of KM activities. The classification of KM mechanisms was

* Real name changed for purposes of confidentiality

based on the purpose and context of use in the organisations. For example, meetings and e-mail would be in the same "knowledge sharing" category. The analysis also related each category to the others in order to illustrate the logical sequence of activities and operations within the organisations. From the analysis it was possible to map each organisation on to the proposed framework.

5.3.1 Results of mapping exercise

Each organisation was aligned to the proposed KM framework, albeit with minor differences. It is suspected that these differences emanate from the emphasis of the operational strategy adopted by the different organizations. As noted above in the OKM framework, operational strategy determines the key knowledge and KM activities in each organization. For example, Manufacturing Co. manufactures gearboxes whose design has not changed significantly and is modified incrementally and therefore does not invest heavily in knowledge creation activities. Evidence and the results of this mapping exercise are illustrated by Appendix 1.

Additionally, it was possible to compile a list of KM mechanisms identified in the organisations; providing context-supported evidence of what organisations do to manage knowledge. These were added to the list of mechanisms identified from the literature review (e.g. OECD, 2001; KPMG, 2001 and 2003). It is important to note that KM

mechanisms can have multiple applications in an organisation's operations; hence we refer to primary and secondary applications of KM mechanisms.

Further to mapping the participant organisations onto the proposed OKM framework, it was noted that there are organisational "contextual" features that govern the manner in which KM activities are undertaken. These include:

- The nature of personal relationships in the organisation
- Top management attitudes towards KM practices
- The resources made available for KM processes
- Level of motivation to share knowledge
- Availability of skills to create and share knowledge
- Availability of time

These contextual features could act as barriers to the implementation of KM activities in an organisation, particularly knowledge sharing. Therefore they form an integral part of the "current" KM system of an organisation and directly impact on any KM process improvement initiative.

5.4 Discussion

The knowledge categories proposed make an incremental contribution to existing KM literature. There are similarities between this proposal and other prior works; for example, knowledge creation, knowledge storage and knowledge sharing (for example Teece, 1998; Wiig, 1997). The OKM framework, however, emphasises the need for

integration activities which not only help to incorporate new knowledge into existing organisational processes and routines but also enhance the re-use of the new knowledge and ameliorate inefficiencies caused by re-inventing the wheel.

With respect to the noted differences in aligning the three organisations to the OKM framework, it is reasonable to hypothesize that some organisations may not map onto the proposed categorization framework simply because of the differences in operational needs and possible inadequacies in their KM systems. This presents an opportunity to use the proposed KM framework as a means of comparing and benchmarking practices in organisations, assessing KM system effectiveness, and identifying how organisations can improve the integration of knowledge and KM into day-to-day functions. The framework illustrates an aggregate "picture" of the organisational situation which may not be sufficient to adequately represent the individual relationships between KM categories and mechanisms. Therefore, it is suggested that a more concise method or tool that can elaborate the individual relationships between KM categories and mechanisms may be required in order to capture the detail in a KM system of an organisation. Nevertheless, the OKM framework has value because it provides the outline that specifies activities which are expected to be assessed in one way or another. In view of the "contextual" features of each organisation, it is also submitted that a third dimension which incorporates an organisation's operational environment in terms of organisational activity and barriers the KM process is necessary as it provides a more accurate representation of the organisational reality and provides a holistic view of the organisational KM capabilities.

5.5 Conclusion

This chapter has presented an alternative view of knowledge and KM in organisations. It is argued that the operations perspective is pragmatic and therefore relevant to both researchers and KM practitioners. The key element of the operations management perspective is its focus on the relationship between task/ process knowledge of an organisation and the manner in which it is managed. It has been argued that whilst this focus is not prescriptive it proves a more useful means of looking at KM than the general classification of either hard or soft. The KM framework proposed provides an operational overview of the KM activities that organisations undertake-predicated by data gathered from three organisations representing contrasting processes and situational environments. However, as noted from the map of Manufacturing Co., (Appendix 1) the framework provides an aggregate picture of the KM system which does not explicitly outline the relationships between mechanisms. Notwithstanding, the maps provide enough evidence that the framework could inform the development of a KM assessment tool which could illustrate possible inadequacies in organisational KM systems. Therefore the work presented in this chapter is a platform to be used for research aimed at designing tool(s) that can illustrate, assess and benchmark organisational KM systems.

6 Knowledge Management Assessment

6.1 Introduction

This chapter puts the KM assessment problem into context. It builds on the issues discussed by Chapter 3 and emphasises the need for research of this nature. It was noted (from Chapter 3) that organisations could appraise available KM mechanisms in order for them to make informed decisions about their KM initiatives (Binney, 2001) However, this in itself is not sufficient because KM mechanisms and technologies continue to evolve rapidly, especially in the areas of collaboration and search engines (Binney, 2001, p.37). Furthermore, it is argued that organisations need to look internally and establish the extent to which their existing practices are relevant and effective for their daily operations first. This suggests that a method, tool or application that aids the assessment of organisational KM systems is necessary for there to be a sound basis for the improvement or introduction of KM initiatives in organisations. This chapter reviews the KM literature that encompasses KM assessment, KM assessment tools and the issue of KM effectiveness.

The systematic analysis of an organisation's current KM capability is known as KM assessment. This evaluation identifies critical areas where KM is needed. KM assessment is intended to evaluate the necessity of KM solutions, the knowledge these solutions can help to discover, capture, share, or apply along with the influence they can have on individual or organisational performance. A KM assessment can help establish the

baseline for implementing those KM solutions including the existing infrastructure and technologies that can help support those efforts (Becerra-Fernandez et al., 2004).

6.2 Underpinning Theories to KM Assessment

This section reviews some relevant theories in KM assessment:

6.2.1 Contingency Perspective

Becerra-Fernandez and Sabherwal (2001) developed a contingency perspective of knowledge management. The conclusion of their work was that knowledge management processes should be linked to the nature of organisational tasks. They applied the SECI model (see Nonaka, 1994; Nonaka and Takeuchi, (1995) in order to demonstrate that the effectiveness of a knowledge management process is influenced by the particular context in which the knowledge is being used. The research was motivated by the need to answer two fundamental questions:

1. Do the knowledge management processes impact knowledge effectiveness?
2. Does the effect on knowledge management effectiveness vary depending on (a) whether the tasks performed using that knowledge are broad in nature and (b) whether these tasks focus on "what to do" or "how to do it"

Although the study focused only on knowledge sharing out of the identified seven KM categories as presented in the OKM framework, it made a very important argument that a

knowledge process depends on the circumstances under which it is used. In other words, instead of following the universalistic view that all four knowledge management processes (socialisation, externalisation, combination, internalisation) are always effective, it suggests that the impact of knowledge management is moderated by the context in which the knowledge is being used- namely the nature of the tasks. Essentially, Becerra-Fernandez and Sabherwal argued that task characteristics and the task domain moderate the knowledge sharing process. They characterised tasks as content-oriented tasks and process-oriented tasks; the former focusing on the specific ends or goals to be achieved and hence relying upon know-what or declarative knowledge while the latter focuses on the processes or means that should be used to attain goals and hence rely on know-how or procedural knowledge. By extension, it can be argued that the processes of knowledge development, retention, access and integration are also dependent on task characterisation. For example, knowledge related to content–oriented tasks can be externalised and retained in manuals or knowledge repositories whereas process-oriented know-how is not as easily externalised and may require multiple employee interactions before it is transferred and subsequently accessed by other organisational employees.

The task domain dimension distinguishes between focused and broad task domains. Subunits performing focused tasks have low task variability but greater specialisation, while subunits performing broad tasks have greater variability and greater need for working with other subunits with in the organisation (*ibid)*.

The contingency perspective theory is illustrated by figure 6.1. It illustrates how the relationship between knowledge management processes and knowledge management satisfaction is moderated by the characteristics of the tasks performed by the unit; i.e. the implementation of processes that suit the tasks performed by the unit will provide more knowledge management satisfaction than implementation of those that do not.

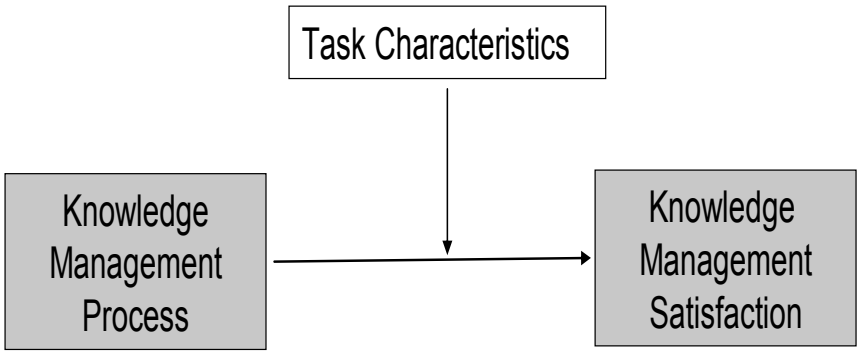


Figure 6.1: Contingency Perspective Constructs (Becerra-Fernandez and Sabherwal, 2001)

The operationalisation of the knowledge management processes in this study was included in the description of the task characterisation using Nonaka's (1994) modes of knowledge sharing. However, the operationalisation of knowledge management satisfaction is not operationalised very well (Lindsey, 2002). A discussion of this apparent flaw is addressed in section 6.3.

6.2.2 Organisational Capabilities perspective

Gold et al (2001) developed an organisational capabilities perspective of knowledge management. The outcome of their research was a model for examining the effectiveness of knowledge management from the perspective of organisational capabilities. They argued that the key to understanding the success and failure of knowledge management within organisations is the identification and assessment of the preconditions that are necessary for the effort to flourish. The preconditions are broadly described as "capabilities" or "resources". These capabilities are divided into infrastructure capabilities and process capabilities. The focus of their research was those organisational capabilities that are critical to knowledge processes.

Infrastructure capabilities include technology, structure and culture. Since technology is multi-faceted, the organisation must invest in a comprehensive infrastructure that supports the various types of knowledge and communication that are critical. The technological dimensions that are part of effective knowledge management include business intelligence, collaborations, distributed learning, knowledge discovery, knowledge mapping, opportunity generation as well as security (Gold et al, 2001, p. 187-188). Organisational structure is important in leveraging technological architecture. Structural elements have often had the unintended consequences of inhibiting collaboration and sharing of knowledge across internal organisational boundaries (*ibid*). Hence structure provides the relationship context. Culture provides the shared context in the organisation (Lindsey, 2002). Employee interaction should be encouraged, both

formally and informally, so that relationships, contacts, and perspectives are shared by those not working side by side. This type of interaction and collaboration is necessary when attempting to transmit tacit knowledge between individuals or convert tacit knowledge into explicit knowledge (Nonaka, 1994; Nonaka and Takeuchi, 1995). Process capabilities are similar to the knowledge management processes that have been put forward by various authors. Most studies include the following knowledge management activities/ processes: creation, use, exploitation, assemble, experiment, capture, transfer, acquire (Delong 1999; Leonard 1995; Spender, 1996). This thesis has also suggested KM activities that are encapsulated by the OKM framework. According to Gold et al (2001), acquisition-oriented knowledge management processes are those oriented towards obtaining knowledge. Many terms have been used to describe these processes i.e. acquire, seek, generate, create, capture and collaborate. All these terms have a common theme-the accumulation of knowledge. Conversion-oriented processes are those that are oriented towards making existing knowledge useful; application-based processes are those oriented towards the actual use of the knowledge; security-oriented processes are those designed to protect the knowledge within an organisation from illegal or inappropriate use or theft. The knowledge infrastructure capability and the knowledge process capability are combined to form the capabilities model whose outcome is knowledge management effectiveness; illustrated by figure 6.2.

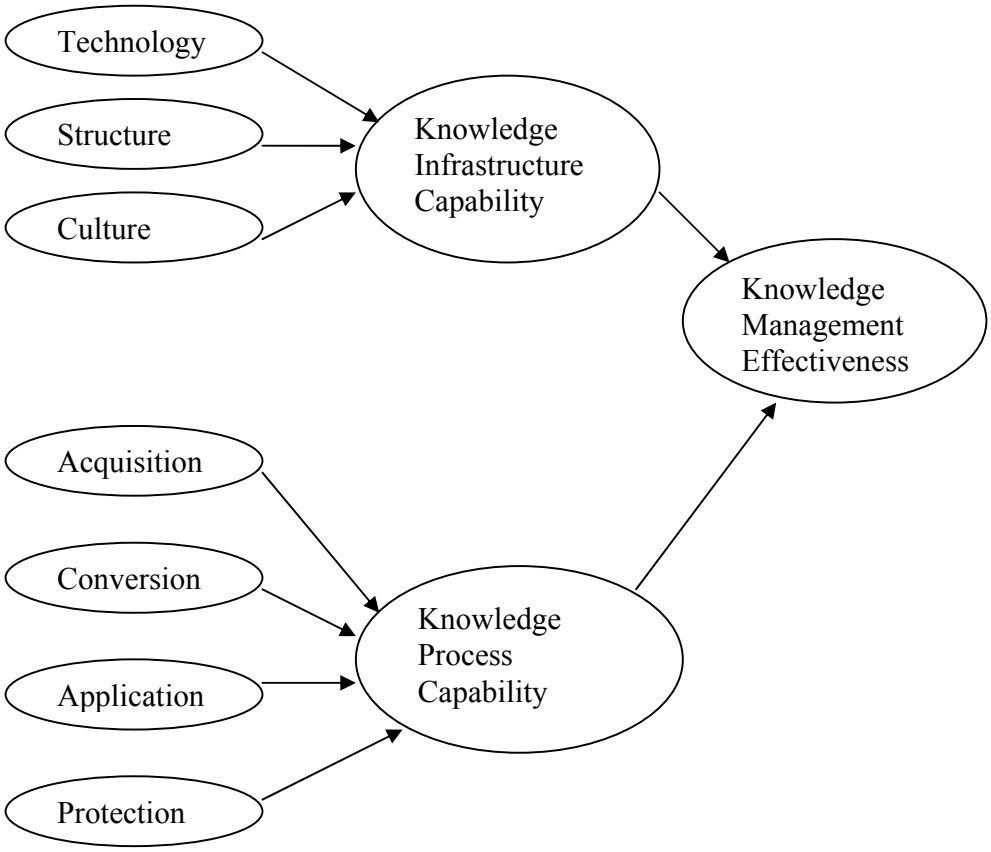


Figure 6.2: Knowledge Management Capabilities and Organisational Effectiveness (Gold et al, 2001)

The concept of knowledge management effectiveness was discussed briefly when considering the contingency perspective by Becerra-Fernandez and Sabherwal (2001). Gold et al (2001) did not sufficiently define the concept which is consequentially taken to mean the same as organisational effectiveness (Lindsey, 2002). However, Gold et al (2001) stated that effective knowledge management through the development of capabilities should contribute to key aspects of organisational performance. In particular, the organisation should experience a learning effect in which it improves in its

capabilities for creating value. This perspective of knowledge management effectiveness does not necessarily de-emphasise traditional indicators of knowledge contribution in terms of bottom line figures such as return on investment (ROI) and return on equity (ROE) etc, but highlights the importance of other indicators that may include: improved ability to innovate, improved coordination efforts and rapid commercialisation of new products etc. This viewpoint is supported by Ahmed et al (Ahmed et al, 1999) who argue that investment in knowledge, process improvement and people development leads to pay-backs and impacts on financial performance but does so in future accounting periods. This creates the need for interim performance measures to check progress and guide actions. Therefore, a more holistic approach to knowledge measurement asks what it is that drives the top line performance measures; whether it is process, people, leadership or resource utilisation (Ahmed et al, 1999). Clearly, there is consensus that effectiveness of knowledge management systems can be determined and assessed using other organisational indicators-information which could be extracted from the people interacting with the organisational processes. This perspective of KM effectiveness is very important for assessing KM particularly from an Operations viewpoint because it measures the impact of KM on process and day-to-day operations- a key element of the OKM.

6.2.3 Task-Contingent Organisational Capabilities perspective

Finally, Lindsey (2002) combined the two perspectives discussed above into a "task-contingent" organisational capabilities perspective. Lindsey (2002) argued that

combining both theories into a single theory overcomes the problems associated with the theories when considered independently. For example, the organisational capability theory fails to recognise the moderating effects that task characteristics have on the relationship between knowledge management processes and knowledge management effectiveness. The major drawback of the task-contingent theory is the ambiguous nature of the outcome, knowledge management satisfaction. The combined theory constructs are illustrated by figure 6.3.

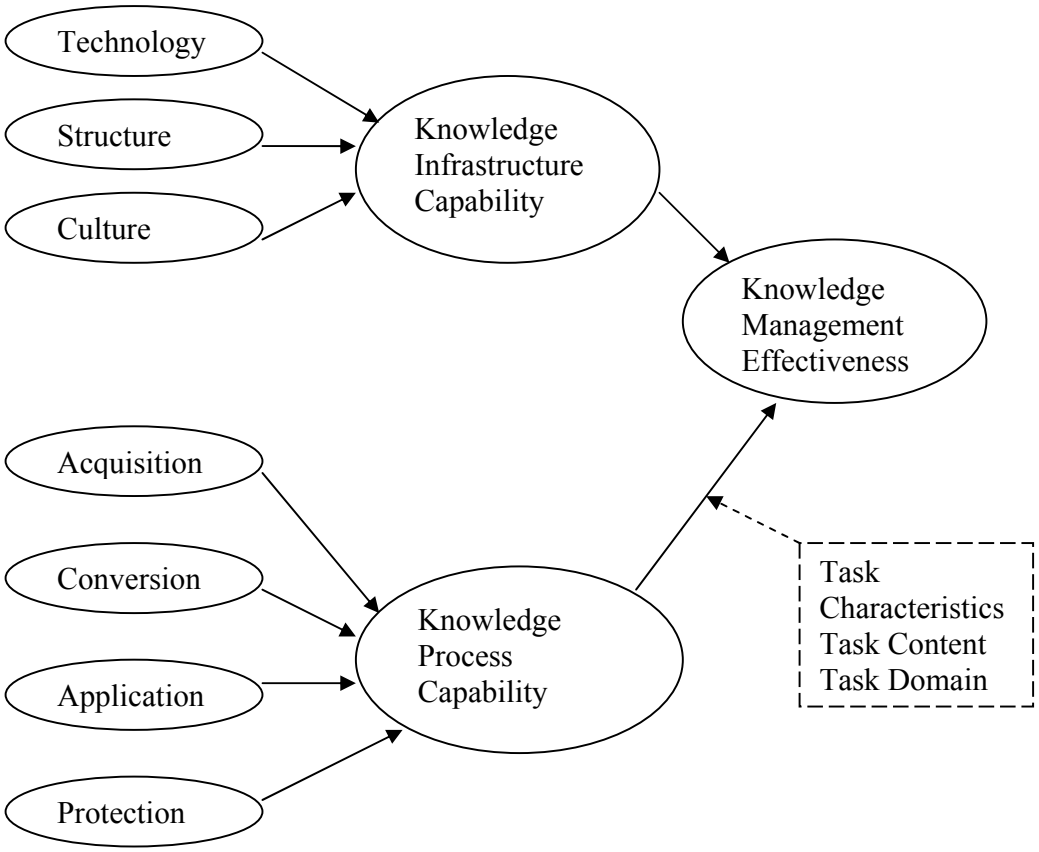


Figure 6.3: Combined Theory Constructs (Lindsey, 2002)

To summarise section 6.2, there is a common element in the three theories presented: that KM assessment is linked to KM effectiveness. In other words, KM assessment should determine the effectiveness of the KM mechanisms and practices of an organisation in relation to the organisational processes and day-to-day activities. Thus KM mechanisms and practices of an organisation need to reflect the organisational processes for which they support in order for them to be considered effective. Hence it is concluded that KM assessment should include and link the following elements in order for it to be complete:

- Establish organisational current KM performance
- Determine effectiveness of KM mechanisms for organisational processes
- Establish KM requirements
- Identify areas for improvements
- Implement improvements

By extension these elements need to be evident in a KM assessment methodology and tool in order for it to be complete. These elements are revisited later in this chapter in order to critique KM assessments tools identified from the KM literature.

6.3 KM Assessment: OKM Perspective

The foregoing discussion informs the view of knowledge management assessment presented in this thesis in the following ways:

- Knowledge management practices can be assessed for their suitability for particular tasks, activities or operational processes.

- Knowledge management effectiveness from an operations perspective can be ascertained by the extent to which it facilitates the availability and application of process knowledge as, where and when it is required.
- Task characterisation dictates the nature of knowledge used to complete tasks and hence the manner in which the aforementioned knowledge is managed.
- The organisational context i.e. structure and culture affects the ability of the organisation to accumulate, convert, share, store and apply knowledge.

Considering the OKM framework presented in Chapter 5, it is posited that the knowledge management categories represent all of the knowledge process activities from an operational viewpoint. Furthermore, the KM mechanisms include the technological and structural capabilities of the organisation. The organisational "contextual" factors include the cultural issues arising in the organisation that enable or inhibit the sharing, accumulation, retention and access to knowledge. Finally, the process-based orientation provides a task contingent perspective of KM that is necessary to associate KM processes with organisational processes and KM effectiveness. Therefore the proposals of the OKM framework are consistent with the KM assessment theories presented in this chapter.

The transformation model provides the basis for analysis where it is possible to relate inputs, outputs, mechanisms and controls pertaining to activities, tasks, and processes hence making it possible to carry out analysis at any organisational level. Controls specify the conditions required for the activity to produce correct outputs. Mechanisms are the means by which the activity is done i.e. people, tools, equipment etc. Therefore

within the OKM perspective, knowledge could be a mechanism or control that facilitates the completion of organisational activities and processes. The identification, retention, accessibility and use of this knowledge is evident in the successful completion of the activity with which it is associated- in effect linking organisational and knowledge management processes. However, the issue of measures of effectiveness still presents potential challenges in light of the various measures of organisational effectiveness. As observed above, traditional indicators of effectiveness have often been financial indicators, for example, return on investment (ROI) (Ahmed et al, 1999). However, Ahmed et al (1999) identify other indicators that include process, people and resource utilisation. The OKM perspective takes the view that KM effectiveness can be predicated by the ease with which task/process knowledge is identified, created, developed, shared, integrated, retained and accessed in time for it to be applied to organisational processes as and when it is required. Therefore KM effectiveness is operationalised and determined by the availability of knowledge at the right time and place for application to process.

6.4 Tools for KM Assessment

This part of the chapter is dedicated to analysing the manner in which KM assessment is generally conducted. It reviews a few research –based and consultancy approaches to the concept of KM assessment.

6.4.1 The Knowledge Management Assessment Tool (KMAT)

The KMAT was developed by the American Productivity & Quality Centre and Arthur Andersen in 1995 to help organisations to self-assess where their strengths and opportunities lie in managing knowledge (APQC, 2001). The tool is divided into five sections: the KM process; leadership; culture; technology and measurement. The tool can essentially be characterised as a questionnaire which consists of questions belonging to each of the five aforementioned sections. The questionnaire utilises a 1-5 scale upon which respondents rate the performance of their organisation. At the end of each section respondents are asked to add the total for each of the questions in the section. The tool does not elaborate how the results should be interpreted, neither is a pictorial representation of the output suggested.

6.4.2 KM Maturity Assessment model

The knowledge maturity model (KMmm) defines stages of maturity that an organisation can expect to pass through in its road to improve its overall knowledge-centric practices and processes and ultimately business performance (The Knowledge Compass, Inc., 2006). According to The Knowledge Compass Inc (TKCI) the KMmm assessment covers both the perceptual and factual pillars within the organisation's key business and support areas. These areas represent distinct themes within the client's infrastructure and form the unit of assessment. The KMmm model key components are: maturity model levels; KM assessment areas; KMmm assessment tool and KMmm assessment methodology. Of the

scant information available on the TKCI website, www.knowledgecompass.com, the most notable were the KM assessment areas which included strategic, people, process and technology. Some overlap with research-based work was observed thus indicating consensus on some key issues. However, no information was provided about the KM assessment tool itself.

6.4.3 Knowledge Management Assessment (knowledge-management-online.com)

This assessment tool is a simple web-based knowledge survey tool to assess the knowledge orientation of an organisation and provide an indicator of how advanced an organisation is in understanding and implementing knowledge management (knowledge-management-online.com). The survey is a multiple choice questionnaire consisting of forty-six questions. A sample question is provided below:

Q1. People at all level of the organisation have a general understanding of the concept of "knowledge management"

Possible answers

- Not applicable
- To a degree (or less than a third - 33.3%)
- To a stronger degree (or 33.3% - 66.6%)
- Very strong (or 66.6% - 100%)

The questionnaire is oriented towards building a KM profile for organisations; it is not specific to the assessment of the effectiveness of the KM profile. It is similar in many ways to the KM surveys conducted by KPMG and the OECD (KPMG, 2003; OECD, 2001).

6.4.4 KM Assessment model and tool (European KM Forum)

The KM assessment is structured into the following sections: general section; KM strategies; human and social KM issues; KM organisation; KM processes; KM technologies; KM leadership; KM performance measurement and KM implementation; business areas. Next to these major sections the assessment consists of open questions, closed questions, indicators and rating scales (European KM forum, 2002). Table 6.1 gives an overview of the KM assessment structure.

	Open Questions	Closed Questions	Indicators	Rating scales
General section	A,B,C,…	1,2,3,…		
KM strategies	…	…		
Human + social KM solutions	…			
KM organisation	…			
KM processes				
Technologies				
Leadership				
Performance Measurement				
Implementation + Business cases				

Table 6.1: Structure of KM assessment (European KM Forum, 2002)

The assessment structure illustrates the themes of questions that make up the KM assessment model. The most noticeable aspect of the KM assessment questionnaire is its breadth. It covers a wide spectrum of KM activities: structural, cultural and technological enablers as well as organisational elements that are affected by KM from financial to process. It is therefore difficult to narrow the functionality of the model to a specific organisational hierarchical level i.e. strategic, tactical or operational. The constructs seem to be interwoven-perhaps a result of the amalgamation of existing KM assessment models and tools. While breadth may be considered to be strength of the tool, it makes it difficult to assess particular aspects of KM in any amount of detail because of the variety of

analytical methods that will need to be employed in order to extract meaning out of the output. For example, some parts of the questionnaire require answers that are limited to a yes/no, while some require description of process; still, others require some form of rating on a 1 to 5 or sometimes -2 to 2 scale. Clearly the analysis and presentation of such an exercise could be cumbersome. Table 6.1, which represents a pictorial representation of the model, makes it difficult to imagine how the tool could represent all the issues presented in the required amount of detail that makes it possible to ascertain the current KM situation obtaining in an organisation for the purpose of effecting improvements.

In the final analysis, the KM assessment tools and models reviewed above have in common the questionnaire structure consistent with surveys. KM assessment is treated mainly as a means to provide a KM profile of the organisation or level of KM "maturity". This is acknowledged as an essential part of KM assessment. However, as the foregoing review of KM assessment theories found, KM assessment profiles need to be associated with other elements such as KM effectiveness, requirements, and improvements in order to be regarded as complete. To be fair, the KM assessment tool and model (European KM forum, 2002) in some ways addresses this, but their proposition is deemed too broad in other aspects in a manner that makes analysis of outcomes difficult. This has the effect of limiting the tool's capacity to identify areas for KM improvement. Table 6.2 shows the characteristics of the KM assessment tools discussed above. It shows how the reviewed KM assessment tools meet (or do not) the criteria of a KM assessment tool as outlined above.

	KMAT	KMmm	KM Assessment	KM Assessment model (European KM Forum)
Illustrates current profile	x	x	X	x
Link to effectiveness				
Identifies areas to improve	x			
Establishes KM requirements				
Demonstrates analysis of output with clarity				
Pictorial Illustration				x

Table 6.2: Illustrating the characteristics of the KM assessment tools

From Table 6.2 it is ascertained that all the assessment tools could be used to illustrate KM profiles. However, their main failing is that profiles do not facilitate sensible decision-making; for example, a decision to improve a low performing area may be a waste of resources if it has minimal impact on the attainment of strategic objectives. This requires that a link to organisational effectiveness is established in order to determine the overall impact of individual KM mechanisms. Therefore, a KM assessment tool should be able to link and aid the understanding of the relationships between mechanisms, categories and organisational outcomes. This becomes the basis for the identification of the "ideal" KM profile for an organisation and the initiation of KM improvements.

6.5 Pictorial Representations of KM assessment Tools

The radar diagram is a common tool in KM literature. Recently, the radar diagram was used by Tasmin and Woods (2008) to measure KM in organisations. They suggested five measures for knowledge management practices: leadership, culture, technology, process, and measurement; arguing that this proposition encapsulates the overall "best practices" of knowledge management in both worlds of practitioners and scholars (*ibid*).

Their results show the level of KM practices among Malaysian large manufacturing firms is at a moderate range; measured at an overall mean value of 3.06 using a scale from 1 to 5. The description of the 1 to 5 scale was not reported. This research is similar in many respects to the survey type assessment of organisational KM which does not go beyond providing a KM profile for an organisation.

Likewise, Burnett et al (2004) used the radar diagram in order to show working practice within the tax department of a multinational oil exploration and production company. The radar diagram was used to represent the current level of KM activity, both for individuals and the department. Six KM criteria were chosen for measurement: acquisition and learning, dissemination and transfer, storage and maintenance, application and exploitation, knowledge creation, and performance measurement. The study used a scale that showed performance levels from 1 to 6 as follows:

- Score 1- This activity does not occur
- Score 2- This activity happens occasionally

- Score 3- This activity is done on an ad hoc basis
- Score 4- This activity happens frequently even when unsolicited
- Score 5- This activity is carried out regularly as a separate activity
- Score 6- This activity is embedded in working practice

In their study Burnett et al, found that the comparisons made between individual and departmental performances helped to identify the main areas for improvement. An underlying assumption of this work is that the KM mechanisms used for each of the knowledge management processes being measured were appropriate- hence more use of the KM mechanisms would directly constitute a more effective impact on operational activity outcomes and is therefore an improvement. This is considered to be a flaw as there is insufficient evidence from the tool that suggests that the KM mechanisms were appropriate for the organisational processes and were hence directly tied to strategic objectives.

Similarly, Rowlance (2007) also used the radar diagram as a "knowledge management scanner" to illustrate the improvements in a manufacturing company in the following: transferability, subjectivity, embeddedness, self-reinforcing, perishability, spontaneity and knowledge pull. The radar diagram was used to illustrate areas that had been improved after a KM initiative had been undertaken in a specific production area. The study used a 1-5 scale as follows:

- Score 1- Not used at all
- Score 2-Seldom used

- Score 3-Occassionally used
- Score 4-Often used
- Score 5- Always used

The common aspect of all these studies is that they measure and illustrate "aggregate" variables, for example, technology, acquisition and learning and transferability. Although these constructs are informed by a set of questionnaires in the study, the output cannot illustrate how the elements of the questionnaires contribute individually. They can only provide an illustration for the whole. In the context of this research, this is considered as a weakness. The KM assessment tool, while providing an aggregate picture of the organisational KM profile, also needs to show the individual relationships between KM categories and mechanisms in a manner that lends the relationships to scrupulous evaluation. The following description of an attempt to apply the radar diagram will illustrate this point more effectively.

6.5.1 Applying the Radar Diagram as an assessment tool

The radar diagram was tested in this research, in order to represent the knowledge categories in the participating organisations and the knowledge mechanisms within each of these categories. It was proposed that a rating system from 1 to 5 would be used to represent the extent to which a mechanism is used in the organisation as follows:

- Score 1- The mechanisms is never used
- Score 2- The mechanisms is used infrequently

- Score 3- The mechanism is only used when required
- Score 4- The mechanism is used frequently
- Score 5-The mechanism is embedded in practice

For each KM category, an organisation would be able to illustrate the KM mechanism and the level of use. Hence the exercise would produce seven KM radar diagrams for each of the seven KM categories. An example of such a diagram is shown in Figure 6.4. Also, a single radar diagram depicting the KM assessment profile of the seven categories alone could be derived from the other outputs.

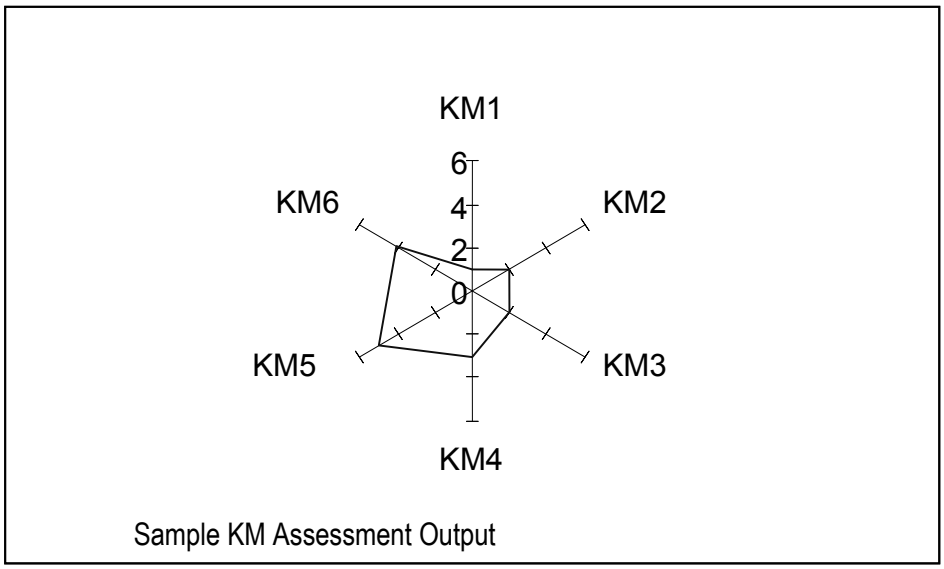


Figure 6.4: Sample KM Assessment Output

Such a representation of an organisation's KM mechanisms can help to identify the main areas for improvement; to allow organisations to compare their practices against similar organisations in order to find ways to improve their KM practices and integrate

knowledge into their processes more efficiently. However, some inefficiencies of this use of the radar diagram are notable. Firstly, the method of illustration is not user-friendly. The process was found to be cumbersome and sometimes confusing because of the number of radar diagrams required to show all the KM categories explicitly. Secondly, the method did not adequately illustrate the interdependence of KM categories, i.e. situations where KM mechanisms were applicable to more than one KM category. Therefore, it was difficult to ascertain overall use of a mechanism. This is an important issue in the design of the tool as it is a key requirement of the research; to show the KM mechanisms where improvements could lead to a better functioning of the KM system in an organisation. Understanding relationships between mechanism, categories and outcomes is essential to establishing effectiveness of KM mechanisms for organisational processes. Thirdly, it is submitted that a third dimension that reflects the "contextual" features of the organization that inhibit KM operations should also be included as these help to present a holistic and more accurate representation of organizational reality. Finally, it is argued that it would also be helpful to illustrate those KM mechanisms that are *not* in use in the organisation. This feature would offer organisations the opportunity to appraise the other KM mechanism options as well as to see the bigger picture of the organizational KM capabilities. In this way, it would put the organizational KM practices into perspective. However, this suggestion resulted in overcrowded radar diagrams, given that there were twenty-five KM mechanisms initially identified. Therefore a different approach to the use of the radar diagram was considered.

6.5.2 The measurement matrix

Ahmed et al, (1999) used what they called a measurement matrix in order to "measure knowledge". They argued that the matrix helps in obtaining a deeper understanding of how KM affects the organisation as a whole and it also prompts practitioners to look at the various aspects of implementing KM. It forces the practitioner to consider all factors, "soft" as well as "hard" factors and it also forces managers to link KM to the overall organisation's policy and strategy (Ahmed et al, 1999 p. 309).

The measurement matrix combines the COST model and the four steps for KM. The COST model represents the key areas to which an organisation must direct attention so as to capture all aspects for effective knowledge management. The model, according to Ahmed et al, represents the following:

- Customers- what can we learn from our customers? How can we learn from our customers? How can we become effective in learning from our customers?
- Organisation- What are the likely skills needed to make the business a success? Who has these skills? How are these skills harnessed, and shared? How are we doing compared to other businesses?
- Suppliers- how are our supplier links? Does the organisation obtain an optimum quality, cost and delivery service from the suppliers? Does the organisation conduct supplier quality programmes?

- Technology- how many computer terminals (which are hooked up for information transfer) are available per employee? And are these links being used effectively within the customer-organisation-supplier (*ibid*, p. 308).

On the other hand, the four steps of KM, which were not explicitly defined by Ahmed and his colleagues, are knowledge capture, share, measuring and learning. These are taken to represent the KM activities which were discussed in section 3.6 (Chapter 3) of this thesis. The COST model and the four steps of KM are combined into a measurement matrix illustrated by Table 6.3.

	Capture	Share	Measuring	Learning
Customer Organisation Supplier Technology				

Table 6.3: Measurement Matrix Ahmed et al (1999)

The proposal by Ahmed et al (1999) did not provide a scale of measurement, neither was there a practical application of the matrix in order to test its value. However, it was observed that the use of a matrix could overcome the major weakness identified when appraising the radar diagram tool- its inability to illustrate individual relationships. The matrix could be used to show the individual relationships between KM categories and mechanisms. Furthermore, it would be possible to show the interdependence in the KM categories- where KM mechanisms are applicable to two or more KM categories. Table

6.4 illustrates an example of the use of a simple matrix in this research. The matrix used combined KM categories and mechanisms and used the same 1-5 rating described in section 6.5.1.

Table 6.4: Cross-section of the measurement matrix

	Apprenticeships	Mentoring	Process Mapping	Seminars	Meetings	Training	E-mail, bulletins	Books, manuals	Handover session	5-Y Analysis
Knowledge Identification					3					5
Knowledge Development		3		2		4				
Knowledge Creation					1					2
Knowledge Sharing					4					
Knowledge Retention										
Knowledge Access				1	3			2		
Knowledge Integration					1					

The matrix was able to show the individual relationships between the KM categories and the mechanisms. Moreover, it was possible to show primary and secondary relationships between KM categories and mechanisms. For example, Table 6.4 illustrates how it can be possible to determine the contribution made by meetings to the various KM categories. The measurement matrix, therefore, has potential as an assessment tool for KM. The only notable shortcoming of the measurement matrix is that it did not have the third dimension which could provide the "contextual" detail which specifies barriers to KM in an organisation. Furthermore, it would be helpful to show the knowledge management

categories that are particularly important to an organisation based on its operational activities and core competencies. This is a key feature of the process-based approach presented in Chapter 4 and subsequently the OKM framework presented in Chapter 5. It also represents the first step towards operationalising the task characterisation dimension which is essential in determining the effectiveness of the KM mechanisms.

It would also be essential to adopt a method of analysis which manipulates the measurement matrix output into descriptive and evaluative accounts/reports of an organisation's KM system. This is the first step towards the development of performance benchmarks; establishing whether a match exists between organisational work and KM processes; comparison of KM practices between different organisations, and the improvement of KM practices. Notwithstanding the noted weaknesses in the current use of the matrix, it is posited that some adjustments could be made to enable the matrix tool to meet the requirements of the KM assessment tool as outlined in this chapter. A detailed proposal is outlined in Chapter 7.

6.6 Conclusion

This chapter presented relevant theories pertaining to KM assessment. It was found that the assessment of an organisation's KM practices should be the precursor to the implementation of KM initiatives and improvements that enable an organisation to migrate towards its "ideal" KM state. In the process of assessment it is necessary to establish the effectiveness of the existing KM practices in order to determine their

contribution towards achieving an organisation's strategic goals. Hence the key elements that a KM assessment methodology and tool needs to possess as identified from the literature review are:

- Establish organisational current KM performance
- Determine effectiveness of KM mechanisms for organisational processes
- Establish KM requirements
- Identify areas for improvements
- Implement improvements

The KM assessment tools that were reviewed in the chapter were limited in that they did not satisfy all these requirements. Their main failing was that they provide KM profiles which are not adequate to inform decision-making. However, the application of the measurement matrix showed potential to satisfy all the key elements identified above. Its main advantage over the other tools is that it was able to illustrate both the aggregate KM profile as well as the individual relationships between KM categories and mechanisms-a very important aspect related to illustrating effectiveness of KM mechanisms. However some outstanding issues remain:

- There is a requirement to show an additional dimension illustrating the structural and cultural issues that affect the implementation of KM in organisations. These issues are referred to as "contextual" issues because they reflect the peculiarities of an organisation's internal environment. It is posited that a matrix can accommodate the addition of this dimension better than any of the tools reviewed in the chapter.

- The use of the tool must be supported by a methodology that can establish the importance of KM categories as a reflection of the strategic objectives of an organisation. Establishing the importance of KM categories has two equally important outcomes: firstly it is the basis for establishing the KM requirements of an organisation; and secondly it is the basis for determining how effective KM mechanisms are in an organisation and the precursor to improvement initiatives.
- Use of the matrix tool should be accompanied by a method of interpreting and reporting findings which leads to the identification of KM areas that require improvement. This is the ultimate purpose of implementing a KM assessment exercise.

It could be argued that a tool that addresses these outstanding issues is suitable for KM assessment. Chapter 7 presents a tool and methodology that extensively uses matrices for quality improvement purposes. This tool is adapted to the research "problem" and modified in order to address the outstanding issues outlined above, culminating in a proposal for its use as a KM assessment tool.

7 Quality Function Deployment

7.1 Introduction

This chapter presents a tool and methodology that makes extensive use of matrices: Quality Function Deployment (QFD). QFD was introduced by Yoji Akao in 1966; applied for the first time by Kobe Shipyard and was then referred to as quality tables (Zairi, 1993). It is proposed that adaptation of this tool in the context of this research is appropriate because of the manner in which the matrix data are analysed and interpreted. Furthermore, QFD matrices have a variety of "rooms" which could be adapted to the OKM framework. This chapter outlines the manner in which the QFD tool and methodology will be adapted to the KM context and KM assessment in particular. It is argued that the QFD matrix provides the opportunity to include the variety of relationships identified as pertinent in illustrating a complete assessment of an organisation's KM system from an operations perspective. The main outcome of this chapter is the proposal and description of the KM assessment tool and methodology.

7.2 What is QFD?

Quality function Deployment (QFD) has been defined as follows:

A technique or discipline that can improve the process of developing and producing products. It deals with "verbal data" and accomplishes this task not by requiring massive

investments in engineering or manufacturing, but by capturing the customer's needs in focusing on meeting as many of them as possible (Adams, 1992)

QFD is a participatory technique which focuses on the voice of the customer to achieve high product quality. It is designed to improve customer satisfaction with the quality of products and services (Akao, 1983).

A system for translating customer requirements into appropriate company requirements at each stage from research to product development to engineering and manufacturing to marketing/sales and distribution (Ungvari, 1991).

QFD provides the framework and technique for identifying, prioritising and focusing efforts to produce the best possible product with the most efficient use of resources (Biondo, 1991).

QFD is a systematic means of ensuring that customer or marketplace demands (requirements, needs, wants) are accurately translated into relevant technical requirements and actions throughout each stage of product development (Fortuna, 1998).

QFD is the most complete and convincing methodology for planning the goals of a stream of processes to align them to the final requirements of the stream – that is so that they meet the customer's requirements (Conti, 1989).

A systematic way of ensuring the development of product features, characteristics, and specifications, as well as the selection and development of process equipment, methods, and controls, are driven by the demands of the customer or market place (Eureka and Ryan, 1988)

Maddux et al, (1991) identified the objectives of QFD as: identifying the customer, determining what the customer wants and providing a way to meet the customer's desires. To achieve this, it is necessary to listen to the "voice of the customer" throughout the process of product or service development (Lampa and Mazur, 1996). The fundamental difference between QFD and other quality systems is that the more traditional quality systems aim to minimise negative quality (such as poor service or broken product). With those systems, the best you can get is nothing wrong- which is not good enough when all the players are capable (Lampa and Mazur, 1996). In contrast, QFD maximises good quality such as convenience and enjoyment which create value and competitive advantage through repeat business.

These definitions do not really bring out the benefits of QFD with reference to this research. In order to bring out the relevance of QFD to this research it is essential to revisit some of the definitions and contextualize their meaning with reference to this research project. Biondo (1991) makes reference to "identifying, prioritizing and focusing" efforts while Fortuna's (1998) reference to "requirements, needs and wants" suggests that a key element of the QFD tool and methodology is the careful selection of the vital few characteristics from an array of customer wants and needs. To put this into

the research context, the organisation's employees are the customers. They have certain demands and requirements for knowledge as they interact with their daily tasks. Therefore, they require a KM system (product) that has particular design characteristics that enables them to identify, develop, share, access, integrate and apply process-related knowledge effectively. Hence the QFD tool (adjusted to the KM context) represents the potential tool to assess current KM systems (the product) and help to improve it according to the needs, requirements and the articulations of the customers (employees).

7.3 The QFD matrix

The QFD matrix (also referred to as the House of Quality) is a formal articulation of how the company sees the relationship between the requirements of the customer (*the whats*) and the design characteristics of the new product (*the hows*) (Slack et al, 2004). The fundamental idea is to translate the voice of the customer into the final product or service quality. The whole translation can be considered in stages. Therefore, it is possible to have multiple levels of QFD matrices with *hows* of one matrix forming the *whats* of the next. According to Tan et al., (1998) when using QFD, this is the most important tasks: to define and understand the *whats* – the needs of the customer and to define the *hows* to meet the customers' needs.

A QFD matrix is able to show the relationship between results and causes or between objectives and methods when each of these consists of two or more elements or factors (Asaka and Ozeki, 1988). Asaka and Ozeki continue by stating that various symbols are

used to indicate the presence and degree of strength of a relationship between two sets of essential items. They propose some four key benefits of using matrix diagrams with symbols as follows

i) The use of symbols makes it visually clear whether or not a problem is localised or more broad ranging

ii) It is possible to show the problem as a whole, and view all the various relationships between the various elements at once

iii) By testing and evaluating each relationship intersection of the essential factors it becomes easier to discuss the problem at finer levels of detail

iv) A matrix makes it possible to look at specific combinations, determine essential factors and develop an effective strategy for solving the problem

QFD employs mathematical analysis using a series of matrices which depend on functional relationships to arrive at the highest level of quality in product. Various types of graphs and charts are automatically prepared for aiding in analysis of the matrix. Also the matrix allows the comparison of products or service with other competitive products or services so that the organisation can make improvements to its own design.

7.3.1 The Central Matrix (Relationship matrix)

The central matrix represents the view of the inter-relationship between *whats* and *hows*. This is often based on the value judgements of the design team. Sometimes symbols are used and they indicate the strengths of the relationship (Slack et al, 2004). Typically the

correlation between the *what* and *how* attributes is weighted as follows: 9 for a strong correlation; 3 for a medium correlation; and 1 for a weak correlation.

7.3.2 Technical Assessment

The bottom box of the matrix is a technical assessment of the product or service. This contains the absolute importance of each design characteristic. This is also translated into a ranked scale of relative importance. In addition, the degree of technical difficulty to achieve high levels of performance in each design characteristic is indicated on a scale of 1 to 5.

7.3.3 The triangular "roof"

The "roof" of the QFD matrix describes the correlation of each *how*. The cells in the "roof" are used to identify where the *hows* support or impede each other. For each of the cells in the roof the following possibilities exit: improving one *how* causes the other to improve (synergy) or improving one *how* causes the other to deteriorate (compromise). Sometimes no relationship is perceived. The QFD matrix is shown by figure 7.1.

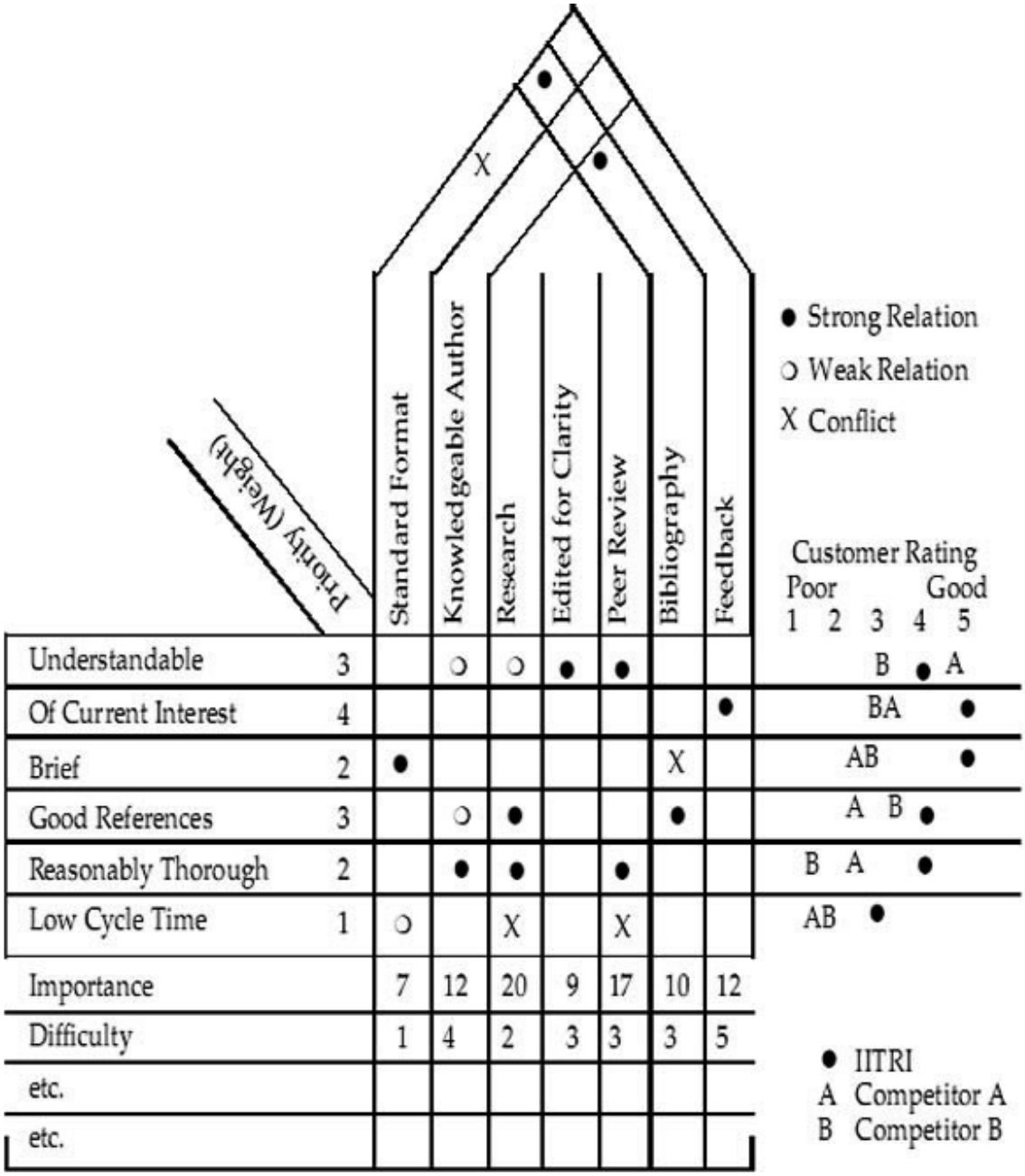


Figure 7.1: Illustration of a QFD matrix

7.4 The QFD process

According to Zairi (1993) the QFD process is as follows:

- The starting point is really the customer requirements, or what is often referred to as the non-measurables. Usually these are things attributed directly to the product/service or "feel" of using it (e.g. how it looks, ease of usability, how it feels, how comfortable it is, durability, how does it compare to other products/services available, etc).
- The emotional and physical requirements of the customer can then be converted into proper technical specifications through the use of technical transfer teams, for example. This stage is often referred to as the design requirements or measurables.
- The process is propagated further by converting the technical specifications into proper elements which, together, would lead to an end product capable of performing to customer requirements. The conversion in this stage is often referred to critical part characteristics.
- The next stage is really deciding and determining how the accepted design of the product or service is going to be transformed for the benefit of the customer (i.e. the process aspects)
- Lastly once the process of converting the design into tangible outputs has been determined, the next stage is to plan and schedule the various operational activities.

7.4.1 Some Applications of QFD

Traditionally QFD has been used for the development of specifications for products in manufacturing industries. The common element in all of the applications of QFD is that the final product needs to reflect the customer requirements in quality to the point of delighting them (Kano, 1984). This concept has been transferred to various other industries including health, education and government. Table 7.1 illustrates some recent case studies in which QFD has been applied.

Table 7.1: Illustrating some applications of QFD

Author	Application
Chan et al (2006)	Development of an education curriculum
Lampa and Mazur (1996)	Improving sales in the hospitality industry
Mazur, Gibson and Harris (1995)	Improving Health care and quality of life
Carey and Mazur (2007)	Concept innovation and strategic decision-making in health
Dimsey and Mazur (2002)	Design of a brake system
Johnson (2008)	Automotive industry
Stansfield and Cole (2008)	Development of a mobile data collection system
Helper (2008)	Predicting future health insurance scenarios
Hines, (2008)	Understanding, prioritizing, and developing solutions to address the future needs of customers
Haraga (2007)	Effective business design
Akao (2007)	Designing a college women's dormitory
Kapucugil et al (2008)	Process improvement in a ship-owner company

The variety of the applications is evidence that QFD can be adapted to any scenario and environment that has the main objective of producing a quality product/service for its end-user, hence the potential for application in this research project. In the context of this research project, the "product" is taken to be the KM system of an organisation and the organisation is the customer. Therefore the main goal is to improve the quality of KM practices in organisations so that they are effective for their daily operations which they

support. QFD has the potential to help in achieving this goal in two ways: firstly, to be applied as an assessment tool that can illustrate the current state of organisational KM systems; and secondly, to be applied to determine KM requirements for organisations, conduct a gap analysis with current state and finally to recommend and implement improvements. In order to achieve this, it is imperative to first adapt the QFD matrix to reflect the dimensions of the OKM framework, i.e. KM categories, mechanisms and barriers. Therefore an important part of the research is to adapt the QFD tool to what is termed in this research the KM assessment tool and methodology. This is described in section 7.6.

7.6 Towards a KM assessment tool: a proposal

This section is dedicated to outlining the aspects of QFD methodology that make it a potential tool to be used in the assessment of KM in the organisation. It details the modifications considered necessary to make to the traditional QFD in order to reflect the OKM framework presented in Chapter 5.

7.6.1 The KM Assessment tool: modification of the QFD matrix

7.6.1.1 KM Categories- (*The Whats*)

KM categories provide a framework of activities that organisations engage in on a day-to-day basis in order to manage knowledge. Previous work in this area suggests that the key KM activities are knowledge creation, knowledge storage, knowledge dissemination and knowledge application (O'Dell, 1998; Wiig, 1993; Beckman, 1999). However, it

was noted that the need to integrate new and existing knowledge in business processes is not explicitly addressed by the KM framework propagated by the extant literature. Moreover, the perception of knowledge management as either hard or soft leads to fragmented understanding of the philosophy. Hence KM may be incompletely conceptualised and, as a consequence, KM in the organisation is only imprecisely understood and measured. The categorisation of KM activities in organisations and the resultant OKM framework clearly outlines the KM activities that organisations need to be engaging in to efficiently manage their knowledge resources and embed KM practices into organisational processes. KM categories can be perceived as a foundation for building KM systems. It provides specific KM areas that organisations can identify with respect to operational efficiency – *the whats* of KM systems.

7.6.1.2 KM mechanisms – (*The Hows)*

KM mechanisms (*hows*) are the means by which organisations achieve their KM requirements (*the whats*). For example, an organisation may choose from meetings, seminars, mentoring, short courses (all KM mechanisms) to satisfy its requirements in the knowledge sharing category. KM mechanisms may be applicable to more than one KM category; hence it is possible to have primary and secondary uses of KM mechanisms. Primary use of KM mechanisms is determined by the organisation's focus or intentions when using a KM mechanism. For example, an organisation may decide to use meetings primarily to share knowledge. However, in the process, it can be found that knowledge identification occurs during the discussions. As such knowledge identification becomes the secondary use of meetings to the organisation. The configuration of the KM

assessment tool allows the illustration of such relationships where the strength of each is shown using different symbols. For example, Table 7.2 illustrates the symbols used to show the different strengths of association between KM categories and mechanisms.

Symbol	Association
●	Strong (9)
○	Moderate (3)
▽	Weak (1)

Table 7.2: Some symbols used in the KM assessment tool

Therefore, it could be ascertained from the QFD tool, what a KM mechanism is used for primarily and secondarily based on the scores assigned for each association between a KM mechanism and the corresponding KM categories. Whether the strengths of association illustrated by the QFD tool are representative of the distinction between primary and secondary use of KM mechanisms is debatable and could vary from organisation to organisation. However, it was considered necessary to recognise the multiplicity of uses for organisational KM mechanisms.

7.6.1.3 KM Barriers – *(Related Data to KM Categories)*

KM barriers are a recurring theme in KM literature, for example Alavi and Leidner, 1999; Handzic, 2003; KPMG, 2003; OECD, 2001. KM barriers are perceived obstacles to the embedding of KM practices into the day-to-day activities of an organisation and therefore directly affect the development of activities within the proposed KM categories to different degrees. As such a modification to the traditional QFD tool was proposed

where KM barriers replace competitor ratings and direction of improvement as related data to the KM categories. Table 7.3 shows a list of identified KM barriers.

KM BARRIERS
Time consuming
No incentives
Lack of top management support
Lack of infrastructure
Lack of time
Knowledge hoarding
Fear of job loss
Fear of penalty
Fear of idea robbery
Lack of IT skills
High cost of investment

Table 7.3: KM barriers

Inclusion of the KM barriers as one of the "sections" of the KM assessment tool was justified by the fact that showing their relationship to the KM categories highlights the factors affecting KM implementation and development. KM barriers replace a section of traditional QFD which illustrates competitor information. Notwithstanding the difficulties associated with acquiring competitor information, it is also argued that the traditional QFD matrix with its "section" on competitors does not add value to the process of identifying the KM needs of an organisation. Conversely, KM barriers help to bring out the "contextual" issues occurring in the organisation that may impact on the building of the organisational knowledge base. The KM barriers listed include structural, cultural and

technological elements which provide a richness of detail that is imperative to consider when assessing KM systems.

7.6.1.4 KM mechanisms Assessment – *(Related Data to KM Mechanisms)*

The KM mechanisms assessment dimension of the KM assessment tool is similar to the technical data assessment dimension in traditional QFDs. It calculates the overall and relative effectiveness of each mechanism to an organisation. The scores are calculated based on the strengths of the relationship between a mechanism and each of the KM categories and are subsequently summed up in order to show the overall effectiveness of a mechanism in the organisation. An example is shown by Table 7.4.

Table 7.4: Worked Example for Meetings in PPH

Calculation of the Overall effectiveness of Meetings.

KM Categories	Importance to PPH	Effectiveness rating of Meetings	Overall Effectiveness (Importance of Category * effectiveness rating of meetings)
Identification	3	3	9
Development	3	3	9
Creation	3	3	9
Sharing	5	3	15
Access	4	3	12
Retention	5	3	15
Integration	4	3	12
Overall effectiveness			81

A percentage calculation shows how effective a mechanism is relative to the scores of other mechanisms. This dimension is important because it provides numerical evidence of which KM mechanisms an organisation considers to be most effective. Changes and improvements to the KM system can be based on these scores hence their significance and inclusion in the KM assessment tool.

7.6.3 The KM assessment matrix

The KM assessment matrix is used to illustrate "current" KM situation in organisations with respect to their KM practices. The KM assessment matrix illustrates the mechanisms of KM being used by organisations and allows organisations to assign ratings of effectiveness to those that apply to them. The KM assessment matrix mitigates against restricting KM mechanisms to just one category. Furthermore, other dimensions such as KM barriers which show the various challenges that the organisation encounters in implementing KM practices on a day-to-day basis are illustrated by the matrix. In effect, the KM assessment matrix could be used to capture the KM situation in an organisation in alignment with the OKM framework discussed earlier in this thesis. The tool encapsulates all the elements identified as essential to illustrate a holistic picture of organisational KM reality.

Straker's work (Straker, 1995) can be used to summarise the use of the KM assessment matrix for assessing KM in organisations in this respect. He suggests three areas where tools can be used which are;

i) Collecting various levels of numeric and non-numeric information

ii) Structuring the information in order to understand aspects of process and problems

iii) Using the information to identify and select a plan for specific actions

The KM assessment matrix has the attributes that satisfy each of the areas suggested by Straker. Given a populated "current" KM assessment illustration, an organisation should be able to ascertain its KM system's strengths and weaknesses and potential for improvement. Furthermore, by applying the tool as a design mechanism, it will be possible to use information gathered from an analysis of tasks and processes in order to identify areas for improvement. As such, the KM assessment tool has the potential to satisfy the requirements of a tool to be adopted for KM assessment and improvement. Figure 7.2 is an illustration of a typical KM assessment tool. This illustration shows how the three main dimensions relate to each other. The manner in which this matrix is used and interpreted is similar to traditional QFD tools- the main difference being its bias towards KM system assessment. The next section describes the KM assessment process in more detail.

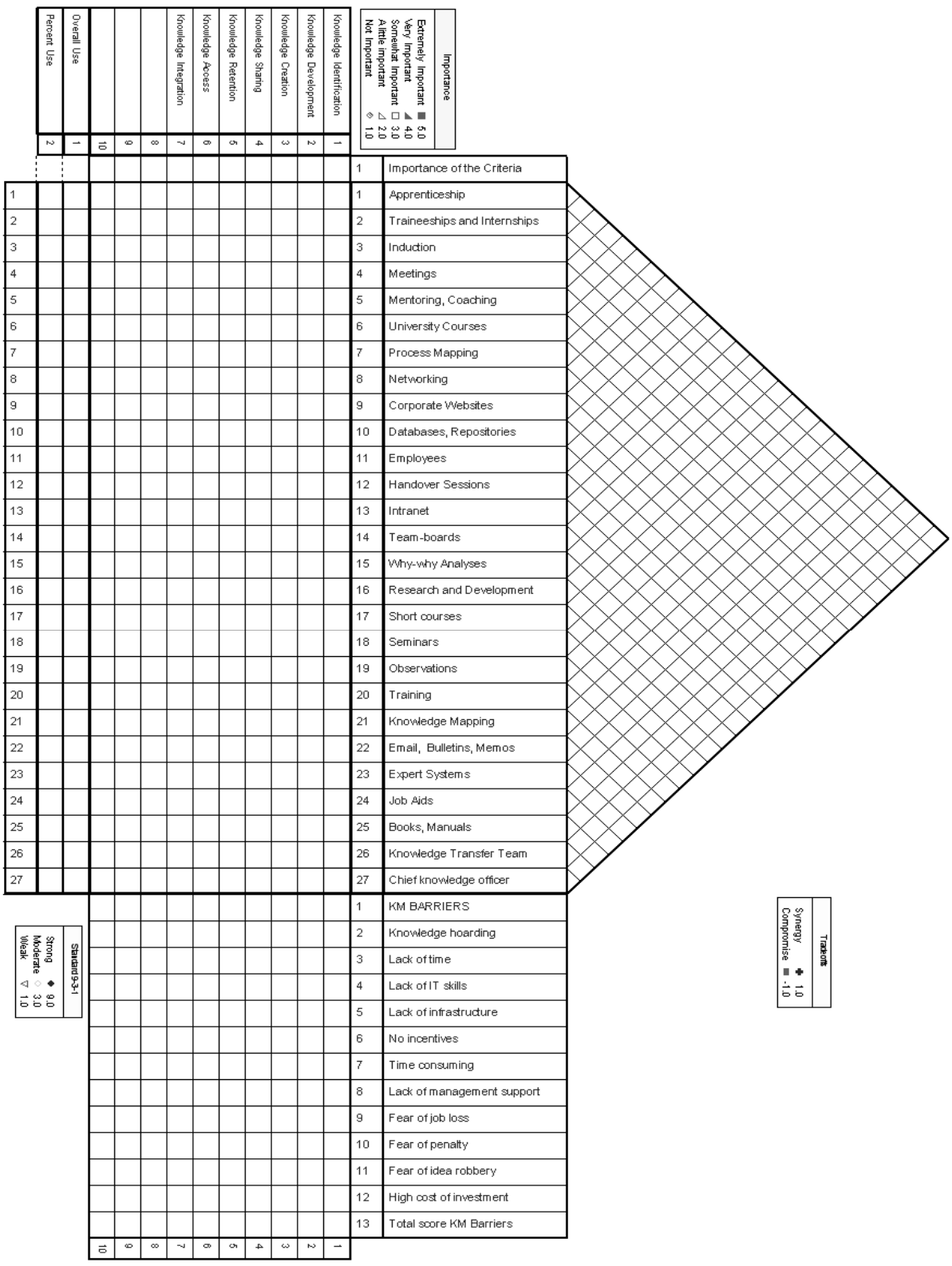


Figure 7.2: The KM Assessment tool

7.6.4 Using the KM assessment tool

Each cell which is an intersection between KM category and mechanism represents a weighting for the effectiveness of the KM mechanism in the category. For example, using the key illustrated by Table 7.5, a black circle in the cell which is an intersection between knowledge sharing (KM category) and meetings (KM mechanisms) means that the effectiveness of meetings in knowledge sharing is strong. An empty cell would mean that meetings are not used for knowledge sharing in the organisation therefore rating this relationship is inapplicable.

Likewise, each cell which is an intersection between KM categories and barriers represents the perceived impact of the KM barrier on the knowledge category. The relationship between KM categories and barriers is defined by the 9-3-1 scale as follows:

Symbol	**Relationship**
9	Strong
3	Moderate
1	Weak

Table 7.5: Key for relationship between KM categories and barriers

For example, a *9 weighting for a relationship between "Lack of IT skills" (KM barrier) and knowledge retention (category) means that "lack of IT skills" has a strong impact on knowledge retention in that organisation. The weighting represents the organisation's

Should reflect the organisations situation as it is

current state. An empty cell would mean that "lack of IT skills" is not a KM barrier in the organisation.

The use of the 9-3-1 scale is common in QFD applications, for example, Zairi (1992); Chan et al (2006); Slack et al (2004); Maji (2006). It is a widely accepted standard for the main "section" of the matrix which pairs the *"whats"* with the *"hows"*. The 9-3-1 scale was adapted for this project primarily on the merits of its wide acceptance in QFD literature. Notwithstanding this position, it is noted that the use of scales in research impacts on the robustness of findings (Van der Ven and Ferry, 1980). In particular, the inferred meaning of the 9-3-1 scale is that the difference between strong, medium and weak weightings is a factor of 3. This in itself could become problematic especially since the measure of effectiveness is by the perception of users and management and hence subjective. Therefore it is likely that "intermediate" weightings are lost in the gap between these options. Van der Ven and Ferry (1980) also argue that when assigning scales for assessment, the options for respondent answers should be optimal to reflect the differences in the variables being measured -too few options may result in the disparity in the scale too big while too many also make the difference too fine to detect or interpret the differences in the measures. Notwithstanding, the 9-3-1 scale was deemed appropriate on the strength of its widespread use in QFD; to be reconsidered in the event of problems arising due to its application.

The "roof" of the KM assessment tool represents the inter-relationships between the KM mechanisms. The cells in the "roof" are used to identify where the KM mechanisms

support or impede each other. For each of the cells in the roof the following possibilities exit:

- Improving one KM mechanism causes the other to improve (synergy)
- Improving one KM mechanism causes the other to deteriorate (compromise)
- There is no perceived relationship between the two KM mechanisms.

Tradeoffs are represented by the following key:

Symbol	Relationship
-	Compromise
+	Synergy

Table 7.6: Key for inter-relationships between KM mechanisms

Further to these relationships, there is a column which depicts the relative importance of each of the KM categories from the organisation's perspective. This measure is shown in the column alongside the KM categories. Table 7.7 shows the symbols used and their corresponding values.

Symbol	Importance Weighting
	5
	4
	3
	2
	1

Table 7.7: Showing the importance weightings of KM categories

This dimension is very important to the research because it reflects the priorities of an organisation with respect to KM activities. Process and task characterisations within the organisation influence the importance of knowledge management categories. Organisations are asked to use the contextual information about their operations, tasks, knowledge types and knowledge flows in the organisation in order to assign importance scores to these knowledge management activities. For example, knowledge creation would be scored as very important in organisations where product life cycles are short and there is a requirement to continually bring new products to the market in order to remain competitive. This would differ quite significantly from an organisation that is production-oriented and the changes to the product range and design are few and incremental. For analysis at task and process level, the use of the ICOM diagram depicting inputs, outputs, mechanisms and controls is suggested. An organisation could gather all the process-related information required to make the correct ratings associated with the process with respect to the importance of KM activities. Therefore, organisations need to take all these issues into consideration when rating the importance of KM categories. It is important to note that the priority ranking of KM categories (illustrated in the importance to organisation weightings) reflects the characteristics of operational tasks and what is important in an organisation's functioning. According to Becerra-Fernandez and Sabherwal (2001), the implementation of processes (mechanisms) that suit the tasks performed will provide more knowledge management satisfaction. This satisfaction is reflected in the effectiveness weightings assigned for the relationships between KM categories and mechanisms.

The assessment of KM mechanisms is done using the traditional QFD methodology where scores are calculated based on the strengths of the relationship between a mechanism and each of the KM categories which are added up in order to show the overall effectiveness of a mechanism in the organisation. An example is provided by Table 7.4 above.

7.6.5 Assessment and Improvement of a KM system

It is possible to notice inconsistencies between the KM category importance ratings and effectiveness ratings assigned by an organisation for the relationship between KM categories and mechanisms. In other words, an organisation can, by looking at the KM assessment tool, notice KM categories where KM mechanisms are rated as ineffective despite that particular KM category being identified as important to the organisation and vice versa. These become obvious targets for improvement. Moreover, the tool is structured in such a way that the assessment team could observe some KM mechanisms that they do not use in the organisation. As such it is possible at this stage to ask questions such as: Why does the organisation not use process mapping when it seems relevant for the type of work we do? Further analysis of the KM system can be conducted as the organisation seeks to determine whether the KM mechanisms rated as most effective in the organisation are appropriate when their task characteristics and other organisational elements are considered (see chapters in results section). This is the initial link between organisational operations and KM mechanisms effectiveness.

Up to this point of the assessment, the organisation is still not fully aware of the extent to which its KM practices are effective (or not) for the organisation's operations therefore any improvement plans maybe incomplete. It is proposed that organisation could use the KM assessment matrix to configure a KM system that would be "desirable" for their organisation. This task requires the population of a second KM assessment matrix. It is averred that the juxtaposition of this "desirable" KM system with the "current" system more clearly highlights the shortcomings and weaknesses of the current system and provides the assessment team with an opportunity to appreciate the size of the task of making KM improvements.

Traditional QFD methodology has a dimension which assesses the technical difficulty of implementing changes to product or service criteria (*the hows*). The KM assessment tool incorporates this dimension on the "desirable" KM matrix in order to assign difficulty scores for making improvements on certain KM mechanisms. However, the KM assessment matrix uses a specially designed method of analysis in order to arrive at the organisational difficulty score instead of relying on intuition as is the case in the traditional QFD tool. It is argued that a method of calculation reduces the inconsistency caused by guesswork. More importantly, the method makes use of the "contextual" information contained in the ratings assigned to the KM barriers dimension and the "roof" of the KM assessment tool. In this way, the data gathered about the organisation and represented on the KM assessment tool, is used to produce a holistic picture of the KM situation in an organisation and enriches the potential gains to be made from undertaking the KM assessment process (see results section for a demonstration of the

method). The method goes further to suggest how organisations can prioritise the improvement plans. It is suggested that in organisations where KM is not viewed favourably or resisted by employees, KM improvements should prioritise KM mechanisms that are easy to implement and where the quickest benefits could be realised. An underlying assumption of this method is that resistance to KM will gradually diminish once the benefits of KM have been realised; opening the door for the introduction of KM mechanisms that are more complicated and difficult to implement.

7.7 Discussion

The proposal presented in this chapter is informed by QFD methodology. It is essentially a QFD application in a Knowledge Management environment. However, there are some fundamental aspects of the design that require differentiation from traditional QFD that make it unique. The most obvious being the fact that the KM assessment does not follow the traditional four phase model to develop specifications. The KM assessment tool is the product of KM literature review and a pilot study which culminated in the Operations Knowledge Management framework (OKM). The QFD matrix was adapted to the OKM framework as detailed in this chapter. The proposed application of the tool is therefore fundamentally different from traditional QFD because there seems to be an underlying assumption in the proposal (of the KM assessment tool) which suggests that the design characteristics and measures proposed are correct and complete; that it is a standard against which organisations should assess their own KM practices. It is the position of this research that the initial design of the tool and the proposal presented is theoretical and requires testing. The objective is to modify the proposal and design of the tool using

the feedback from practical applications of the tool. The emphasis of this work is the development of a KM assessment tool; the detailing of the process; the evolution of the concept of KM assessment and the presentation of a modified and tested KM assessment tool. It is expected that some additions and/or subtractions will occur to the components of the tool as more application of the design is carried out in practical settings. Therefore two notable but intertwined processes are taking place: the process of assessing organisational KM systems at the operational level and the process of developing an assessment tool. Table 7.7 summarises the differences in the KM assessment tool and the QFD tool.

KM Assessment Tool	Traditional QFD Tool
Two phases (assessment and gap analysis)	Four phase model
KM matrix is specific to KM	QFD matrix is generic
Primarily for assessment and improvement	Primarily for design
No benchmarking element in matrix	Benchmarking is a key element on the matrix
Requires internal data only	Requires internal and external data
Employs a consistent method to determine organisational difficulty for improvements	Uses intuition to determine organisational difficulty of new specifications

Table 7.7: Differences between QFD and the KM assessment tool

Another key difference is that the assessment function of the KM assessment tool is fundamentally different from traditional QFD applications because it is aimed at presenting a picture of organisational reality and not to design a new product (i.e. a KM system). The aim is to show the current KM system as it is in order to identify opportunities for improvement. However, a similarity exists in the way the KM

assessment tool goes through the process of designing what is considered to be a "desirable" KM system for the organisation which is then used as the basis to perform a gap analysis in comparing it to the "current" KM system. In the process, special attention is given to the requirements of the organisation with respect to knowledge management processes and mechanisms. Process and task characterisations are an integral part of this stage. They are used to inform the KM requirements of an organisation -to determine the best possible KM mechanisms of getting knowledge to the people that require it, when it is required (see Becerra-Fernandez and Sabherwal, 2001). This is similar to the QFD process where the design team gathers all the articulations of the customer (voice of the customer) and converts them into product or service features.

Table 7.8 shows how the concept of the KM assessment tool meets requirements of a KM assessment tool as outlined in Chapter 6. The table matches the attributes of the KM assessment tool with the requirements of a KM assessment tool.

Requirements of the KM assessment tool	KM Assessment Tool Attributes meeting requirement
Establish organisational current performance.	Two phases (assessment and gap analysis)
Determine effectiveness of KM mechanisms	KM matrix is specific to KM and shows individual relationships of KM categories and mechanisms
Identify area of improvement Implement improvement	Primarily for assessment and improvement
	No benchmarking element in matrix
Establish KM requirements	Requires process and task characterisation to specify what KM needs
	Employs a consistent method to determine organisational difficulty for improvements

Table 7.8: Matching the requirements of the KM assessment tool with KM assessment attributes

Some of the attributes of the KM assessment tool apply to more than one requirement. For example, the two phases of assessment and designing an "ideal" allow an organisation to establish its current performance as well as to identify areas of KM improvement. Therefore the KM assessment tool conceptually satisfies the objectives of KM assessment.

Finally, the method for calculating organisational difficulty for implementing changes requires discussion. Traditional QFD is done by well-informed design teams that have in-depth knowledge of QFD and product designing. Therefore it is logical to assume that the intuitive scores they assign for organisational difficulty are more or less a reflection of reality. To suggest otherwise is also hypocritical because this is essentially the same method proposed for determining effectiveness of KM mechanisms in this research project. It is assumed that managers and production workers are best placed to provide

this information because of their daily interactions and depth of knowledge of the organisational and knowledge processes. However, a problem arises where the organisational difficulty of implementing an improvement to KM systems is done by an individual who does not possess an in-depth knowledge of the KM assessment methodology and/or KM. The proposal put forward in this research incorporates all the information on the KM assessment tool, including the "roof" which forms a negligible portion of the analysis in traditional QFD. It is argued that the method takes a holistic view of the KM system and could be a consistent application for non-KM experts.

7.8 Conclusion

This chapter has reviewed the QFD tool and methodology and has identified the attributes of the tool that would make it potentially suitable to adopt as a KM assessment tool. The most appealing aspect of the QFD tool was initially its extensive use of matrices. Matrices were identified as possessing considerable potential as assessment tools. However, closer analysis of the QFD tool and methodology showed other attributes which went beyond the initial requirements of the study but were, however, eventually acknowledged to be useful.

The chapter provided examples of applications of QFD outside the manufacturing environment in order to demonstrate the potential in the adoption of the tool. The traditional QFD tool was modified to reflect the KM dimensions that together constitute the OKM framework presented in Chapter 5. The KM categories of the OKM framework

make up the *whats* and the KM mechanisms make up the *hows* on the KM assessment tool. A major modification to the QFD tool is the inclusion of KM barriers as an extra dimension on the KM assessment tool. It is averred that the KM barrier dimension is important because it provides "contextual" organisational information and thus provides a holistic view of what is taking place in an organisation. Key features of the KM assessment tool and QFD tool are juxtaposed in table 7.7 to highlight the modifications made to the traditional QFD tool.

The proposed KM assessment tool and methodology are theoretical and need testing. The objectives of the testing of this KM assessment are twofold: to assess and improve the KM systems of participants and secondly to modify the proposal and design of the tool using the feedback from practical applications of the tool. The emphasis of this work is therefore the development of a KM assessment tool; the detailing of the process; the evolution of the concept of KM assessment and the presentation of a modified and tested KM assessment tool.

Finally, the chapter makes a very important reference to the link between the effectiveness of KM mechanisms and the KM priorities of an organisation. It is posited that the KM priorities of an organisation (reflected in the "importance to organisation" weightings) are moderated by an organisation's operations and task characteristics (Becerra-Fernandez and Sabherwal, 2001). Chapter 8 expounds on this link and reviews the characterisations of tasks and processes.

8 Characterising Process Tasks

8.1 Introduction

In chapter 7, a significant part of the proposal to design a "desirable" KM system for an organisation was contingent upon the determination of task and process characteristics and the organisational context where the operations of an organisation are taking place. This has been a key observation in KM literature reviewed (e.g. Gold et al, 2001; Andreu and Seiber, 2001, Becerra-Fernandez and Sabherwal, 2001). It is argued that task characteristics and the task domain moderate the knowledge sharing process (Becerra-Fernandez and Sabherwal, 2001). Tasks were characterised as content-oriented tasks and process-oriented tasks. By extension it has been proposed in Chapter 6 that the processes of knowledge development, retention, access and integration are also dependent on task characterisation. For example, knowledge related to content–oriented tasks may be argued to be easily externalised and retained in manuals or knowledge repositories whereas process-oriented know-how is not as easily externalised and may require multiple employee interactions before it is transferred and therefore accessed by other organisational employees. However, the upshot of the focus on tasks and their characteristics with respect to this research is that the characteristics of organisational tasks can help to formulate a profile of the knowledge needed to execute such types of tasks. This information can subsequently lead to the establishing of the KM mechanisms required to manage that knowledge effectively.

A characterization of tasks coupled with a description of the task domain (see Becerra-Fernandez and Sabherwal, 2001) provides a clear understanding of the organizational "context" which aids the appraisal of an organisation's KM system – thus advancing investigations on the KM assessment "problem". The description of tasks and organisational context links with the KM assessment tool in the ranking and prioritising on KM activities; i.e. an organisation's task profile determines which KM activities (categories) will represent the greatest value for its operational objectives. It is also the precursor to establishing an organisations KM requirements. To that end this chapter makes a proposal for a characterization of tasks/processes which can be applied in conjunction with the KM assessment tool proposed in chapter 7 for assessing KM systems.

8.2 Task characteristics, organisational context and knowledge types, and KM

Becerra-Fernandez and Sabherwal (2001) characterised tasks as content-oriented and process-oriented tasks. Interestingly, they linked these characterisations with knowledge types, stating that content-oriented tasks focus on the specific ends or goals to be achieved and hence rely upon know-what or declarative knowledge while the process-oriented tasks focus on the processes or means that should be used to attain goals and hence rely on know-how or procedural knowledge. This approach to task characterisation does not focus much on the work that is being done but more on the knowledge that is required to complete it. In view of the aims of the research to link task characteristics to

knowledge type and KM mechanisms, this characterisation is effective. However, it is unclear on some important aspects such as task variability or volume of work, which would give the overall impression of "how much" knowledge needs to be acquired, retained, shared and integrated in order to make the process outcome a successful one.

Slack et al. (2004) characterised tasks using the following: skills variety, task identity, task significance, autonomy, and feedback. They established a link between variety and volume with respect to management of tasks on a small scale and the operation at a large scale, and discuss the relative complexity associated with doing high variety, high volume tasks. This approach is two dimensional, allowing classifications of tasks according to the range of tasks associated with completing a job or the varying workload for a range of skills associated with certain jobs. They use the examples of two operations occupying the two extremes- an architect's practice and an electricity utility. The architects' job involves producing designs according to customer requests, with little or no repetition and outputs vary so much that the next outputs will involve different activities therefore they have no standardisation. In contrast, at the electricity utility production is continuous, volume is high and variety is virtually non-existent.

Slack's (2004) contribution is weak in terms of associating process characteristics with knowledge artefacts and hence KM mechanisms. It is more relevant to discussions associated with motivation of employees by job design. Their examples, however, bring up an important issue of standardisation. It has been argued that new process knowledge can be integrated through establishment of procedure and standardisation (Grant, 1996).

Consequentially, it is submitted that the degree to which processes are standardised influences the configuration of an organisation's KM system in terms of KM mechanisms for knowledge storage, sharing and access. Therefore degree of standardisation of operating procedures or guidelines is an important characteristic in characterising the work of organisations.

An alternative approach to task characterisation was made by Elliman et al. (2005) who described tasks according to how frequently they occur during a specified period of time, typically a day. From their interview data, they established three types of tasks: scheduled tasks, on-demand tasks, and at-will tasks. As the name suggests, scheduled tasks are designated to take place at a particular time, for example, meetings and hand-over sessions. On-demand tasks occur with no prior notice and require immediate attention. At-will tasks are characteristically individual activities where the employee engages with the business for a significant length of time, for example, drafting, designing, planning and analysing. The characterisation by Elliman et al. is useful because it allows an analysis of an organisation's tasks to ascertain which ones are suitable for standardisation in terms of procedure and decision-making processes. It is logical to assume that decision-making processes in on-demand tasks are less defined than those in scheduled tasks hence making it more difficult to achieve consistency of outcomes. However, Elliman's characterisation has the same weakness as that of Slack et al., (2004) in that its description of the task does not associate process characteristics with knowledge types (or objects that contain knowledge such as manuals, databases etc) and hence KM mechanisms.

Anand et al. (2003) made a contribution to the problem of characterising tasks but went further to match knowledge distribution type to appropriate tasks as characterised by dimensions of routinisation, standardisation, complexity and uncertainty. They averred that routinisation and standardisation are similar concepts that refer to whether the task has an understandable and stable sequence of steps. Routine, standardized tasks require employees to perform the same job in the same way most of the time. Complex tasks have more unique acts required to complete them, require many sources of information and high levels of coordination among employees, and often involve changing process or output criteria. Finally, uncertain tasks are characterised by unclear goals, frequently changing requirements, varying workload, lack of clear methods to accomplish work and difficulty predicting what will be required of the employees. Table 8.1 below is adapted from Anand et al (2003).

Knowledge Structure	Task Characteristics	Example
Undifferentiated, Internal knowledge	Routine, specified tasks of low complexity. May involve transfer of both explicit and tacit knowledge; knowledge created will be incremental only	Paper mill department task force solving a simple, local problem (mostly explicit); Production line procedure (tacit)
Undifferentiated, external knowledge	Moderately complex tasks of non-routine demands; some degree of uncertainty. Transfer between team and external knowledge will be explicit	Audit committee of a board of directors; seeks outside expertise to complete audit (integration of explicit knowledge)
Differentiated, internal knowledge	Complex tasks of local scope; some level of routinisation and fairly low uncertainty. Explicit knowledge exchange across functions; tacit tasks will require more time to complete but may result in significant knowledge creation	Cross-functional product development team (acquisition, integration and knowledge creation)
Differentiated external knowledge	Highly complex, uncertain, innovative task requiring exposure to outside knowledge sources. Useful for integrating diverse sources of explicit knowledge; tacit exchange improbable except in long-term teams.	AFL-CIO board of directors dealing with multiple entities (integration of explicit knowledge)

Table 8.1: Team knowledge structures and their associated tasks (Anand et al, 2003)

Anand et al. (2003) combined a characterisation of tasks with the knowledge types and objects that are required to complete such tasks. However, their examples are not robust enough for one to have a clear understanding of how task characteristics have been

matched with knowledge types and job examples. “Complexity” is loosely defined and hence cannot be readily ascertained from the given examples. However, their reference to complexity of decision-making processes is important because it highlights the central issue in KM from an operations viewpoint. Knowledge is managed primarily to influence decision-making at various levels of the organisation and process. Therefore, a sound characterisation of processes (from an operations perspective) should consider the factors affecting the relative ease or difficulty to make a decision during a process, for example, is the process standardised; are the tasks team-based; what type of knowledge is required; how easy is it to access; how many functional teams depend on the knowledge? This sort of characterisation has got the potential to identify situations within the process that could benefit from KM practice. For example, it is argued that rigid decision-making structures tend to benefit the least from KM efforts while decision-making structures that emphasise “meaning and order” would benefit from KM efforts that drive innovations geared towards increasing the efficiency of procedural aspects of decision-making (Raghu and Vinze, 2007). Raghu and Vinze (2007) go on to argue that autonomous decision-making structures are the most amenable to knowledge sharing and storage and retrieval solutions. Such decision-making structures benefit from interactivity among decision-makers both within and outside the process domain; they also benefit from retrieving knowledge related to solutions and procedures applied to similar decision problems from within and outside the problem domain (*ibid*). This contribution pertains more to the task domain as defined by Becerra-Fernandez and Sabherwal, 2001 and could also be interpreted to relate to structure as proposed by the organisational capabilities approach (Gold et al, 2001). It suggests that tasks/processes characterisation cannot be complete

without consideration of how they are impacted by other tasks/ processes, organisational structure, interactions between employees, practices and norms. Therefore a clear understanding of organisational context needs to be established in KM assessment. A comprehensive conceptual perspective of contextual, structural and economic factors is proposed by Van de Ven and Ferry (1980).

Domain Factors	**Structural Factors**	**Economic Factors**
Organisational age and history No. of years in existence Description of origin and history *Organisation domain type* Types of functions performed Types of products/services rendered *Domain uncertainty* Agreement on goal priorities Clarity of knowing how to respond to events occurring in the domain *Domain complexity* No. of different products/services, markets and territories organisation operates in Domain Restrictiveness Degree of external mandates and regulations Slack and transferability of resources Specificity of domain statement	*Vertical Differentiation* No. of supervisory levels *Horizontal differentiation* No. Of sections, units and job titles *Spatial differentiation* No. of geographical operating sites *Forms of departmentation* By function, program, geography, matrix at upper levels of organisation *Administrative intensity* Supervisor-staff ratio Manager's span of control *Distribution of power and authority* Relative amounts of influence in making specific decisions by different supervisory levels, organisational units and other interest groups	*Demand for products or services* Production quota for period Projected no. clients/customers *Supply or size of resources available* Number of employees in period Production/service capacity Operating budget for period

Table 8.2: Organisation context and structure (Van der Ven and Ferry, 1980)

In the meantime, it is also important to link task characterisation to knowledge types. The operations perspective (Chapter 5) described in some detail the conceptualisation of knowledge within this research. It was demonstrated (with use of the feedback loop) how information and knowledge are inseparably connected to each other, as well as how data and information are used to make decisions or changes to process. The chapter went on to

differentiate between know-what (the explicit dimension of knowledge) and know-how (the tacit dimension) while explicating their interaction during transformation processes. In this section the research draws upon the work of Eraut (Ed. Rainbird et al., 2004) in order to gain a deeper understanding of the knowledge and knowledge objects found in the workplace. Table 8.3 summarises Eraut's work.

Knowledge Found in the workplace
1. Codified knowledge acquired during initial professional training and further episodes of formal learning; or in workplace itself. The former includes codified academic knowledge of concepts, theories and methodology. The latter includes job-specific technical knowledge and knowledge of systems and procedures. 2. Skills needed for competence in a wide range of activities and for performing several work-related roles, including leadership and working collaboratively within a team. These can be grouped under four headings- technical, interpersonal, thinking and learning-and acquired through practice with feedback. Progression is associated with increasing fluency, responsibility and complexity. 3. Knowledge resources include a range of materials and on-line resources; but learning from other people is even more important in most work settings. These include immediate work colleagues and other members of one's organisation; networks of clients/customers, suppliers and competitors; professional networks; and other personal contacts developed over time. 4. Understanding provides the basis for most action, although it is inevitably incomplete. It encompasses the understanding of other people – colleagues, clients, managers, etc.; the understanding of situations and contexts, including one's own organisation and its environment; self-understanding and strategic understanding of a range of changes and developments. This includes both explicit and implicit theoretical perspectives and theories of action. 5. Decision-making and judgement vary with conditions in which they are exercised. Decisions may be rapid, with little or no time for consultation, or deliberative and consultative. When situations are complex or information is sparse, judgement becomes a critical aspect of decision-making: judgement of people; judgement of quality of products, practices and processes; judgement of the relative significance of, and interaction between, different factors; judgement of priorities, options and strategies

Table 8.3: Adapted from Eraut (Edited by Rainbird et al., 2004), p. 207

An understanding of the knowledge found in the organisation gives an insight into the KM challenges and opportunities that are encountered by organisations. Each

organisation has unique process characteristics that determine the knowledge and knowledge objects found in an organisation and hence its KM system. We can therefore establish the following link: process characteristics-knowledge types-knowledge objects and KM system. Given the discussion thus far, the challenge now is to propose a characterisation of tasks that will be used as a basis for process comparison in this research project.

8.3 Proposing a characterisation of process tasks

As noted above, process characteristics that should be of concern in terms of KM are those that affect how easily a decision about process is made. As gathered from the review of extant literature these include:

- *Standardisation*- According to Grant (1996) the establishment of process rules, procedures and directives ensures the re-use of knowledge through knowledge integration. It requires employees to perform the same job in the same way most of the time with little or no variation (Anand et al., 2003). Where tasks are highly standardised, it is expected that a large amount of explicit knowledge (on what to do in order to complete the tasks) is available. However, an organisation with standardised processes and a large amount of codified knowledge may encounter storage and retrieval challenges (see Raghu and Vinze, 2007). For these challenges various forms of KM mechanisms are available such as books, manuals, databases/repositories, job aids, etc. The most efficient mechanisms suitable for an organisation will dependent on ease of access to knowledge

artefacts in order to make process decisions; a condition that varies according to organisational situations and environment.

- *The number of interacting parts*- This is taken to mean the number of entities i.e. individuals, teams, subunits or departments that have an interest in the process decision outcome. To simplify it further, it refers to the number of entities that contribute towards a process decision as well as those that depend on the output after a decision is made. For example, team-based work is particularly important from a KM viewpoint because of the requirement to access various kinds of knowledge to aid the decision-making process. Therefore knowledge sharing and access takes an important role in achieving process objectives in light of time constraints. Knowledge sharing in this context would depend to a great extent on the motivational structures and the cultural setting within which the process operates (Raghu and Vinze, 2007).
- *Knowledge types*- Chapter 3 discussed in depth the knowledge typologies in the extant KM literature: explicit, tacit, individual, group/collective. A more detailed description is provided by Eraut in Rainbird et al. (2004) and helps to put KM systems comparison in context. For example, team-based processes that are not standardised require skills needed for competence in a wide range of activities and for working collaboratively within a team. Where such skills are not available in an organisation, a decision needs to be made on the most suitable KM mechanisms to adopt in order to address the problem. Furthermore, a discussion of knowledge types is directly related to the challenges of storage/retention and access, knowledge sharing techniques and possibilities of knowledge integration.

It remains debatable how much tacit knowledge is transferable, however an appreciation of the dominant process knowledge helps organisation's to assess options available to them to aid knowledge integration.

8.4 Discussion and Conclusion

The three characteristics described above cover a broad area as they are directly or indirectly linked to other salient features that make up the process domain. These include autonomy and pressure of time (linked to the number of interacting parts), emergencies (linked to standardisation), and availability of resources (linked to knowledge types). Therefore, it is argued that the characterisation provides enough breadth to the description of organisational processes which is meaningful and sufficient for the assessment of KM systems. It is acknowledged that one cannot fully understand process without a detailed description of the performance domain (Eraut in Rainbird et al, 2004). Therefore it is proposed that this analysis of process characteristics is accompanied by contextual detail including locations, organisational culture and their salient features. An example of the issues to be considered was provided by Van der Ven and Ferry (1980). The description of tasks and organisational context links with the KM assessment tool in the ranking and prioritising on KM activities; i.e. an organisation's task profile determines which KM activities (categories) will represent the greatest value for its operational objectives. It is also the basis for building an outline of the KM needs of an organisation; essentially the "voice of the customer". The findings help to visualise and

build a "desirable" KM system design for an organisation, potentially identifying key relationships between process, knowledge categories and mechanisms.

An advantage of developing such criteria for assessing organisational KM systems is the potential to compare organisational KM systems. It is noted that to conduct any form of cross-case analysis, it is imperative to first establish some characteristics which will be used as a basis for comparison (Eisenhardt, 1989). Therefore where some overlaps can be established, organisations could compare each others KM practices as a means of improving their KM systems.

This chapter has argued a case for the characterisation of process tasks. These characteristics have been identified based on their influence on how easily process decisions are made. In the process, a link between process characteristics and domain, process knowledge, knowledge objects and KM systems has been established. It is argued that the characterisation is an important part of this research project because it links daily operational activity with KM categories and hence the KM assessment exercise. It also helps to establish KM requirements of an organisation. Therefore KM assessment is incomplete without the characterisation of tasks and organisational contexts. Potentially, task characterisation is useful in analysing and comparing organisational KM systems. Establishing task criteria could become the basis to compare and contrast KM systems of different organisations as argued for by Eisenhardt (1989). As such the characterisation proposed has focused on the level of standardisation in processes, the number of interacting parts and knowledge types. It is averred that the characteristics are linked to

other salient features of process such as autonomy in decision-making, availability of resources, emergencies and pressure of time and therefore have enough breadth to compare organisational processes at a meaningful level which provides enough basis for a comparison of KM systems.

9 Application of the KM Assessment tool (The Case of PPH)

9.1 General Overview of Chapters 9-11

This phase of the research project had two related objectives: firstly, to test the usability of the proposed KM assessment tool through its application in real life organisations and secondly, to modify the tool and the methodology where inadequacies are noticed during its application. The testing of the KM assessment tool required the collection of context-specific and rich data about an organisation in order to create a picture of organisational reality while at the same time allowing respondents to rate the effectiveness of their KM practices for the daily operations they undertake. Data about the organisational processes, structure, culture, knowledge sharing practices and norms was required to determine the KM requirements and challenges that emerge in the organisation on a day-to-day basis. It was against this backdrop that respondents in the organisation rated the importance of the knowledge management categories proposed by the OKM framework to their organisation. Furthermore, respondents rated the effectiveness of KM mechanisms based on the perceived impact of those mechanisms on their organisational processes i.e. are the KM mechanisms effective in identifying, creating, developing, sharing, accessing, integrating and retaining knowledge that is used in the operational activities of the organisation. Where problematic issues relating to the use of the tool arise, modifications to the tool or assessment process are made, in a spiralling process akin to, but not action research. This cycle is illustrated by figure 9.1.

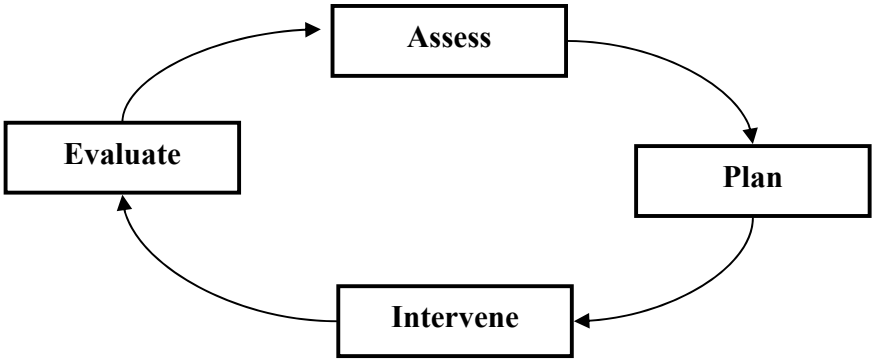


Figure 9.1: The cycle of modifying the QFD tool

9.1.1 Data Collection

The data collection methods used were semi-structured interviews and documentary evidence. The KM assessment tool is an integral part of the data collection phase. Primarily, the relationships between KM categories and mechanisms, and KM categories and barriers were discussed within the context of each organisation's daily operations. The ratings assigned to each relationship were provided by the interviewee. The ratings are a reflection of the interviewee's perception of the organisational situation with regards to KM practices. Moreover, data pertaining to the overall functions of the organisations; historical developments of certain aspects of the organisational practices and norms; relationships between units, subunits and departments, etc. were investigated in order to develop a clear understanding of the organisational contexts of the participant organisations. Some of the data pertaining to organisational context was represented as ratings in the KM barriers section of the KM assessment tool.

9.1.2 Data Analysis

The first challenge of the data analysis phase was to convert the output of the KM assessment tool into a meaningful articulation of the KM situation of an organisation. There were two issues related to this challenge: determining whether the KM assessment tool output was an accurate reflection of the interview, and whether the interview data was a reflection of the organisational reality. If these two issues could be verified, then it could be concluded that the KM assessment tool output had captured the organisational reality.

The KM assessment tool has a section which reports on the overall impact of each KM mechanism on the KM system of an organisation. Calculations similar to QFD technical assessment were used to reach these findings (refer to Appendix 2). These figures are summary analyses of the relationships between KM categories and mechanisms. From the figures detailing the overall and relative effectiveness of the KM mechanisms it was possible to rank the KM mechanisms in order of effectiveness in the organisation. Furthermore, the ratings assigned to the KM barriers are added up horizontally to determine their impact on the KM activities of the organisations. It was possible to cross-check some articulations by participants against the scores assigned to the KM barriers and KM mechanisms scores. In some instances some inconsistencies surfaced, which triggered further collection of data and clarification. In other cases, inconsistencies could be noticed where importance ratings for KM categories did not correspond with the

effectiveness ratings of the KM mechanisms in those categories. Such analyses revealed the strengths and weaknesses of the KM system of the organisations.

Another major challenge of the analysis was to determine the KM requirements for each of the participant organisations. KM requirements are derived from the articulations of the interviewees about the operational environment and organisational processes. This is similar to "capturing the voice of the customer" and expressing it in a set of design characteristics as is the case in traditional QFD methodology (Lampa and Mazur, 1996). The objective is to identify organisational situations and processes that would be amenable to KM practices; identify the KM categories that correspond to those situations and where appropriate, making suggestions for KM mechanisms based on knowledge of KM literature or by transferring the KM experiences of other participant organisations. This analysis culminated in the proposal of a "desirable" KM system for each organisation. The researcher reported these proposals to the organisations for feedback and clarification whereupon adjustments were made to the proposed "desirable" KM system for each organisation. The "desirable" KM system would be juxtaposed with the "current" KM system in order to perform a gap analysis and identify KM mechanisms that required improvement. Conclusions on the effectiveness of the entire KM system or parts of it are drawn from these comparisons. This is the advantage of using the KM assessment tool -its ability to analyse either the entire system or sections of it.

In the meantime, shortcomings of the initial design of the KM assessment tool were revealed. Observations were made about the use of certain "sections" of the tool which did not contribute enough to present an accurate picture of the organisations. These

shortcomings in the design of the tool and the methodology of KM assessment would then be modified and inform the final design of the KM assessment tool.

9.1.3 Reporting on Findings

The reporting of cases was done on a case by case basis; discussing the merits of the KM assessment tool and process in each of the organisations. The populated KM assessment tool was discussed in each of the reports, describing what the output of the tool meant and how this impacted on the operations of the organisation. All accounts of the use of the KM assessment tool were given to the participant organisation for two reasons: first to provide feedback that could enable the organisation to make improvements to its KM practices, and second to enable the researcher to get clarification on the accuracy of the reports; make adjustments on inaccurate reporting of the organisational reality and clarify "fuzzy" issues. Therefore all accounts presented in this thesis have been agreed with participants. The final product of the second stage of the research project is the proposal of a modified KM assessment tool and methodology.

9.2 The Case of Private Psychiatric Hospital (PPH)

The remainder of this chapter presents the case of *Private Psychiatric Hospital. – a private Mental Health organisation in which the KM assessment concept was applied in order to identify aspects of the concept that require modification and to improve the KM practices of the organisation. Private Psychiatric Hospital (PPH) is a special services

* Real name changed for confidentiality purposes

provider dealing with Personality Disorders (PD) of autistic, and Aspergers syndrome clients. It has a capacity of 102 beds which requires 80 direct contact staff during the night shift and between 130 and 140 staff for the day shift. Given that PPH is a private institution, there is a requirement for innovation towards marketing the organisation. Furthermore, expectations for quality services from the service user and increased profits from the internal perspective put more impetus on the need to manage knowledge better. Therefore PPH presents a good knowledge intensive environment where application of the KM assessment tool could yield useful feedback on the usability and value of the tool.

9.2.1 KM Assessment Output

It is ascertained from the KM assessment matrix (refer to Appendix 2), that PPH rated the importance of the knowledge categories to PPH as follows:

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Retention	Extremely Important (5)
Access	Very Important (4)
Integration	Very Important (4)
Identification	Somewhat Important (3)
Development	Somewhat Important (3)
Creation	Somewhat Important (3)

Table 9.1. Illustrating Importance ratings of the KM Categories in PPH.

The last three categories were given the same importance rating. An analysis was carried out in order to ascertain whether these ratings were reflected by the output of the KM assessment matrix. The findings are discussed below. Assuming that the importance ratings are a true reflection of the organisational reality and that the KM practices in PPH reflect these importance ratings, then the associations between KM categories and

mechanisms should have a recognisable pattern as follows: KM categories with higher importance ratings should be seen to have more KM mechanisms with which they have strong effectiveness scores than those with low importance rating.

9.2.2 KM Categories and Mechanisms

Initial analysis of the KM assessment matrix (Appendix 2) involved calculations that would determine the overall effectiveness and percentage effectiveness of each of the KM mechanisms. It was found that the mechanisms were ranked in the following order from the highest to the lowest in terms of overall effectiveness in PPH:

- Employees (as knowledge repositories),
- induction,
- databases,
- seminars
- university courses

In terms of overall effectiveness, these mechanisms represent the top five in PPH. Despite the fact that the KM assessment matrix has a list of 25 mechanisms, these five are the most notable because of their significantly high scores in overall effectiveness within PPH. Table 9.2 illustrates the associations between the top five KM mechanisms and the KM categories in PPH.

KM Mechanisms	KM Categories with Strong Association	KM Categories with Moderate Association	KM Categories with Weak Association	KM Categories rated as Important to Organisation	Number of categories with strong association to KM mechanism
Employees	Sharing Retention Access	Identification Development Integration	Creation	Sharing Retention Access Integration	3/4
Induction	Development Integration	Sharing Access	Identification Creation Retention	Sharing Retention Access Integration	1/4
Databases	Retention Access		Identification Development Creation Sharing Integration	Sharing Retention Access Integration	2/4
Seminars	Development Sharing	Access	Retention Integration Identification Creation	Sharing Retention Access Integration	1/4
University Courses	Development Sharing	Access	Identification Creation Integration Retention	Sharing Retention Access Integration	1/4

Table 9.2: Summary of Findings from KM assessment Matrix (PPH)

Table 9.2 shows that there is limited association between the KM categories rated as most important in PPH and the most significant KM mechanisms. The number of strong associations between the most important KM categories and mechanisms show no clear pattern.

Meanwhile, Table 9.3 matches the importance rating of each of the KM categories with the number of strong associations each of the categories has with KM mechanisms.

KM CATEGORY	Number of strong Associations	Importance Rating Assigned by Interviewee
Knowledge Sharing	7	5 (Extremely Important)
Knowledge Development	5	3 (Somewhat Important)
Knowledge Retention	2	5 (Extremely Important)
Knowledge Access	2	4 (Very Important)
Knowledge Integration	1	4 (Very Important)

Table 9.3 Comparing KM category ratings and number of strong associations (Derived from Appendix 2)

In doing so, Table 9.3 shows whether the importance ratings assigned to the KM categories by the interviewee are reflected by the KM assessment output in terms of the number of strong associations. It is a test of consistency within the KM practices in PPH and to establish whether importance ratings are reflected in the associations between KM categories and mechanisms.

It is gathered from Table 9.3 that there is no observable pattern between KM category ratings and the number of strong associations each category has with KM mechanisms. This situation is epitomised by the knowledge development category which, despite being strongly related to three of the five significant KM mechanisms making it the second most developed KM category in PPH, has a rating of "somewhat important". Two conclusions can be drawn from these findings: that the KM system in PPH is not by design but has evolved over time. The management of knowledge is therefore being done on an *ad hoc* basis. Secondly, it is concluded that PPH is performing poorly in knowledge retention, access and integration. This point is reflected in the low number of strong

relationships between KM categories and mechanisms despite the high importance ratings of the KM categories.

The KM assessment output also shows that PPH primarily retains its knowledge in the heads of employees. This raises the question of how accessible this knowledge is. Analysis of the KM assessment output shows that there are only two KM access mechanisms with strong associations: databases/repositories and employees. IT skills (refer to the KM barriers section of Appendix 2) are not a considered to be a barrier therefore PPH staff could interact effectively with the databases and obtain information and knowledge as and when they require it- hence the strong effectiveness rating. However, accessing the knowledge that is in employees heads is dependent on a variety of factors such as the willingness of employees to share their knowledge, the arrangement of work within the organisation, and the number of interactions with other personnel that allow the transfer of tacit/internalised knowledge. Further assessment of the KM assessment tool shows that there is insufficient contact between employees through traditional KM mechanisms such as mentoring and coaching and networks. These have both been rated weak for their effectiveness. Consequently, there is likelihood that tacit knowledge is not being transferred effectively in PPH.

The KM assessment output also confirms the association between storage and retrieval of knowledge. The two KM mechanisms: databases/repositories and employees are strongly related to the knowledge retention as well as the access categories. While this situation confirms the association between knowledge retention and access (Carlisle and Rebentisch, 2003), more importantly it shows the overdependence of PPH on its

employees as KM mechanisms where other mechanisms could be used. Alternative KM mechanisms for knowledge retention and access are discussed below where a "desirable" KM system for PPH is proposed.

Finally, the KM assessment output shows that process and knowledge mapping are both weakly associated with all the 7 knowledge categories. While it is acknowledged that the NHS is a well-regulated body with standard practices governed by rules, procedures and guidelines, hence the possibility that process and knowledge mapping are not as valuable, it is important to point out the potential of the KM mechanisms in an organisation such as PPH. As a special services provider dealing with Personality Disorders (PD), PPH requires internal mechanisms that provide a framework for consistency of decisions and outcomes for critical incidents e.g. the management of difficult patients, self harm and attempted suicides; something that should become part of the organisational KM system. In such instances process and knowledge mapping could be the mechanisms to outline a course of action and where particular organisational knowledge artefacts can be accessed and applied.

To summarise, the KM system in PPH is more *ad hoc* than the product of careful design. The analysis also shows that there are weaknesses in the "current" KM system particularly in retention, access and integration of knowledge. Furthermore, its configuration could be described as a "soft" system according to Swan et al's., (1999) definition. Preliminary analysis of the output suggests that the current system is not sufficient for PPH to efficiently manage its knowledge. However, further analysis of

operations and processes in PPH will confirm this as well as to identify the requirements of the organisation.

9.2.3 KM Barriers

This section illustrates the challenges to the implementation and integration of KM practices in PPH. There are 11 KM barriers in total that were identified in the literature review and pilot studies. From the KM assessment output, it is gathered that PPH has problems with the following:

- Lack of infrastructure
- No incentives
- Lack of management support

These KM barriers were given a rating of 9 which means they strongly impact the implementation and integration of KM activities in PPH. These ratings are supported by some of the contextual information provided by the interviewee with regards to challenges to KM in PPH. However, a discrepancy is notable in the scores assigned to "knowledge hoarding" and "no incentives". It is argued that knowledge hoarding is directly related to the no incentive KM barrier; where there is no incentive to share knowledge employees hoard knowledge in what is known as the "knowledge is power" syndrome (Kluge et al., 2001). Therefore, the assigning of a 1 score for knowledge hoarding and a 9 for no incentives is inconsistent. A 9 score for knowledge hoarding would have been consistent. Perhaps a logical explanation for this outcome is the fact that PPH operates in a humanitarian industry where care for clients and professionalism are

incentives above material incentives or personal recognition. Furthermore, it is noticeable that the scores are identical throughout the whole column for each of the KM barriers. This trend is identified as another discrepancy as KM barriers would be anticipated to impact on each of the KM categories to different degrees. Further discussion of these findings is done under lessons learned (section 9.11)

The next section analyses the operations in PPH in order to develop a list of KM requirements for the organisation which will be converted into a KM system that is deemed to be "desirable" for PPH. It would be helpful in highlighting the shortcomings of the "current" KM system that was analysed above

9.3 Designing a "desirable" KM System for PPH

This section reports on the "contextual" information about PPH which helps to paint a reality of the existing situation in the organisation. It aims to combine background information about PPH and the nature of work in PPH in order to illustrate how this influences the design of a KM system for PPH.

9.3.1 Characteristics of Process Knowledge in PPH

There are multiple disciplines associated with the care of autistic, Personality Disorder (PD) and Aspergers syndrome clients. These include psychology, psychiatry, occupational therapy, social work and nursing; all necessary for the kind of work undertaken in PPH. When nurses are developing care pathways and treatment regimes for clients, they are required to integrate information from all these disciplines. It is found

that while nurses do not require in-depth knowledge of all these disciplines, they are required to interpret the information they are provided and evaluate its significance in the development of a treatment regime. Therefore a high level of analysis, assessment and integrative capabilities is essential to do the required job. Table 9.4 shows the core activities taking place on the wards in PPH. It summarises the types of data, information and knowledge associated with the PPH's services.

Service Operations	**Examples of data, information and Knowledge generated**	**General characteristics of knowledge**
Ward Round/ Client Assessment	Observed behaviour; Client activities; Global Assessment Forms (GAF) score sheets; Activity Daily Living Skills (ADLS) forms; Activity Logs; Daily Progress Report Forms; Risk Assessment Forms	Short exploitation period; Data and information prone to rapid change; Wide range of users; Stored as electronic patient records (EPR).
Client Care	Drug dosages; Care pathways; Treatment regimes; Progress review forms	Subject to debate and dialogue; Input from multiple disciplines; Knowledge mostly carried in employees' heads Medical history stored on EPR

Table 9.4: Summary of data and information and knowledge found in PPH

Having established the general characteristics of processes in the day-to-day routines on the ward in PPH, it is important to determine how these are classified in terms of the level of standardisation, interaction with other organisational functions and knowledge types. These three criteria are characterisations of process tasks that were used as a basis for analysing processes in order to determine the KM requirements of the organisations studied -in line with the operations perspective proposed in this research. They also provide the basis for making comparisons and contrasts between organisations (Eisenhardt, 1989) which are useful for transferring KM practices. It is not an objective

of this research to transfer KM practices; however, obvious cases for the transfer of KM practices will be identified from the case study organisations to make this point. Table 9.5 summarises the characterisation of tasks and knowledge types in PPH. The table also shows the researcher's submissions on the KM implications of the task characterisations and knowledge types found in PPH.

Characterisation of Process Tasks	**PPH Task Characteristics**	**KM Implications**
Level of Standardisation	Structured days; Defined activities with specific output forms. High probability of emergencies in management of difficult patients. Ad hoc response to situations.	Knowledge retention possible if output forms are standardised. Potential gains from established process maps for critical incident occurrences.
Number of Interacting Parts	High level of interaction required between teams of nurses and multi-disciplinary groups e.g. psychologists, psychiatrists, social workers, care assistants, nurses, and occupational therapists. High inter-dependence of functions. High pressure of time to make decisions	Potential for better interaction through knowledge sharing. Need for integrating useful information and knowledge from several sources. Access to information and knowledge sources is critical. Potential gains if information and knowledge is retained and stored centrally
Knowledge Types and Artefacts	High reliance on explicit data and information- Observed behaviour; Client activities; Global Assessment Forms (GAF) score sheets; Activity Daily Living Skills (ADLS) forms; Activity Logs; Daily Progress Report Forms; Risk Assessment Forms. Tacit knowledge- Analysing and interpretation of information. Integration of multiple sources of data and information into treatment regimes. Decision-making and judgement in pressure situations of difficult client management	Regular updating of knowledge sources required. Interaction between and among teams has potential for knowledge and skills transfer. Transfer and retention of implicit and tacit knowledge is critical for consistent decision -making

Table 9.5: Summary of PPH Task characterisation.

9.3.2 Capturing the Voice of the customer

This section briefly outlines the KM needs of PPH as captured from the articulations of the interviewee. It contributes towards establishing the requirements of the KM system for PPH. According to Lampa and Mazur (1996) the voice of the customer can be in the form of problem situations outlined by the customer, suggested solutions or identified opportunities. However, sometimes the customer is not fully aware of their needs. Inclusion of the unspoken needs in the final design of the product has the potential to delight customers (Kano, 1984). In this research project, reference is made to some interview excerpts which partly inform the list of KM requirements in PPH:

"We have an environment where we have to make decisions rapidly and any sort of tool or mechanism that is put in place to help us in our decision-making process is welcome. I am talking about care plan treatment regimes; I am talking about managing difficult patients".

"We make decisions in a vacuum. Information accessibility is of paramount importance".

"People are not willing to share their knowledge or they give too little information which is meaningless".

"You have to choose the relevant information because a lot of meaningless information is floating about".

"There are non-specific tools to assimilate information from clinical team managers meetings. There are no formal systems"

"How we transfer specialist knowledge in fields like Psychology, Psychiatry, Nursing…Nurses need to know how to assimilate all this information and need an induction programme or something to help them..."

From the above excerpts of the "voice of the customer" and the subsequent discussion of task characteristics, the following conclusions can be made about the KM requirements of PPH:

- The temporal dimension is very important with regards to access to information and knowledge as it may literally mean the difference between life and death. The KM system should prioritise the immediate and short term accessibility of information and knowledge. Moreover, regular updating of information is important as the information has a short exploitation period.
- Knowledge sharing should form a significant and important part of the KM activities because there are multiple interacting disciplines and teams. Furthermore, since it has been observed that PPH retains knowledge in the heads of employees, it is important that this knowledge is accessible through multiple channels of knowledge sharing in order to share tacit knowledge and ensure consistency of good decision-making and high quality care.

- Recording and standardisation of critical incident resolution is important to retain knowledge. Furthermore, trends can lead to knowledge development and act as the trigger for the identification and/or creation of new knowledge.
- Developing "primary care giver" knowledge is paramount to keep their knowledge current. Also, knowledge about the other disciplines is necessary for nurses so that they can correctly evaluate the value of information where they encounter it.

In a discussion to confirm these conclusions with PPH, it was agreed that the KM requirements noted above addressed most of the inefficiencies identified from the "current" KM assessment output. For example, the requirements emphasise the need for information and knowledge possessed by staff to be more accessible. This requirement particularly addresses an earlier observation that PPH retains most of its knowledge in employees' heads. Moreover, the identification of knowledge and the potential to create more knowledge is addressed with the suggestion of process mapping and 5-Y analysis.

9.3.3 A "Desirable" KM System

From the foregoing analysis of the interview data and requirements of a KM system in PPH, a "desirable" KM system, was constructed (refer to Appendix 3). In the absence of a best practice example this was done by logical deduction. Section 9.4 discusses the differences between the "current" and "desirable" KM systems and further explores the methods/processes or mechanisms by which PPH can move from the "current" to the

"desirable" system. In this section, proposed changes are presented and justified. Firstly there is a requirement to revisit the importance of the various knowledge management categories to PPH in view of the above findings. It is proposed that the importance ratings for the KM categories be revised as follows:

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Retention	Extremely Important (5)
Access	**Extremely Important (5)**
Integration	Very Important (4)
Identification	**Very Important (4)**
Development	**Very Important (4)**
Creation	**Very Important (4)**

Table 9.6: Illustrating "desirable" Importance ratings of the KM Categories in PPH.

The ratings that were changed are highlighted in bold. These ratings were agreed upon with PPH staff to be a correct reflection of the reality given the contextual and situational analysis of PPH. All the KM categories were found to be very important as part of a holistic KM system, however, some were found to be priorities. For example, it was agreed that access to information is extremely important in assessment of clients. It involves collecting, organising and analysing information about the client before an assessment about their mental and physical state can be concluded. Therefore access to data and information is a basic part of providing a holistic health service. Furthermore, knowledge sharing and retention were found to have an association. PPH operates in an environment where employee turnover is high. Hence, knowledge sharing was found to be a means of decentralising the knowledge base of the organisation; where service impairment could occur should knowledgeable employees leave the organisation. Moreover, the "current" KM assessment output showed how most of the knowledge in

PPH was stored as tacit knowledge in the heads of employees. As such knowledge sharing is rated as extremely important in order to ensure consistent decision-making of high quality. Appendix 3 shows the proposed KM system that would be suitable for PPH based on these findings.

The KM assessment output of the "desirable" KM system (Appendix 3) is more balanced in terms of the scores for the overall importance and relative importance of each of the KM mechanisms. There are no KM mechanisms that "stand out" in terms of their effectiveness in the organisation. Notable introductions to the "desirable" KM assessment output are 5-Y analysis, process mapping and knowledge mapping. These KM mechanisms are effective for the identification of bottlenecks, jams and missing knowledge and could potentially be the triggers for the creation of new knowledge in PPH. Most notable is the decreased reliance on employees as a knowledge retention mechanism. Other mechanisms which improve the accessibility of information and knowledge have been included, for example, corporate websites and intranets, process and knowledge maps, and databases.

There are notable differences between the "desirable" and "current" KM systems in terms of the number of strong associations between KM categories and KM mechanisms. For example, the knowledge sharing category had 7 strong associations in the "current" which improved to 16. Furthermore, the knowledge retention category improved from 2 strong associations to 7, while the knowledge access category improved from 2 strong

associations to 10. These increases illustrate the changes to importance ratings of the KM categories and the KM requirements in PPH illustrated by Table 9.6.

It is important to state that the proposals for specific KM mechanisms in the "desirable" KM system depicted by Appendix 3 have been identified as appropriate by analysing practices of other organisations that participated in the research project. The association between assessment and transfer of practices in order to continuously improve operational practices has been established (for example, Zairi, 1993). Therefore the "desirable" KM system proposed is theoretical but contains elements that have been proven to work in practical settings.

In the final analysis, the "desirable" KM assessment matrix shows a KM system that could not be described as either "soft" or "hard". It shows a steady blend of "soft" and "hard" KM mechanisms which is encapsulated by the operations management perspective of KM (OKM).

9.4 Prioritising KM mechanisms for Improvements

The main differences in the two KM matrices are the effectiveness ratings of the following KM mechanisms:

- Process Mapping
- Knowledge Mapping
- 5-Y analysis

- Intranet
- Databases/repositories
- Meetings
- Mentoring and coaching

The rationale behind these changes in the "desirable" KM matrix is provided by the KM requirements outlined above. Mentoring and coaching as well as meetings are designed to facilitate sharing of knowledge and the transfer of tacit knowledge amongst employees. Likewise, databases/repositories and the intranet could be used more effectively to transfer and retain knowledge in PPH and also to make it more accessible to employees. Process and knowledge mapping and 5-Y analysis address the need to standardise procedures for critical incidents occurring in the hospital. These are the issues identified as key KM requirements.

However, it cannot be assumed that PPH can implement these KM mechanisms without considering other organisational factors. Issues to be considered should include the organisation's know-how, willingness, financial capacity and infrastructure to make the improvements as well as the perceived barriers to such actions-in other words, the organisational contextual issues referred to in Chapter 6. In this section data in the KM barriers section and the "roof" of the KM assessment tool is considered as part of the decision-making process on which KM mechanisms should be prioritised. It is argued that implementation of KM mechanisms should begin with those mechanisms whose implementation is quicker and relatively easier to implement in order to garner quick

benefits and more support for the initiatives once the benefits are realised. A method that was developed in this research to help with the order of KM mechanism implementation is outlined below.

9.4.1 Determining Organisational Difficulty to Implement changes

Organisational difficulty in traditional QFD applications is assigned based on the intuition of product engineers and designers – the QFD team. Problems do not arise in such situations mainly because experience and know-how of the QFD teams informs this activity. In the case of the KM assessment tool, it is a recognised fact that users of the tool may not be conversant with its application or have experience with KM systems or QFD methodology. As such there is a need to develop a method for users of the KM assessment tool to arrange their proposed changes in order of priority. The method proposed here takes into account the contextual issues that may impact the ability of the organisation to implement the changes. It is argued that this approach enhances consistency of outcomes for users given the aforementioned likelihood that users will not be conversant with the application.

Organisational difficulty is calculated on the basis of the KM barrier scores and organisational competence scores (refer to Appendix 3). It is suggested that dividing the KM barrier score by the organisational competence score yields a figure that gives an indication of how difficult the implementation of improvements for a particular KM mechanism may become- the organisational difficulty score. Ideally the KM barrier score

should be as low as possible since it is an indication of the difficulty in implementing KM activities in an organisation. Conversely, a high organisational competence score indicates that an organisation has the capability to implement proposed changes; hence this score needs to be as high as possible. It is therefore deduced that a high organisational difficulty score for a proposed change places the change in question lower down a priority list. Appendix 3 shows the KM barrier totals for each of the KM categories in PPH. The average score for the KM barriers is 37. Table 9.7 shows the 7 KM mechanisms identified as representing the major improvements in PPH and how the figures produced in Appendices 2 and 3 are applied to inform the decision-making process of prioritising KM mechanisms. Appendix 4 (KM Assessment guide) shows how the organisational competence scores for each of the KM mechanisms are calculated using the output of the KM barriers section on the KM assessment matrix.

KM Mechanism	KM Barriers score	Organisational Competence score	Organisational Difficulty	Priority Number
Intranet	37	3	12.3	**7**
Databases/Repositories	37	7	5.3	**3**
Process Mapping	37	6	6.2	**4**
Mentoring and coaching	37	7	5.3	**1**
5-Y Analysis	37	4	9.3	**6**
Meetings	37	7	5.3	**2**
Knowledge Mapping	37	4	9.3	**5**

Table 9.7: Calculation of organisational difficulty and order of implementing improvements

From Table 9.7, it is concluded that PPH could start by implementing the mentoring and coaching KM mechanism. Two other KM mechanisms have an equally low organisational difficulty score. Where an organisation has two or more KM mechanisms

with the same organisational difficulty scores, the decision on which KM mechanism to implement first should be based on the effectiveness scores because it is expected that an organisation would realise more of a change from its application than the alternatives. Consequently, mentoring and coaching, which has a total effectiveness score of 207 (refer to Appendix 2), would be implemented first in PPH. Meetings are ranked second on the priority list because of the superior effectiveness score they have to that of databases/repositories. The same principle is used to separate the KM mechanisms 5-Y analysis (why-why analysis) and knowledge mapping which are ranked fifth and sixth respectively.

An underlying assumption of this method of prioritising is that organisations will accept changes and improvements that yield results quicker. Therefore if an organisation implemented changes in KM mechanisms that it is more competent in, it is likely that the benefits will be realised much quicker and the initiative would garner more support from sceptics.

9.5 Discussion

The "current" and the "desirable" KM assessment outputs have significant differences that are worth exploring. While discussing the outcomes of the "desirable" and "current" outputs with PPH, it was observed that the differences in the KM assessment outputs was down to the fact that the "desirable" KM assessment output is a product of careful planning and design whereas the "current" KM assessment output is not. When organisations do not actively design their KM systems and manage KM practices, it is

likely that they do not fully appreciate their KM requirements or the strengths and weaknesses of their KM practices. Consequently, it is expected that KM practices in an *ad hoc* system are inconsistent with the KM categories that an organisation considers to be highly important as in the case of PPH. It is suggested that the absence of a carefully designed KM system in PPH is linked to the reluctance of top management to implement an organisation-wide KM initiative. There is a general lack of awareness of the benefits of KM which is characterised by a lack of proper assessment of processes and benchmarks which could help to define the success (or lack thereof) of the aforementioned KM processes. KM is perceived as a cost and not as an investment. Consequentially, the development of the "current" KM system over time has not been supported by specific KM design methodology and has resulted in identifiable gaps between what would be a "desirable" KM system for PPH and the "current" KM system. Moreover the lack of KM design methodology resulted in some "anomalies" in the "current" KM assessment output, examples of which are list below:

- Anomaly 1: The importance rating assigned to the knowledge development category in the "as is" QFD output did not correspond to the number of strong associations with KM mechanisms.
- Anomaly 2: The ratings assigned to the "no incentives" and "knowledge hoarding" KM barriers did not correspond.

However, another viewpoint and explanation for these "anomalies" suggests that the "anomalies" may be indicative of the inability of organisations (PPH in this case) to conduct a self-assessment exercise. Another noted "anomaly" was in the analysis of KM

barriers where the scores for KM barriers were identical throughout the whole column for each of the KM barriers. This trend is identified as another discrepancy as KM barriers would be anticipated to impact on each of the KM categories to different degrees. Meanwhile, a different viewpoint may suggest that the observed anomalies are evidence of the limitations of single-respondent feedback; that some discrepancies should be expected where a single point of view informs the shaping of an organisational reality. In the case of PPH, a senior manager informed the research output. It could be argued that their position offers a bird's eye view of the organisation and it is therefore expected to be sufficient. However, the questions that arise from anomalies observed necessitate that this possibility should be eliminated within the design of the KM assessment exercise. As a consequence, a few key questions were asked concerning the ability of organisations to self-assess their KM systems. These are:

- Are organisations fully aware of their KM needs?
- Are organisations competent enough to assess their KM requirements?
- Does single-respondent feedback provide an accurate reflection of the organisational situation?

The foregoing questions contribute to lessons learned in the use of the KM assessment methodology to assess and design a KM system and these are discussed below.

9.5.1 Lessons Learned

- It may be necessary to employ the help of an expert in KM where organisations are not conversant with the subject area and the processes involved in self-assessment.
- Secondly, the data collection process needs to be conducted in a consultative manner which seeks to obtain consensus on the ratings assigned to the KM assessment variables. It is likely that individuals at different levels in an organisation will hold different views of the organisational reality based on their experiences and interactions with the organisational day-to-day operations. Therefore it is argued that a consultative approach combines these diverse views into a holistic reality of the organisation.

It is noticeable that there are additions to the KM mechanisms of the "desirable" KM system (Appendix 3). These were mechanisms that were identified in PPH but were not on the KM assessment tool. Therefore these were previously omitted in the early design of the tool. The importance of this is that it emphasises an earlier observation that the initial design of the KM assessment tool requires testing in a practical setting. The lesson is that the initial list of KM mechanisms is only a reflection of reviewed literature and the pilot study. It should be expected that this list will expand as more and more organisations are included in the research project. Therefore subsequent applications of the KM assessment tool should actively encourage organisations to add to the existing list.

9.6 Conclusion

This chapter has outlined the manner in which the KM assessment tool was used in PPH, a privately owned Mental Health Hospital. In the process, it was possible to produce a KM assessment output which made it possible to ascertain the "key" KM mechanisms in PPH but more importantly, how these "key" KM mechanisms are linked to the KM categories considered to be the most important in PPH. This exercise was used to determine whether the importance of KM categories was reflected in PPH's current KM practices. To this end, it was necessary to determine PPH's core processes and characterise them in terms of level of standardisation, knowledge types and number of interacting parts. The characterisation also enabled the researcher to establish KM requirements for PPH, which subsequently became the basis for proposing a "desirable" KM system for PPH. The most important aspect of the assessment exercise is that a juxtaposition of the "current" and "desirable" KM outputs allowed the visualisation of aspects of the "current" KM practices that required improving in order for the organisation to migrate towards an "ideal" state.

On appraising the KM assessment exercise in PPH, it was noted that there were aspects of the KM assessment exercise that required to be modified. The most important issue was that a consultative approach to assigning ratings and providing feedback is more suitable than single-respondent feedback because it has the potential to eliminate discrepancies in the data provided. It potentially increases the chances of a more holistic organisational reality while enhancing the chances that the exercise will be completed in

a competent manner. Furthermore, during the assessment exercise, it is imperative to inquire from organisations whether all their KM mechanisms are reflected in the KM assessment tool. The exercise in PPH showed that the initial list was not comprehensive therefore there is likelihood that more organisations will expand the list further.

10 Summary of Findings Manufacturing Co.

10.1 Introduction

This section presents the case of *Manufacturing Co. – an organisation in which the KM assessment concept was applied. Manufacturing Co. manufactures 3 different kinds of transmission boxes for Ford. They produce approximately 1,465 IB5 type, 260 MT82 and 100 MT75 type gear boxes per day. The output at Manufacturing Co. is fairly steady and repetitive. Most processes are done daily, at given times and resources used are mostly the same. The shop floor divides into five sections and twenty-nine teams. The factory has seven hundred and forty employees that are made up of six hundred and forty hourly paid employees and one hundred staff. The method, collection and analysis of the data have been articulated in Chapter 9. Therefore, this section will only discuss the findings of the application in Manufacturing Co.

10.2 Findings of the case study in Manufacturing Co.

10.2.1 KM Assessment Output

It is ascertained from the KM assessment matrix (refer to Appendix 4) that Manufacturing Co. rated the importance of the knowledge categories to Manufacturing Co. as follows:

* Real name changed for confidentiality purposes

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Retention	Extremely Important (5)
Access	Somewhat Important (3)
Integration	Somewhat Important (3)
Identification	Somewhat Important (3)
Development	Somewhat Important (3)
Creation	Somewhat Important (3)

Table 10.1: Illustrating Importance ratings of the KM Categories in Manufacturing Co.

Notable is the fact that the last five knowledge categories were rated the same- as "somewhat important". Essentially this output suggests that Manufacturing Co. places a significant amount of resources towards knowledge sharing and retention. It is expected, therefore, that the "key" or significant KM mechanisms in Manufacturing Co. support these two KM categories. An analysis was carried out in order to determine whether these "importance to organisation" ratings were reflected by the KM mechanisms is use in the operation.

10.2.2 KM Categories and Mechanisms

It was found that the KM mechanisms were ranked in the following order from the highest to the lowest in terms of overall effectiveness in Manufacturing Co.:

- Job Aids (e.g. process diagrams, operations sheets, structured week)
- Traineeships
- Apprenticeships
- Databases/Repositories
- Employees
- University Courses

These represent the top six KM mechanisms in Manufacturing Co. These 6 are the most notable because of their significantly high scores in overall effectiveness in Manufacturing Co. Table 10.2 summarises the associations between the most effective KM mechanisms in Manufacturing Co. and the KM categories.

KM Mechanisms	KM Categories with Strong Association	KM Categories with Moderate Association	KM Categories with Weak Association	KM Categories rated as Important to Organisation	Number of categories with strong association to KM mechanism
Job Aids	Identification Sharing Retention Access Integration	Development	Creation	Sharing Retention	2/2
Traineeships and Internships	Development Creation Retention Access	Sharing Identification Integration		Sharing Retention	1/2
Apprenticeships	Retention Access Sharing Integration		Identification Development Creation	Sharing Retention	2/2
Databases	Sharing Retention Access	Identification Development Integration	Creation	Sharing Retention	2/2
Employees	Identification Retention Access	Development Creation Sharing Integration		Sharing Retention	1/2
University Courses	Creation Sharing Access	Development Integration Retention	Identification	Sharing Retention	1/2

Table 10.2: Summary of Findings from KM assessment matrix of Manufacturing Co.

There are enough strong associations between the most effective KM mechanisms in Manufacturing Co. and the KM categories that are rated as important to suggest that there is a direct relationship which is the result of organisational design. Assuming that the ratings are a true reflection of the reality in Manufacturing Co. it could be concluded that

the KM system in Manufacturing Co. is effective for the organisational needs. Whether the "importance to organisation" ratings assigned by Manufacturing Co. are representative of the organisational KM requirements is a question that is answered below. Meanwhile, it is important to explore other aspects of the KM assessment output.

The KM assessment output shows that the two KM categories (sharing and retention) have 5 and 8 strong relationships respectively. These two KM categories have been rated as "extremely important" by the organisation therefore this outcome shows some consistency. However, the output also shows that knowledge access has 9 strong relationships despite being rated as "somewhat important". This could be considered an inconsistent outcome if it is assumed the KM system in Manufacturing Co. is a product of planned organisational design. The other KM categories (creation, development, identification and integration) reflect associations with KM mechanisms that are consistent with the importance ratings assigned to the KM categories. A different viewpoint of this outcome would suggest that there is a direct relationship between knowledge sharing and knowledge accessibility. It would be expected that knowledge is readily accessible in an organisation where employees are more willing to share their knowledge through various KM mechanisms and vice versa. This suggestion is true in the case of Manufacturing Co. where each KM mechanism that has a strong relationship with the knowledge sharing category also has a strong relationship with the knowledge access category.

Likewise, it is noticeable how the KM mechanisms that are strongly related to knowledge retention are the same ones applicable to knowledge access. The KM assessment output shows seven matches between KM retention and access mechanisms; confirming the storage/retrieval relationship often referred to in KM literature. Also, a significant amount of knowledge is retained in the heads of employees yet this mechanism is only moderately associated with the knowledge sharing category. The KM mechanism (employees) is strongly associated with the knowledge access category. This leads to the conclusion that knowledge retained by employees as tacit knowledge is easily accessible through various forms of interactions. The KM assessment output suggests that this knowledge is accessible as employees interact through the following: apprenticeships, traineeships and internships, mentoring and coaching and meetings. However, meetings are shown to be weak for knowledge access.

There clearly is a connection between the willingness of employees to share their knowledge and the accessibility of this knowledge. The KM assessment output shows that employees are moderately effective in sharing their knowledge. This is supported by information in the KM barriers section: the KM barriers knowledge hoarding, no incentives and fear of idea robbery are all rated as strong in the organisation. This could explain why employees are rated as moderately effective for knowledge sharing.

The output also leads to the conclusion that the KM system in Manufacturing Co. is biased towards “soft” KM mechanisms such as apprenticeships, mentoring and coaching and traineeships. These make up the bulk of the most effective KM mechanisms and have

the most number of strong associations. Although mapping of processes and identification of new knowledge using a variety of techniques including 5-Y analysis was discussed during the interview, the output shows that their effectiveness is minimal and does not contribute significantly to the KM system.

10.2.3 KM Barriers

The interview data reveals that one of the biggest challenges to implementing KM activities in Manufacturing Co. is a lack of incentives to do so. The interviewee revealed that the biggest stumbling block on the shop floor is a desire to work overtime. He said

> "*the biggest problem in this company is overtime…everybody wants overtime. 90% of the arguments are over overtime…who has got more than them and why. It's punishment to share your knowledge because then you lose your overtime. If someone knows something he will not share his knowledge so he can get his Saturday. The people that are overtime hungry will not tell you anything or bare minimum. If I tell you how to fix that machine you might come out on Saturday…next week there might be something that you might know so we get into a sparring of not sharing information".*

Clearly the organisation suffers from a culture of knowledge hoarding. These findings were confirmed by the ratings assigned to knowledge hoarding, fear of idea robbery and lack of incentives on the KM assessment output (KM Barriers). An interesting insight into the incentive system at Manufacturing Co. came up during one of the interviews when the interviewee mentioned that Manufacturing Co. had previously rewarded

employees with a car if knowledge shared led to savings of at least one million pounds. The result was a burgeoning suggestions list with ideas that were not very useful. When employees realised that some of their ideas were not taken it resulted in them becoming de-motivated to share. However, when this incentive scheme was discontinued, employees were left with no real motivation to share knowledge. Manufacturing Co. has now begun to introduce other forms of incentives such as pride in your job and recognition, in order to get employees to participate more, particularly in sharing the knowledge that they have. It has not yet gathered momentum.

Further to this, there was a problem with old and problematic machinery on the shopfloor. Interview data revealed that continuous breakdown of machinery created a crisis situation where there was no time to properly record and document the work that was being done on the machinery-information which would have benefited the next maintenance personnel to work on that machine. Manufacturing Co. has a "W" drive which was supposed to be used for documenting knowledge. However, use of the "W drive" had not been efficient for two reasons: firstly, because of the crisis mode, there was no time to record process work done on machinery and secondly, the initiative stalled unless there was someone in management driving it. The interviewee revealed that a maintenance coordinator who was responsible for driving the initiative was no longer in the employ of Manufacturing Co. and hence the initiative had suffered. This situation showed that there was no organisational buy-in into the benefits of KM and ownership of the initiative. Both these issues were emphasised on the KM barriers section of the KM

assessment tool; the KM barrier "lack of time" was emphasised when the interviewee discussed the work structure in the organisation.

Meetings are a significant part of the structured week. However, they were only rated as moderately associated with knowledge identification, development, sharing and integration and weakly related to the rest of the KM categories on the KM assessment output (Appendix 4). An analysis of documentary evidence showing the structured week activities revealed that out of the whole week, the interviewee had only 6 hours that were not devoted to meetings. Further inquiry from the interviewee revealed that there was a problem of "over-implementation" of the structured week. Though the structure is present, it was revealed that there were too many meetings and the organisation was too "regimental" with the process. This is an example of a situation where implementation of KM activities yields sub-optimal deliverables. As argued by the interviewee,

> "*you can identify as many problems as you want, unless you have got the time to do it, it is not going to get done…in terms of all this meeting stuff, when am I actually supposed to do anything? Just going round meeting after meeting after meeting…it's a waste of time to be honest"*.

In the final analysis of Manufacturing Co., the organisation has a sound appreciation of the benefits of KM. However, a combination of organisational culture barriers, the continuous evolution of KM mechanisms and other factors (such as over-implementation) had resulted in the KM system facing operational challenges. Therefore the next section

shall take a critical look at the operation and propose a "desirable" KM system for Manufacturing Co.

10.3 Designing a KM System for Manufacturing Co.

This section reports on the contextual information about Manufacturing Co. It aims to combine background information about Manufacturing Co., the nature of work in Manufacturing Co. in order to inform the KM requirements of the organisation which would underpin the designing of a KM system.

10.3.1 Characteristics of Process Knowledge in Manufacturing Co.

There is a substantial rate of process knowledge creation in Manufacturing Co. As a manufacturing organisation, knowledge and information that is derived from data is used to improve product quality and production efficiency. Day-to-day manufacturing activities usually do not require nor create substantial amounts of new knowledge except in the cases when SPC and other TQM techniques are used to control and continuously improve production efficiency.

Knowledge used and generated during normal production operations has various characteristics. For example, analyses of SPC charts have a relatively short exploitation time-frame and must be updated regularly. Furthermore, the knowledge extracted from the SPC data is useful not only to the production engineers but also to quality and maintenance personnel. This knowledge is also useful to machine operators, managers, graduate engineers, apprentices etc. Therefore, it can be concluded that knowledge in

Manufacturing Co. has a wide range of users, requires frequent updating, has a short period from which to extract its utilisation. However, the information and knowledge has a high re-utilisation rate where past work, and procedures for problem-solving is revisited to avoid re-inventing the wheel.

The interviewee divided the process knowledge into production knowledge and product knowledge where the production dimension is made up of process (manufacturing), machinery, control systems, operators and quality control. The product dimension is made up of design, quality control and function. It was argued that the key to efficient plant operations is to address the production dimension. If this dimension is controlled well, the dimensions of the product are delivered. As a primarily production-oriented organisation, Manufacturing Co. focuses on the production knowledge from a plant operations point of view. This is emphasised in the following quote from the interviewee with reference to recruitment of engineers:

> "*…the problem that we have had here is that on engineers, we have taken on engineers that know about gear boxes. And we could be making anything, it doesn't matter what we are making. You need to get process engineers…you need to get people that know about control systems…how to improve manufacturing processes…it could be anything, it just happens to be a gear box this time. The only time you need to know about a gear box…it's a small portion of our work".*

The characteristics of process knowledge in Manufacturing Co. are illustrated by Table 10.3.

Production Operations	Example of data, information and knowledge generated	General characteristics of knowledge
General Operations	Production trend charts SPC charts, OEE data Stock list, inventory data	Knowledge and information change relatively fast. Short exploitation period before it becomes obsolete
Maintenance Operations	Maintenance schedule Minutes of production meetings	Regular updating required and a wider range of users for most generated knowledge
Quality Control Operations	Quality procedures Capability study data, Set-up times TQM documents	Knowledge is stored in various media such as word documents, spreadsheets, templates, graphs, charts, databases and software programmes

Table 10.3: Characteristics of knowledge used and generated in processes

Having established the general characteristics of processes in the day-to-day routines in Manufacturing Co., it is important to determine how these are classified in terms of the level of standardisation, interaction with other organisational functions and knowledge types. This characterisation of organisational tasks is important in determining the implications for KM in an organisation. The rationale for the use of this characterisation has been articulated in Chapter 7. Table 10.4 summarises the characterisation of tasks and knowledge types in Manufacturing Co.

Characterisation of Process Tasks	Manufacturing Co. Task Characterisation	KM Implications
Level of Standardisation	Structured week provides high level of standardisation. Continuous mass production; low variation Well-defined processes evidenced by process diagrams. Established process inputs and outputs Occasional emergencies such as machine breakdown	Large amount of explicit data-retention and access ease is important. Limited amount of process innovation and creation of knowledge. Consistency of outcomes quite high
Number of Interacting Parts	High interaction and data flow required between maintenance team, quality department, engineering department, and logistics department. Autonomous intra-departmental decision-making. Personnel work in own "pigeon holes". Pressure of time to make decisions is high Inter-dependence on data analyses	Potential for better interaction through knowledge sharing. Integration of intra and inter-departmental data and information into processes is crucial. Effective retention through recording and storage of work done is very important. Accessibility of knowledge resources critical
Knowledge Types and Artefacts	Heavy reliance on explicit knowledge-SPC output, process diagrams, OEE data, Pareto charts, Trend charts Stock list, inventory data, latest scrap rate, Machine maintenance schedule, part specification and gauge data Explicit knowledge has short exploitation period. Tacit knowledge application- understanding and interpretation of process data and information. Decision-making and judgement of action to be taken. Interaction within teams and interpretation of situations	Timely access to and exploitation of data and information. Regular updating of knowledge artefacts e.g. trend charts required. Increased interaction for transfer and development of tacit knowledge. Potential to standardise decision-making process for consistency of decisions.

Table 10.4 Summary of Manufacturing Co. task Characterisation

From the foregoing the following conclusions can be made about the KM requirements in Manufacturing Co.:

- Knowledge sharing should form an important part of the KM activities because the many teams of various disciplines require the same data, information and knowledge

- The management of data and information cannot be separated from knowledge processes because the creation and application of knowledge is dependent on the availability of up-to-date data and information. Therefore, data sources and final users should be identified through the mapping of processes and knowledge. The mapping of processes and knowledge also supports the development of standard processes which is relevant to Manufacturing Co. since the operation is mass production focused.
- Recording and standardisation of machine breakdown and critical incident solutions already occurs in Manufacturing Co. but needs to be supported by the removal of impediments identified as KM barriers in the organisation, e.g. lack of time to record new knowledge and lack of incentives to share knowledge. A change of culture and attitudes towards KM is also required on the shop floor.
- The high re-utilisation rate of data and information in Manufacturing Co. means that the storage and retrieval mechanisms need to be given due attention in designing a KM system.

The "importance to organisation" ratings assigned to the KM categories in Manufacturing Co. needs to be revisited in light of these KM requirements. Knowledge identification was rated as "somewhat important" in the "current" KM assessment output as was knowledge access. However, it is felt that these two KM categories should be assigned a higher importance rating in the organisation for the following reasons:

(1) The information and data in Manufacturing Co. is utilised by employees that represent various departments including maintenance, quality and general machine operators. As such the movement and accessibility of this information amongst these departments has a bearing on how effectively and efficiently decision-making is done. Knowledge access is therefore very important to Manufacturing Co.

(2) Knowledge identification is very important to Manufacturing Co. so that they do not continue to react to problems noted in section 10.2.3. Manufacturing Co. was reported to be in crisis mode because of the continuous breakdown of machines. Triggers for the identification and creation of new knowledge can put the organisation in a position where they anticipate situations instead of always reacting to them.

Table 10.5 illustrates the changes to the "current" ratings. The adjustments are highlighted in bold.

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Retention	Extremely Important (5)
Access	**Very Important (4)**
Integration	Somewhat Important (3)
Identification	**Very Important (4)**
Development	Somewhat Important (3)
Creation	Somewhat Important (3)

Table 10.5: Illustrating Importance ratings of the "desirable" KM system.

10.4 The "desirable" KM System

A "desirable" KM system for Manufacturing Co. is illustrated by Appendix 5. The importance of knowledge sharing is underlined by the number of KM mechanisms that have strong associations with the KM category. The "desirable" KM output shows 13 strong associations as opposed to 5 in the "current" output. The knowledge access and identification categories also have increases from 9 to 16 and 2 to 5 respectively. This underlines the importance of these KM categories to the operations in Manufacturing Co. However, notable improvements in effectiveness from the "current" are process mapping, intranet and 5-Y analysis. These KM mechanisms have a direct impact on the KM requirements that were identified above. These KM mechanisms largely impact the ability of the organisation to identify bottlenecks in the system, which become the triggers for knowledge identification and/or creation. As such the organisation is not always reacting to situations but can anticipate and avoid disruptions to production.

Further to these observations, there is a notable balance in the use of KM mechanisms in the KM assessment output. There are no KM mechanisms that could be considered to be more significant relative to the other mechanisms in the organisation.

10.4.1 Prioritising KM mechanisms

The main changes have been noted for the following KM mechanisms:

- Process Mapping
- Knowledge Mapping

- 5-Y analysis
- Intranet
- Handover sessions
- Meetings
- Short courses

However, it cannot be assumed that Manufacturing Co. can implement these KM mechanisms without considering other organisational factors. As noted in Chapter 9, issues to be considered should include the organisation's know-how, financial capacity and infrastructure to make the improvements as well as the perceived barriers to such actions. Similarly, the output of the KM assessment tool in the KM barriers section and the "roof" is considered as part of the decision-making process on which KM mechanisms should be prioritised. It is argued that implementation of KM mechanisms should begin with those mechanisms whose implementation is quicker and relatively easier to implement in order to garner quick benefits and more support for the initiatives once the benefits are realised. Application of a method that uses the information gathered on the KM assessment tool is integral to this activity. This is discussed in more detail below.

10.4.2 Determining Organisational Difficulty to Implement changes

Appendix 5 also shows the KM barrier totals for each of the KM categories. The average score for the KM barriers is 48. Table 10.6 shows the 7 KM mechanisms identified as

representing the major improvements in PPH and how the figures produced in Appendices 5 and 7 are applied to inform the decision-making process of prioritising KM mechanisms.

KM Mechanism	KM Barriers score	Organisational Competence score	Organisational Difficulty	Priority Number
Intranet	48	7	6.6	**2**
Team-boards	48	7	6.6	**3**
Process Mapping	48	5	9.6	**6**
Short courses	48	6	8	**4**
5-Y Analysis	48	6	8	**5**
Meetings	48	7	6.6	**1**
Knowledge Mapping	48	3	16	**7**

Table 10.6: Determining Organisational difficulty in Manufacturing Co.

From Table 10.6, it is concluded that the KM mechanism where improvements could start is mentoring and coaching despite the fact that two other mechanisms have an equally low organisational difficulty score. Where an organisation has two or more KM mechanisms with the same organisational difficulty scores, the decision on which KM mechanism to implement first should be based on the effectiveness scores. Therefore, meetings are ranked first on the priority list because of the superior effectiveness score they have to that of the intranet and team-boards. The same principle is used to separate the KM mechanisms short courses and 5-Y analysis (why-why analysis) which are ranked fourth and fifth respectively.

10.5 Discussion

KM is fairly developed in Manufacturing Co. The organisation has implemented KM initiatives to a certain extent and has the structure from which a KM system could be

further developed. For example, prior KM work in Manufacturing Co. has sought to use the intranet as the key medium for interfacing with the user (see Buniyamin, 2004). Furthermore, the interview revealed that a variety of mechanisms had been implemented in order to aid the management of data, information and knowledge. For example, before the Master Stock (an inventory management application) was introduced, calculation of requirements for production components was done manually. However, with the introduction of the application, a production meeting could identify areas where more components are required by identifying areas that are shown in red -these show production points where component levels have fallen. Effective management of this data helps in the decision-making of productions-related activities and is an example of the data-information-knowledge progression. The interviewee also provided documentary evidence of process diagrams that were created using simple Microsoft applications, that are valuable for knowledge retention and accessing process knowledge.

The framework for the KM initiative in Manufacturing Co. is provided by the structured week. Documentary evidence provided established that each day of the week is structured as follows:

Monday - Safety

Tuesday - People

Wednesday - Quality

Thursday - Cost

Friday - Engineering.

Each of these days is divided into specific tasks/activities that are concerned with the identification of problematic areas where improvements are required. For example, on Monday the focus is on safety. Documents at hand show a list of safety tasks/activities to be completed on the day, the resources to be used while performing the tasks, and finally the expected outputs or deliverables of the activities. Knowledge about tasks, where to find the knowledge, and the expected outcomes is mapped onto the structured week documents. The structure allows Manufacturing Co. to isolate and improve particular areas of their operation systematically. The structured week is dependent on meetings, exchange of production knowledge, and review of process data. Therefore it provides a platform for identification of knowledge, requirements for training and development, sharing and integration. The KM practice in Manufacturing Co. is therefore based on the application of process and continuous improvement. There are specific processes that can be identified and singled out for KM process application in the organisation. From the foregoing, it is suggested that a KMS in Manufacturing Co. should focus on processes through the application of practices that create, capture, share and leverage knowledge. The knowledge objects that are generated by the processes can be labelled with the relevant information for users such as machine type, date of service, problem solution or some identification that is required to allow retrieval for the next user of the process. The current KM system is based on this application of process; however, application is not organisation-wide and does not include all the possible KM mechanisms that the organisation could use. The gaps in the use of KM mechanism have been identified from the “current” KM assessment output.

It could be concluded that KM is understood by certain quarters of the organisation and could be implemented where tangible benefits can be perceived. The logical reasons for the gaps identified in the "current" KM assessment output are attributed to inefficiencies created by the cultural aspect of change which was identified as a major KM barrier in the organisation. Moreover, the knowledge hoarding and reluctance to share important information for the purposes of acquiring overtime typifies the "knowledge is power" syndrome which negatively impacts on the KM initiatives in the organisation. Furthermore, a different view might suggest that the rapidly changing business environment may have caused a "lag" in the "current" output and the KM mechanisms that are relevant to KM as the business evolves over time. The value of the KM assessment methodology in an organisation like Manufacturing Co. is that it highlights the shortcomings in the whole KM system as opposed to piecemeal improvements. However, given the resistance to change which is characteristic of Manufacturing Co., it is logical to argue that piecemeal improvements to the KM system are the best approach to KM implementation as opposed to large scale KM initiatives.

Considering the barriers to KM in Manufacturing Co., the implementation of a "desirable" KM system is largely dependent upon acquiring buy-in at organisational level, changing the organisational value system with regards to incentives and rewards; and the creation of a knowledge pull designed into application of process. It is suggested that a KM initiative based on application of process prompts a bottom–up approach which encourages buy-in and overcomes resistance to change as well as creating a knowledge-pull for process users. However, the bottom-up approach is not without its

criticism, for example, Davenport and Prusak (Davenport and Prusak, 2000) suggest that this approach is one of the pitfalls of KM implementation. However, it is argued here that a KM system based on the application of process becomes an integral part of everyday business and not an additional system that is accessed only when knowledge is deemed to be required and is therefore appropriate for Manufacturing Co.

The additional dimension organisational difficulty reflects a consideration for the contextual and situational analysis of the organisational culture and norms in determining the order in which changes and improvements should be implemented. One of the factors that determine organisational competence is whether an organisation has previously used a KM mechanism or not. Points are awarded where previous use can be established without due consideration for the effectiveness of that mechanism. In the case of Manufacturing Co., a potential weakness of the proposed method of calculation is observed. Meetings, handover sessions and team-boards have been given a low difficulty rating because they are already being used in the organisation. For example meetings form a significant part of the structured week. However, a closer analysis revealed that they (meetings) have not been as effective as desired within the organisation. Therefore, prior use does not necessarily entail competence to implement. In the case of Manufacturing Co., the organisation would be required to make adjustments that make meetings more effective such as:

- Reviewing the process of conducting meetings
- Creating feedback mechanisms that monitor outcomes of meetings

- Prioritising certain kinds of meetings (for example, productions meetings) over others

In the final analysis, implementing the KM mechanisms that have the highest effectiveness as well as the lowest perceived organisational difficulty is the best way of implementing changes because it yields quick returns that could further motivate KM champions and win doubters over.

10.5.1 Lessons Learned

- The original KM mechanisms list needs to be more flexible by allowing organisations to add mechanisms that have been omitted in the initial design of the tool. Appendix 5 shows one such addition.
- The assessment process requires to be conducted in a manner that does not make it monotonous and tiring. Perhaps dividing the process into shorter segments may be helpful; for example assessing the KM categories and mechanisms separate from the KM barriers allows the interviewee time to reflect on responses as well as recover physically.
- The scoring system for association between KM categories and KM mechanisms should leave the cell blank where the KM mechanisms is not used instead of assigning a score of one (1). This has been observed with some of the associations with the effect of distorting the final analysis and outcome of the benchmarking dimension in the tool.

10.6 Conclusion

This report has illustrated how KM assessment methodology was used to assess the KM system of Manufacturing Co. In the case study, a KM assessment matrix was analysed and related to specific data from the interview. It could be concluded that the KM assessment matrix is a true reflection of the organisational situation. The value of the methodology in illustrating an organisation's KM reality was, therefore, demonstrated. Overall, the analysis observed a single anomaly in the KM assessment output with regards to the associations between the KM mechanism (employees) and the KM categories knowledge sharing, retention and access. The anomaly typifies the subjectivity of the assessment process which emphasises the need to obtain consensus from all quarters of an organisations undergoing this assessment exercise. The case further illustrated the value of assessing organisations with existing KM initiatives regardless of the scale of implementation. It was possible to recognise the successes of the "current" KM system in Manufacturing Co. and also to specify the mechanisms which the organisation was using to manage its knowledge assets. This gave the platform to further analyse the KM system for possible KM improvements. Given the contextual and situational analysis of Manufacturing Co., it was concluded that a bottom-up approach to implementing a "desirable" KM system was required in Manufacturing Co.

With regards to the functionality of the tool, it was concluded that it was useful in highlighting areas where improvements can be made. Furthermore, the case study identified aspects of the KM assessment process that need adjusting in order to make it

more effective for its intended use. These are articulated under lessons learned. It is acknowledged that the KM assessment methodology used in the case study cannot master every aspect of a KMS. Hence the study has prioritised certain aspects of the KM system in Manufacturing Co. and made proposals for their improvement. Finally, the proposed KM system cannot be deemed to be complete as it should always be evolving.

11 Psychiatric Ward

11.1 Introduction

*Psychiatric Ward (PW) is an acute in-patient ward within a Psychiatric Hospital in the North of England. It has been so named for the purposes of confidentiality. PW has twenty-one beds but houses, on average, sixteen patients at any given time of the year. The ward has twenty-six employees, twenty of whom are qualified nurses. At face value, PW's operations centre on taking care of mentally-ill patients until they are well enough to be re-integrated back into the community. Alternatively, other types of care are recommended. PW offers a 24 hour service for the care of mentally challenged patients. As such work is organised into 3 shifts. For a continuation of care to take place without the interruption of missing information or data, the exchange of such is of paramount importance. Evidently, this is a knowledge intensive environment where the proper application of knowledge is vital for the recovery of patients. This makes Psychiatric Ward an interesting place to study in the context of how operational knowledge is created, stored, transferred and applied. This case study details the work conducted in PW as part of the on-going exercise to develop a KM assessment tool.

* Name changed for confidentiality purposes

11.2 Summary of Findings in Psychiatric Ward

11.2.1 KM Assessment Output

The KM assessment output shows that the Psychiatric Ward assigned the following weightings for importance to organisation (Appendix 6).

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Development	Extremely Important (5)
Access	Very Important (4)
Retention	Very Important (4)
Identification	Somewhat Important (3)
Integration	Somewhat Important (3)
Creation	Somewhat Important (3)

Table 11.1: Importance ratings assigned by PW

An analysis was carried out in order to determine whether these ratings were reflected by the KM mechanisms in use in the operation.

11.2.2 KM Categories and Mechanisms

It was found that five KM mechanisms in PW are significant because of their high scores in overall effectiveness. From the most effective, the KM mechanisms are ranked as follows:

- Training
- Hand-over sessions
- Mentoring and coaching
- Meetings

- Traineeships and Internships

The association between the most effective KM mechanisms in PW and the weightings for KM categories was investigated in order to establish any patterns of interest. These are the main facts:

- All 5 KM mechanisms are strongly related to the knowledge sharing category
- 3 of the 5 KM mechanisms are strongly related to the knowledge development category
- None of the top 5 KM mechanisms are strongly related to the knowledge retention category
- 2 of the 5 KM mechanisms are strongly related to the knowledge access category.

Table 11.2 summarises the relationships that exist between the "key" KM mechanisms in PW and the KM categories.

KM Mechanisms	KM Categories with Strong Association	KM Categories with Moderate Association	KM Categories with Weak Association	KM Categories rated as Important to Organisation	Number of categories with strong association to KM mechanism
Training	Development Sharing	Identification Access Integration	Creation Retention	Sharing Development Retention Access	2/4
Hand-over sessions	Sharing Access	Development Identification Creation	Retention Integration	Sharing Development Retention Access	2/4
Mentoring and Coaching	Development Sharing	Access	Identification Integration Creation Retention	Sharing Development Retention Access	2/4
Meetings	Sharing Access	Integration	Creation Identification Development Retention	Sharing Development Retention Access	2/4
Traineeships and Internships	Development Sharing		Identification Creation Retention Access Integration	Sharing Development Retention Access	2/4

Table 11.2: Summary of relationship between KM categories and mechanisms

The most conspicuous inconsistency in the findings thus far is that knowledge retention has weak associations with all the KM mechanisms. Therefore the importance rating assigned by the organisation is not reflected by the associations with the most effective KM mechanisms. As a matter of fact, knowledge retention is weakly associated with 21 of the 25 KM mechanisms on the KM assessment tool. However, the output is arguably consistent when considering the knowledge sharing and development categories that are rated as extremely important by PW. Knowledge sharing is strongly associated with all the five KM mechanisms identified as most effective while knowledge development has three strong associations. Furthermore, when considering the whole KM assessment

output, knowledge development is the most developed KM category as it has seven strong associations with the KM mechanisms while knowledge sharing has five strong associations. Given that the KM assessment output is a true reflection of the interview data which in turn is a true reflection of the organisational reality, it is important to establish why the inconsistency in knowledge retention has occurred.

11.2.3 KM Barriers

External Influence – There is an industry-wide crisis that is characterised by financial crisis and personnel shortages in the NHS. PW is directly affected by this situation and its problems are characterised by a lack of employee motivation and high labour turnover. The interviewee revealed that "*we have been asked not to fill the position of an employee who left last year so we now operate with a small number of qualified personnel. People need to know what is going on because private hospitals are attracting more and more people away from the NHS".* This statement reveals the uncertainty that surrounds the health care industry and as a result more experienced personnel find it better to work in private institutions where the remuneration is higher than the public sector. The lack of incentives (financial or otherwise) is emphasised by the 9 rating assigned to the "no incentives" KM barrier on the KM assessment output.

Internal Influences – The KM philosophy is new to PW. There had not been any mention of KM prior to the organisation participating in the research project. The interviewee discussed knowledge from a skills and competency perspective where the organisation strives to improve employee skills as well as to motivate them to learn more. Therefore,

knowledge about KM is lacking in the organisation. This is the biggest barrier to KM being implemented on any level. However, there are other issues that impact the ability of the organisation to embed KM into daily operations. For example, the interviewee revealed that there was hardly enough time to engage in KM activities such as the recording of solutions to recurrent problems because patient care in itself consumed a significant amount of time. Therefore proper recording or archiving of important knowledge was deemed to be time consuming and, at times unnecessary. In the event that care personnel deemed it necessary to record information, it was often the case that this was done on pieces of paper or forms which are not easily accessible and difficult to store. The organisation does not have the infrastructure to support knowledge authoring. Therefore re-inventing the wheel is a common occurrence. These findings are illustrated by the ratings assigned to the "time consuming" and "no infrastructure" KM barriers.

11.3 Designing a "desirable" KM system for PW

This section reports on the contextual information about KM in PW. It aims to combine background information about PPH, the nature of work in PW and illustrate how this influences the design of a KM system for PW.

11.3.1 Characteristics of Process Knowledge in PW

PW offers a 24 hour service for the care of mentally challenged patients. As such various activities take place in the designated 3 shifts of work. For a continuation of care to take place without the interruption of missing information or data, the exchange of such is of paramount importance. Table 11.3 outlines some of the activities taking place and

characterises the data, information and knowledge that is created, passed on or required for process tasks to be completed.

Service Operations	Examples of data, information and Knowledge generated	General characteristics of knowledge
Ward Round/ Client Assessment	Observed behaviour; Client activities; Global Assessment Forms (GAF) score sheets; Activity Daily Living Skills (ADLS) forms; Activity Logs; Daily Progress Report Forms; Risk Assessment Forms	Short exploitation period; Data and information prone to rapid change; Wide range of users;
Client Care	Drug dosages; Care pathways; Treatment regimes; Progress review forms	Subject to debate and dialogue; Input from multiple disciplines; Knowledge mostly carried in employees' heads Client Files with daily notes. Client care plan on Total Care System database

Table 11.3: Summary of data, information and knowledge found in PW

Nurses, with the help of care assistants, are the primary care givers in PW. They are assigned the duty to assess clients and make recommendations to psychiatrists, consultants, therapists and other team members on the multi-disciplinary team of care givers. When nurses are developing care pathways and treatment regimes for clients, they are required to integrate information from the other aforementioned disciplines and other nurses. It is found that while nurses do not require in-depth knowledge of all these disciplines, they are required to interpret the information they are provided and evaluate its significance in the development of a treatment regime. Therefore a high level of analysis, assessment and integrative capabilities is essential to do the required job. Table 11.3 is an illustration of the various types of information that needs to be considered before decisions are made, for example to make a care regime, admit or to discharge a

patient. The day-to-day routines in PW were classified in terms of the level of standardisation, interaction with other organisational functions and knowledge types. This characterisation of organisational tasks is important in determining the implications for KM in an organisation and can influence KM system configuration. Table 11.4 summarises the characterisation of tasks and knowledge types in PW.

Characterisation of Process Tasks	**PW Task Description**	**KM Implications**
Level of Standardisation	Structured days; Defined activities with specific output forms. High probability of emergencies in management of difficult patients. Ad hoc response to situations.	Knowledge retention possible if output forms are standardised. Potential gains from established process maps for critical incident occurrences.
Number of Interacting Parts	High level of interaction required between teams of nurses and multi-disciplinary groups e.g. psychologists, psychiatrists, social workers, care assistants, nurses, and occupational therapists. High inter-dependence of functions. High pressure of time to make decisions	Potential for better interaction through knowledge sharing. Need for integrating useful information and knowledge from several sources. Access to information and knowledge sources is critical. Potential gains if information and knowledge is retained and stored centrally
Knowledge Types and Artefacts	High reliance on explicit data and information- Observed behaviour; Client activities; Global Assessment Forms (GAF) score sheets; Activity Daily Living Skills (ADLS) forms; Activity Logs; Daily Progress Report Forms; Risk Assessment Forms. Tacit knowledge- Analysing and interpretation of information. Integration of multiple sources of data and information into treatment regimes. Decision-making and judgement in pressure situations of difficult client management	Regular updating of knowledge sources required. Interaction between and among teams has potential for knowledge and skills transfer. Transfer and retention of implicit and tacit knowledge is critical for consistent decision -making

Table 11.4: Summary of PW Task characterisation.

From the foregoing, the following conclusions can be made about the KM requirements of PW:

- Timely access to information and knowledge is imperative as it may literally mean the difference between life and death.
- Knowledge sharing should form a significant and important part of the KM activities because of the multiple interacting disciplines and teams. The sharing and exchange of ideas and knowledge helps to retain knowledge, ensure consistency of good decision-making and high quality care.
- Regular updating of information is important because of the continuous nature of the work. Also access to information is paramount as the pressure of time to make decisions is high as information has a short exploitation period.
- Recording and standardisation of critical incident resolution is important to retain knowledge.
- Developing "primary care giver" knowledge to keep their knowledge current is paramount.

In light of these KM requirements, it is necessary to re-visit the "importance to organisation" weightings assigned to the 7 KM categories by PW in order to investigate whether these KM requirements are reflected in the weightings assigned to the appropriate KM categories. It is submitted that knowledge integration requires to be assigned a higher score because of the requirement on care givers to combine vast amounts of information which may include patient histories, assessments and diagnoses. Furthermore, given the nature of the operation, it is argued that knowledge access should

be given a higher score because of the criticality of acquiring relevant information and knowledge for decision making. These proposed changes are highlighted in the bold print in Table 11.5.

KM Category	Importance to Organisation
Sharing	Extremely Important (5)
Development	Extremely Important (5)
Access	**Extremely Important (5)**
Retention	Very Important (4)
Identification	Somewhat Important (3)
Integration	**Very Important (4)**
Creation	Somewhat Important (3)

Table 11.5: Proposed weightings for KM system in PW

11.3.2 A "Desirable" KM system

A "desirable" KM system for PW is illustrated by Appendix 7. The importance of knowledge sharing is underlined by the number of KM mechanisms that have strong associations with the KM category. The KM output shows 14 strong associations as opposed to 5 in the "current" output. The number of strong associations for knowledge access and integration categories also increased from 2 to 8 and 0 to 5 respectively. This underlines the importance of these KM categories to the operations in PW.

Further to these observations, there is a notable balance in the use of KM mechanisms in the KM output- evidence of a more balanced KM system which also reflects the balance in the importance weightings assigned by PW for each of the KM categories. There are no KM mechanisms that could be considered to be more significant relative to the other mechanisms in the organisation. Juxtaposing the "current" and "desirable KM assessment

outputs (Appendices 6 and 7) shows notable improvements in effectiveness of process and knowledge mapping, intranet and 5-Y analysis can be noted. These KM mechanisms have a direct impact on the KM requirements that were identified above especially in terms of knowledge access and integration.

At this juncture it is important to note that this proposed KM output which depicts a "desirable" KM system for PW (Appendix 7) is theoretical and some practical considerations need to be taken into account for the improvements to become a reality. For example, the organisation needs to assess how barriers to KM will impact on initiatives to implement the proposed changes. Furthermore, PW also needs to consider whether it has the know-how, financial capacity and infrastructure to make the improvements. Therefore this next section is an assessment of PW and its options in implementing KM improvements.

11.4 Prioritising Improvements

The main changes have been noted for the following KM mechanisms:

- Process Mapping
- Knowledge Mapping
- 5-Y analysis
- Intranet
- Corporate Website

However, it cannot be assumed that PW can implement these KM mechanisms without considering other organisational factors. Organisational difficulty is used to determine the order of implementation.

11.4.1 Determining Organisational Difficulty to Implement changes

The KM mechanisms intranet and corporate website have slightly higher competence scores because they have been in use in the organisation and hence staff in PW is familiar with their use. Appendix 8 also shows the KM barrier totals for each of the KM categories. The average score for the KM barriers is 28 and is adopted as the KM barrier score for PW. Table 11.6 shows the 5 KM mechanisms identified as representing the major improvements in PW and how the figures produced in Appendices 8 and 9 are applied to inform the decision-making process of prioritising KM mechanisms.

KM Mechanism	**KM Barriers score**	**Organisational Competence score**	**Organisational Difficulty**	**Priority Number**
Intranet	28	5	5.6	**1**
Process Mapping	28	3	9.3	**4**
Corporate Website	28	5	5.6	**1**
5-Y Analysis	28	4	7	**3**
Knowledge Mapping	28	3	9.3	**5**

Table 11.6: Illustrating the main improvements to the KM system in PW

From Table 11.6, it is concluded that the KM mechanism where improvements could start could either be the intranet or corporate website. PW has the same score for organisational competence to implement either of these KM mechanisms therefore the

organisational difficulty scores are similar. Also, the effectiveness scores which could have been used to separate the two are the same. Where an organisation has two or more KM mechanisms with the same organisational difficulty scores, the decision on which KM mechanism to implement first should be based on the effectiveness scores. This point can be illustrated well using the KM mechanisms knowledge mapping and process mapping. Despite having the same organisational competence scores and hence organisational difficulty scores, process mapping is ranked fourth on the priority list because it has a higher effectiveness score on the assessment of the KM system.

11.4 Discussion and Conclusion

The sharing of knowledge is perhaps the single most important KM activity in PW. The effectiveness of shift work depends on the passing on of correct and comprehensive information at the conclusion of each shift. Therefore the day-to-day operations in PW are dependent on the passing on of information, and knowledge from shift to shift through hand-over sessions and meetings. Also, work is conducted in teams; the tasks are not individual and can be performed by any member of the team. As such there is a need to decentralise information and knowledge to aid and inform decision-making but more importantly to make decision-making consistent. This underlines the importance of personal knowledge sharing mechanisms such as mentoring and coaching in such environments and is reflected in the KM assessment outputs of PW.

The KM driver in PW is personal development. This position is influenced by the NHS which has introduced the Agenda for change in order to motivate employees to acquire

more skills and improve their remuneration packages accordingly. Documents provided by the interviewee discuss the Knowledge and Skills Framework (KSF) which is an outline of the key skills and competences employees need to do their job. The KSF was developed and agreed nationally as part of Agenda for Change. KSF uses the Review of Achievements and Development (ROAD) process as a vehicle to highlight training and development needs as well as an incentive for motivating staff to get a pay raise. (ROAD) is also a system that allows managers and staff to set clear objectives relating to their jobs and the skills required to carry out the job. It further allows feedback to be given to staff in relation to their performance against the required standard. In a nutshell ROAD links skills and competences to specific jobs within the framework of the whole Health Trust and provides the framework to be used in assessing how well staff have integrated their knowledge into organisational functioning. More central to this case study, is the function of this employee feedback mechanism to become a KM driver for a formal KM initiative as well as a foundation for establishing benchmarks for assessing the progress of the KM initiative in organisations under the NHS, in this case PW.

The importance of knowledge sharing and knowledge development in PW is reflected in the KM assessment output for PW. It is noted that the output is narrow; showing that the knowledge sharing and development categories are the most developed in PW. This fact is further emphasised by the finding that PW adopts personnel development as the KM driver. Although PW has not yet adopted KM formally, personnel development provides the basis upon which a KM system could be initiated. That being said, more consideration needs to be put towards the mechanisms of knowledge retention in light of

the critical operating environment and high employee turnover. In fact, it is remarkable that more effort is not put toward retaining employee knowledge. Despite the importance rating of knowledge retention the KM assessment output reflected a diminished effectiveness in the category.

From the foregoing, it is concluded that one of the reasons why organisations operate with sub-optimal KM systems is that they do not fully appreciate their KM requirements. In the case of PW this is due to the absence of KM knowledge and a lack of design methodology that can highlight the weaknesses of their current system, albeit informal. As such, the value of a KM assessment tool as presented in the case study is further emphasised. Its ability to highlight the weaknesses in the informal KM system in PW as well as to propose a theoretical KM system for PW has been demonstrated.

12 Discussion and Analysis

12.1 Introduction

The three case studies presented provide useful insights into the challenges facing organisations in assessing their KM operational processes and implementing KM improvements. This discussion and analysis re-visits some of the pertinent issues arising from the case organisations and discusses how these have influenced the development of KM assessment tool and methodology.

12.2 Weightings/Ratings of Relationships

The weightings of the KM assessment tool relationships are derived from traditional 9-3-1 and 1 to 5 ratings of QFD methodology. The figures associated with such characterisations for example, strong, medium and weak present an opportunity to attach quantifiable variables that lend themselves to mathematical manipulation and further analysis. Also, the assigning of figures makes it possible to determine the perceived contributions of KM mechanisms to the overall KM operational processes of an organisation in terms of real numbers and percent contributions. It is noted from case study findings that the weightings assigned to relationships are subjective and in some instances imprecise as noted from some of the case studies findings. However, this feature is not uncommon in traditional QFD methodology. QFD methodology attempts to translate subjective customer requirements into objective and relevant products and specifications (Zairi, 1992) and the impreciseness of the weightings is an acknowledged

weakness of the technique. With regards to the KM assessment methodology, there are some mechanisms that could be incorporated into the self-assessment process which could increase the objectivity and precision of the weightings. Gaining feedback on effectiveness of KM mechanisms from multiple levels of the organisation and seeking consensus on ratings assigned to relationships on the KM assessment tool is one way of improving the objectivity and precision of ratings. It is averred that the dialectic process that precedes the assigning of a score for each relationship provides an insight into the nature of not only the KM processes, but also the organisational processes and the infrastructural mechanisms that they are supposed to support. For example, when debating the relationship between the knowledge development category and apprenticeships in Manufacturing Co., considerations do not start and end with contribution of the apprenticeship programme to the KM system in the organisation but also critically examine the operational processes that apprenticeship programmes are best suited for. Therefore a deeper understanding of knowledge processes as well as organisational processes can be achieved. Additionally, participants of the KM self-assessment process need to be aware of the fact that weightings should reflect the organisational context as it is rather than "how it should be" when populating the KM matrix for the "current" KM system. Separation of these two issues is achieved in the methodology by requesting participants to populate a separate KM matrix for what is termed a "desirable" KM system which essentially depicts what an organisation's KM system should be if it was an optimum system. Another possible advantage of having multiple participants to the self-assessment process is that the chances of misconstruing the purpose of the exercise and confusing these two issues are reduced.

12.3 Interpreting KM matrices

The value of the KM assessment tool is that it is able to highlight inadequacies in the "current" KM practices of an organisation. The value of using symbols is emphasised in the initial stages of analysis because it is possible to identify unused KM mechanisms, strong relationships between KM categories and mechanisms, and developed KM categories. Although further analysis which considers the organisation's contextual issues such as size, task characterisations and culture is required for a more in-depth critique of an organisation's "current" KM system, a knowledgeable assessor could, by looking at the KM matrix output, observe notable or interesting patterns in the KM system. However, firmer criticisms of a KM system should depend on the articulations of the organisation with respect to what is important to its operations and daily activities. This is reflected by the ratings assigned to each of the seven KM categories in terms of "importance to organisation". The evaluation of the KM practices is conducted with a particular consideration for the effectiveness of the KM mechanisms used by the organisation. For example, an organisation which assigns an importance rating of 5 (extreme importance) to a knowledge category would expect to observe a considerable number of KM mechanisms rated as effective for that KM category; failing which this would be a noted weakness of the KM system. In light of this, some pertinent questions were raised in the case studies where evaluations of KM systems produced "anomalies" between weightings assigned to "importance to organisation" and the corresponding strengths of relationships between KM categories and KM mechanisms. Some of the "anomalies" can be attributed to an observation made during the course of data collection

to the effect that sometimes organisations are not familiar with KM, not least their KM requirements. It was possible to conclude from the findings in some of the cases studies that the development of the KM systems in the organisations were *ad hoc*, evolving in response to immediate pressures such as skills and human resource shortages, infrastructural inadequacies and sometimes simply because there was no clear design methodology for the KM system. A different viewpoint suggested that cultural barriers as well as weak incentive structures (as in the case of Manufacturing Co.) contributed to the weaknesses observed in the KM practices of the organisations. It was therefore rationalised that the resultant KM systems lacked the comprehensive consideration for operational processes, available organisational resources and possible knowledge processes that could be implemented to manage knowledge as evidenced by the KM assessment outputs. A KM assessment and design methodology as presented in this thesis is able to show these inefficiencies and identify gaps between KM requirements and performance. The three cases presented in the thesis have demonstrated this point.

12.3.1 Populating the KM Assessment Tool: Use versus Effectiveness

When populating the KM assessment tool for the "current" KM system, organisations were asked to identify the KM mechanisms that they use and subsequently assign ratings for the *usefulness* of the KM mechanisms within the organisation's KM processes, i.e. their effectiveness. Two variables can be identified from the above statement and it is pertinent to make a distinction between the two; level of use and effectiveness (of KM mechanisms). Level of use refers to the number of occurrences, amount of resources or time devoted to certain KM mechanisms in the organisations. On the contrary

effectiveness refers to the actual perceived value of implementing or using a KM mechanism. There is a possibility that interviewees confused the two variables and rated the relationships between KM categories for level of use instead of their actual effectiveness. A good example which can be used to illustrate this point better is from the case organisation Manufacturing Co. and concerns the use of meetings. The interviewee described the organisation as *"too regimental"* and that the organisation *"over-implemented"* the structured week and its use of meetings. Although meetings dominated a significant amount of the interviewee's schedule at work, the amount of time devoted to meetings did not reflect in the effectiveness score assigned on the KM assessment tool depicting the "current" KM system. In fact, the interviewee reported that he perceived meetings as a hindrance to performing his work well. In this case, the two variables use and effectiveness were clearly delineated.

In the case of PPH, it was necessary to confirm that weightings assigned to the KM assessment tool depicting the "current" KM system referred to effectiveness and not use. It was concluded that the scores assigned were for effectiveness. However, such confirmation could not be obtained for Psychiatric Ward where access to personnel was a constant challenge throughout data collection. In light of the "use versus effectiveness" debate, it becomes necessary to unequivocally state what type of data is required to populate a KM assessment matrix. It is proposed that adding a second KM assessment matrix to the first stage of assessment which is aimed at illustrating level of use for each KM mechanism is useful. A KM matrix depicting the level of use of KM mechanisms has other advantages other than to assuage the potential for misinterpreting KM matrices. For

example, it would be possible to isolate and investigate KM processes and mechanisms whose overall contribution to the KM system does not justify the resources invested towards their use. The population of a KM matrix depicting level of use of KM mechanisms provides the potential for further analysis into the dynamics of KM processes in an organisation. For example, juxtaposition of the KM assessment outputs illustrating level of use and effectiveness can help to identify activities that are not performing efficiently. Therefore, the KM system can be assessed at various levels that enhance the outcome of the assessment by enriching the facts that can be obtained from the process.

12.4 The KM Assessment tool as a design tool

In the three case studies, one of the main stages leading to the gap analysis is the development of a KM system that is desirable for an organisation. This KM system is, in theory, the best possible KM system for the organisation when all the contextual issues and situational analyses have been considered. However, one important question arises from this statement: How do you determine the characteristics of a "best possible" KM system? Essentially the term desirable is tantamount to claiming best practice without the benefit of knowing what best practise is. In traditional QFD methodology, the designing of innovative and quality products depends on converting the consumers' demands and articulations into quality characteristics and developing design quality for the finished product (Akao, 1990). The final verdict on the characteristics and quality of the product comes from the end-user/customer. Likewise, the designing of the KM systems in the three case studies depended on the organisational context provided in the interviews with

the organisations. The interviewees' articulations were translated into KM requirements and characteristics of a KM system for the organisations, leading to the KM matrix output depicting a "desirable" KM system. Although theoretical, the output can be viewed as a "prototype" awaiting approval by the organisations. The researcher subsequently sought feedback from the case organisations through the interviewees and the necessary changes were made to the "desired" KM matrix output to more accurately reflect the requirements of the organisations. As such, although the designed KM systems were not implemented in the case organisations during the course of this research, it could be argued that the potential of the KM assessment methodology to design KM systems was demonstrated.

The pertinent question to ask is "how is the KM assessment methodology different from traditional QFD application?" When using QFD, the most important tasks are to define and understand the "whats" –the needs of the customer and to define the "hows" to meet the customers' needs (Tan et al., 1998). The KM assessment methodology uses the same approach of gathering the articulations of the organisation in order to determine the KM requirements of the organisation. However, the KM assessment tool has modifications that make it different from the QFD matrix in certain functions. These modifications are necessary to reflect the dimensions of KM which are KM categories/activities, mechanisms and KM barriers. KM categories and mechanisms have been shown to mirror the *whats* and *hows* of traditional QFD matrices respectively. The key difference is that the KM assessment tool adds a third and critical dimension which is KM barriers. KM barriers replace a common feature of traditional QFD matrices which compares

competitors' products with an organisation's product. In this research project, this data is not available, neither is there a need for competitors' information. In the KM assessment tool, KM barriers illustrate the organisational barriers impacting on the KM processes of an organisation and are therefore directly related to KM categories/activities. This is an important and significant modification. Another key difference is the issue of application. While QFD is strictly a design tool, the KM assessment tool, as the name suggests could be applied solely for the purposes of illustrating a KM system of an organisation in order to assess and improve its impact on the efficiency of organisational operations.

Assuming that the lists of KM categories, mechanisms and barriers are comprehensive, it could be argued that the KM assessment tool integrates the most important aspects of KM at the operational level into a single tool which aids two different but related functions: assessment and design. This achievement is made more significant when considering that KM is multi-faceted and perspectives of the subject area make understanding of approaches to KM fragmented and often incomplete. The tool is also flexible as it allows organisations to add more KM mechanisms as evidenced in PPH and Manufacturing Co. Consequentially, inevitable questions about the comprehensiveness of the KM mechanisms and barriers become irrelevant as this concern could be addressed in the methodology of the KM assessment process.

12.5 Improving an Organisation's KM system

The purpose of deriving a "desirable" KM system for an organisation from its organisational context, i.e. its daily operations and what is important to its functioning

helps to determine the KM practice gaps between what an organisation is currently doing and what it ought to be doing. Further to this, an organisation can also examine its existing KM processes and determine where changes and improvements could be made in order to migrate towards the "desirable" state. However, it is acknowledged that KM system improvement can neither be described as complete or comprehensive as it should always be evolving. Therefore, an organisation is required to use the KM assessment methodology to identify the KM mechanisms where implementation would have the most significant impact on the KM system. The KM assessment methodology provides logical steps to be taken towards reaching this decision. The application of the methodology reduces the influence of intuition and guesswork in the decision-making process. To this end considerations need to be taken with regards to the ability of the organisation to implement these changes, referred to as the *organisational competence* to implement improvements and changes to its KM system. Factors to be considered include:

- Whether the KM mechanism has been used in the organisation or not.
- Whether there are any recognised synergies or compromises with other KM mechanisms.
- The ability to pay for the cost of implementing a KM mechanism.
- The time required to implement the KM mechanism.

Data on the first two factors can be derived from the KM assessment matrices. The phrase *ability to pay for the implementation of a KM mechanism* is preferred over the *cost of implementation* as this more clearly reflects the organisational context. Organisations are expected to cope differently with the budgetary demands associated with KM

improvements, hence the term ability to pay. While questions could be raised about the comprehensiveness of the factors listed above, particularly since the flexibility of the organisation in terms of readiness to change has not been included, it is posited that the listed factors can be assessed with a certain degree of objectivity that would be difficult to replicate when considering flexibility of an organisation. It is acknowledged that organisations should also assess their flexibility to change; which is influenced by various factors, not least the prevailing culture and organisational structures, etc. In light of this discussion, the significance of KM barriers as a dimension of KM and its inclusion as part of the KM assessment tool is justified. KM barriers constitute an important aspect of the decision-making process when determining a priority list of KM mechanisms to implement because they indirectly affect the ability of an organisation to change. Some KM barriers, for example, knowledge hoarding, lack of top management support, and fear of job loss could be perceived as elements that characterise organisational cultures. Therefore, it could be argued that issues to do with flexibility to change already constitute part of the prioritisation of KM mechanisms.

Together, the scores for organisational competence and KM barriers can be manipulated mathematically to give an indication of the organisational difficulty to implement changes. Dividing the KM barrier score by the organisational competence score yields the organisational difficulty score. This is an unprecedented method of determining organisational difficulty not least because the KM Assessment tool is a new development. As noted above, traditional QFD methodology relies on the intuition and experience of practitioners to suggest organisational difficulty of undertaking certain actions. The

methodology presented here is not aimed at de-emphasising the value of relying on experience to determine organisational difficulty but is proposed as a tool that enhances consistent outcomes in the decision-making- something that cannot be guaranteed in traditional QFD. Moreover, it is likely that the KM assessment tool will be applied by people that do not have prior experience with QFD applications or KM systems in which case experience or intuition will become irrelevant in the decision-making process. Hence a method such as the one presented in this thesis is a good starting point where further refining and modification could occur as more application of the tool presents issues that necessitate its review and improvement.

12.6 Future work: The Value of Benchmarking

In the three case organisations, KM mechanisms were suggested for the KM matrix depicting the "desirable" KM system for each organisation. These KM mechanisms were derived from the KM requirements established from the organisational contexts established in each of the organisations. In some instances, proposals for KM mechanisms were made based on observations from other organisations. For example, in the case of PPH, it was suggested that having an internship programme with local Universities would enhance PPH's chances of developing the practical skills of its newly qualified employees as well as give the Hospital exposure to potential employees- a practice used well in Psychiatric Ward. This is an example of transferring KM practices from one organisation to another. As argued by Zairi (1996), self-assessment, benchmarking and improvements are inter-connected. In the example provided, it should be noted that the phrase transfer of KM practice was used as opposed to the term

benchmarking as this suggests best practice. However, the potential for benchmarking within the KM assessment process needs to be underlined although given the differences in characteristics of the case organisations, it is difficult to imagine how benchmarking exercises would be possible except in a situation where there has been a comparison of specific criteria in the organisations. The criteria used in the three case studies characterise process/tasks in terms of the level of standardisation of tasks, the number of interacting parts (i.e. individuals, teams or business units) and the knowledge types used in processes- consistent with the operations perspective of KM. It is argued that the criteria could be a basis to compare KM requirements across the case organisations and subsequently applied for KM practice benchmarking where sufficient information could be gathered to establish best practice.

12.6.1 Transferring KM practices: The Case of PW and PPH

Psychiatric Ward (PW) and PPH have similar task characteristics as they are both Mental Health Institutions despite PPH being a privately owned organisation. It is therefore, reasonable to assume that they will have similar KM requirements. Given these similarities, the differences in the KM assessment output become more interesting to explain for these two organisations. The KM assessment outputs show that both PW and PPH exhibit a weakness in knowledge retention. Moreover, knowledge sharing is well developed in comparison with other KM categories but clearly not developed enough to transfer newly created knowledge in both organisations. It was noted that knowledge sharing is well developed with respect to the transfer of existing explicit knowledge. However, the most notable difference in the KM systems is the narrow focus of the

system in PW which focuses on knowledge development. It is suggested that this is a direct consequence of the "Agenda for Change" initiative driven by the NHS; hence knowledge development initiatives such as mentoring programmes and preceptorships form an important part of KM in PW. In contrast, because it is a private entity, PPH policy formulation responded slower to the "Agenda for change" initiative and is lagging behind in implementation. In this instance, an opportunity arises for PPH to learn from the practices of PW- thus instantiating the value of incorporating transfer of KM practice within the KM assessment process.

Furthermore, it is interesting to note how PW and PPH compare with Manufacturing Co. in terms of task characterisation. Similarities in some of their daily activities can be identified here. For example, in Manufacturing Co., decisions about machine maintenance and repair are dependent on available data and information about prior work done on the machines. Therefore, an engineer requires the data and information linked to a machine in order to make informed decisions about work to be carried out on it. Likewise, a nurse in PW or PPH requires information and data about a client's medical history before making any decisions about the treatment regime they will recommend. The availability of up-to-date data, for example, SPC outputs, OEE data, pareto charts and trend charts in Manufacturing Co. and (GAF) score sheets, Activity Daily Living Skills (ADLS) forms, Activity Logs, Daily Progress Report Forms; Risk Assessment Forms in PW and PPH is critical for decision-making. Also, all three organisations have the following similarities:

- shift work that covers all 24 hours in a day

- depend to varying degrees on hand-over sessions between shift change-over
- various interacting functional teams that contribute to decision-making and organisational output
- a significant part of decision-making is dependent on tacit knowledge of the decision-maker –an ability to integrate and interpret various types of data and information.

Given these characteristics, it is expected that there should be significant overlaps in the KM requirements and hence KM practices of these organisations. Therefore, it could be possible to transfer KM practices from the other case organisations regardless of differences in industry or operational focus. In the PPH case study, the rationale for making certain recommendations was obtained from the fact that the recommended KM mechanisms were working well in the other two case organisations. Whether recommended KM mechanisms represent "best practice" or not is debatable. However, it is conceivable that "best practice" could be established through the collection of more KM assessment outputs and premised on consistent outcomes that support this notion. Therefore the KM assessment methodology has a value that goes beyond the scope of the research described here and provides an opportunity to research best practices in KM for organisations in specific industries or niche markets.

12.7 Lessons learned

Given that the three case studies were undertaken in order to influence the modifications that will be made to the initial design of the assessment tool, it is necessary to highlight

some of the findings that shape the final proposals for a KM assessment tool and methodology. There are notable observations that require further discussion as they may affect the process of assessment of KM systems.

It was observed that some of the organisations are not conversant with KM terminology and do not practice KM formally. For example, in Psychiatric Ward, it was helpful to refer to "skills" and "employee training" and "work" as opposed to knowledge, knowledge creation or organisational processes. In such organisations it is debatable whether the weightings assigned for the various relationships reflect the organisational reality if participants do not appreciate or understand the terminology used in the assessment process. It may be necessary to employ the help of an expert in KM where organisations are not conversant with the subject area and the processes involved in self-assessment.

Furthermore, in relation to weightings of relationships, the process needs to be conducted in a consultative manner which seeks to obtain consensus from various levels of the organisation. This approach circumvents a noted weakness of some QFD processes which lack input from all levels of employees (Dijkastra and van der Bij, 2002). From a methodological point of view, assigning weightings or ratings to relationships using single respondents from an organisation is associated with the survey methodology which has criticisms pertaining to the quality of data gathered. Therefore, a consultative approach addresses these methodological weaknesses and could boost the quality of organisational data gathered.

Participants in the weightings of relationships should also leave the cell blank where the KM mechanisms are not used or where a KM barrier is not identified in the organisation instead of assigning a weak relationship or a score of one (1). This pattern of populating the assessment matrices was observed in Manufacturing Co. with the effect of distorting the organisational reality of the KM practices and could also make comparisons with other organisations difficult. This error of assigning relationship weightings also distorts the effectiveness scores of other KM mechanisms when calculated as a percentage.

In addition, it was necessary to add more KM mechanisms to the KM assessment tool after each round of data collection. These were mechanisms that were identified in the case organisations but were not on the KM assessment tool. Therefore the comprehensiveness of the KM mechanisms will be questioned with each KM assessment exercise. However, what is important is that the tool is flexible to allow additions to be made where it is deemed necessary to do so. The important lesson is that the exercise should probe organisations to contribute to the design of the tool by adding any KM mechanisms that are not included on the list of mechanisms.

Finally, the assessment process is quite long and can become a monotonous and tiring exercise. It is therefore suggested that the process be divided into shorter segments; for example assessing the KM categories and mechanisms separate from the KM barriers allows the interviewee time to reflect on responses as well as recover physically. From

the foregoing discussion, a modified KM assessment methodology as informed by the three case organisations is proposed. This is presented in Appendix 8.

13 KM Assessment in Organisations: Testing the Tool

13.1 Introduction

This chapter of the thesis reports on the outcome of the trials of the KM assessment tool in four organisations. It aims to establish whether the proposed KM assessment tool and methodology was sound enough to be a useful tool that could be applied for KM work in organisations. Firstly the aim is to determine whether the KM assessment guide (refer to Appendix 8) was clear such that it could be applied by the participant organisations without major difficulties. This is evidenced by correct population of the KM assessment matrices. Beyond this, meaningful output is expected to be produced by the exercise where the researcher can analyse the output and conclude that the output is indeed logical. Furthermore, evidence of the usefulness, ease of application of the KM assessment guide and tool, and other criteria upon which the value of the tool is to be judged, is derived from a questionnaire feedback that each participant organisation provides after interacting with the KM assessment tool. From this feedback, it will be possible to determine the extent of the usefulness of the tool to organisations.

13.2 Criteria for Assessing KM Assessment tool

This section briefly discusses the questionnaire and the criteria which participant organisations were asked to provide feedback on. Their responses will reflect the successes and failures of the research project in its objective to develop a KM assessment.

13.2.1 Clarity of the methodology.

This criterion aims to establish whether the directions for using the KM assessment tool and process were we1l-defined and relatively easy to follow. It is acknowledged that KM is an emerging paradigm; hence organisations may not be conversant with not only KM terminology but the processes involved in assessing KM activities. As such directions on how to assess KM in organisations should be clear enough to make the task less complicated. In order to provide feedback on the clarity of the methodology, organisations are required to offer their perception of the document that accompanies the KM assessment matrices. This document is presented in Appendix 9 of this thesis.

13.2.2 Ease of use.

KM assessment methodology is based on the traditional QFD methodology. It was noted in chapter 6 that QFD is mostly used in product and service design, a task associated with technical knowledge specific to a few individuals in organisations. Therefore, it is likely that individuals that are not familiar with the technique would struggle with its application or variants of such. It is therefore important to the success of the research project that feedback is obtained with regards to this criterion in order to establish issues of concern and how to address them so that the KM assessment tool can be relatively easy to understand and use. The criterion "Ease of use" is a measure of the difficulties encountered during the application of the KM assessment tool and methodology. Issues that could be explored are the ease (or difficulty) with understanding the tool itself, populating the KM matrices and finally analysing the output in order to extract meaning

out of the output. As previously noted, it is conceivable that organisations may not fully appreciate the intricacies of interacting with this methodology; therefore it is important to gather information on how well the process has been undertaken.

13.2.3 Comprehensiveness of Tool.

This criterion has been included as a measure of how well the KM assessment tool covers the KM activities and issues at the operational level of organisations. It allows organisations to comment on the issues that are presented by the tool and how they relate to their own operations. It has been suggested that the key dimensions of KM assessment should consider the KM activities to be undertaken (i.e. KM categories), how these KM activities are carried out in the operation (i.e. KM mechanisms) and the possible barriers to the implementation of KM in organisations. The QFD tool was adapted to illustrate these dimensions and; in effect producing the KM assessment tool. The inclusion of the "comprehensiveness of tool" criterion gives participant organisations the opportunity to critically appraise the tool from a point of view of their own operations and suggest where possible, those dimensions that the tool does not address. It has already been acknowledged that the list of KM mechanisms could increase as more organisations apply the tool. Therefore the main concern of this criterion is to establish whether or not another dimension of KM should have been added to the KM assessment tool during the design stages.

13.2.4 Representativeness of Output in relation to Organisational Reality.

This criterion is a measure of how well the KM assessment tool can illustrate KM systems in a manner that depicts the organisational reality. Participants need to be able to interpret findings of the KM assessment process and conclude that their findings represent the organisational reality. If this is found not to be the case, then the tool is not valuable for the purpose that it has been developed. It is also critical that participants appreciate the use of symbols to illustrate the effectiveness or use of KM mechanisms for various KM activities. It is against this background that conclusions about the representativeness of the organisational reality can be made; this "reality" of the organisation can help to illustrate gaps in the system and highlight areas for improvement.

13.2.5 Usefulness to Organisation.

This criterion is a measure of the value obtained from participating in the exercise. Each organisation that participates in the research project may realise KM related benefits that may accrue immediately or later. Sometimes this may just be an awareness that the organisation needs to take a long term view of KM and start thinking about their KM strategy. Moreover, this criterion may also be used to rate how the tool may be perceived by other organisations.

13.2.6 Relevance to KM

This criterion considers the value of the KM assessment tool within the broad area of Knowledge Management. It considers whether the development of a KM assessment tool adds to the understanding and practice of KM. In other words, it gives organisations the opportunity to voice their perceptions of the KM assessment tool and its overall contribution to KM literature and practices. This is a reflection of the contribution made by the research project as a whole to the area of KM assessment in particular and whether the concept of KM assessment is perceived as an important aspect of KM.

13.3 Participant Feedback: a general overview

In this section of the thesis, a critical appraisal is undertaken to ascertain the use of the KM assessment tool by the participant organisations. It is important to examine whether the KM assessment tool and methodology were applied appropriately before their perceptions of the tool are taken into consideration. Only then can a thorough understanding of the tool's strengths and/or weaknesses be achieved. An appraisal of KM assessment matrices from the following participant organisations is particularly useful at this stage: Housing Association (HA), Actuarial Services Company (ASC) and Surgical Innovation (SI). The KM outputs were studied in order to establish that the KM assessment methodology was strictly followed. The KM assessment matrices used by the organisations were populated correctly. The use of symbols and figures was appropriate. This gave the impression that the organisations had read the methodology and understood how the assessment process was supposed to be conducted. In spite of this indication of

correct application, it was deemed necessary to further analyse the output in order to establish a clear picture of the KM systems in the organisations. This would also illustrate the relationships in the KM systems and demonstrate that the participant organisations had not just populated the KM assessment tool with random symbols and figures. It is not considered necessary at this stage to describe the output of the KM assessment matrices; it is more important to discuss the nature of the interactions between participants and the tool. However, it should be noted that KM assessment outputs were discussed with participants in order to determine their understanding of the outputs and the meaning thereof. Participants demonstrated a high level of understanding for KM issues in their organisations during the debrief interviews. The willingness to discuss the relationships of the KM assessment matrices and to explain "unusual" weightings provided sufficient evidence for the researcher to conclude that the KM assessment tool and methodology had been understood and correctly applied. However, there were some signs that the KM assessment methodology was not followed strictly by HA. This was evident in the scores assigned to mechanisms not used in the organisation. HA did not leave any cells in the KM assessment matrix blank, suggesting that the finance department uses all the KM mechanisms on the KM assessment tool. However, during the debrief interview it was established that the organisation does not use the following KM mechanisms:

- Apprenticeships
- Chief Knowledge Officer (CKO)
- Knowledge Transfer Team
- Expert system
- Why-why analyses (5Y)

This situation created some confusion with regards to two other KM mechanisms that are actually used by the organisation but were assigned weak ratings by the participants. These are job aids and the intranet. The assigning of weak associations for apprenticeships, CKO, expert system and knowledge transfer team was acknowledged to be an oversight by the participants as the methodology was clear on how to populate the matrix in such cases.

Assigning scores for KM mechanisms that are not used by the organisation distorts the final analysis of the organisation's KM system. It inflates the overall scores of the KM mechanisms and in effect undermines the percentage scores of the other KM mechanisms in the organisation. For example, the percent scores for meetings show a percentage use of meetings in HA is shown to be 5.1 but this rises to 5.6 when calculated without the weak ratings for KM mechanisms not used. Likewise, the percentage use of e-mails and bulletins rises from 7.3 to 8.0. Critically, these differences affect the decision-making process that the organisation is faced with regarding improvements to the KM system in the organisation. The KM assessment matrix depicting effectiveness of the KM mechanisms in HA shows a similar oversight as the one noted in the matrix depicting use of KM mechanisms. There are weak associations assigned for mechanisms that are not used by the organisation. As noted above there are ramifications for the percent scores for each of the mechanisms that are actually used in the organisation as these are shown to be lower then their true value.

The calculations that were performed by the participant organisations were checked by the researcher and found to be correct. These include the calculations to establish overall use and effectiveness and percent use and effectiveness for the KM mechanisms in the organisation. Also for all the participants, KM barrier scores and organisational difficulty scores were completed correctly.

Therefore when considering the application of the KM assessment tool and methodology, it is concluded that the organisations were able to follow the directions provided and to assess their KM practices, evidence of which is provided by the correct population of KM assessment matrices, the accurate calculations as directed by the methodology, and the interpretation of KM assessment outputs.

13.3.1 Perceptions of the Tool: The case of HA

The outcome of the KM assessment exercise in HA demonstrates that the methodology is robust. HA's use and application of the KM assessment tool illustrates that there have not been any misinterpretations of the methodology. The noted omissions on the tool are oversights that are attributable to human error and not anything inherently wrong in the methodology. This section investigates whether the tool itself is useful to organisations; how it is perceived by users and its contribution to the broader area of KM. To start with, the discussion explores the merits of the tool as perceived by HA. It reports on the six criteria introduced in section 13.2. Table 13.1 shows the questions associated with the six

criteria and how the participant group in Housing Association responded to each of the questions.

Criteria	No (1)	Poor (2)	Fair (3)	Good (4)	Excellent (5)	Total	%
Clarity (15)							
The methodology was clear in articulating each step of the assessment process				**x**			
The KM dimensions and inter-relationships were well-defined				**x**			
The method proposed for prioritising the KM mechanisms was logical				**x**		**12**	**80**
Ease of Use (5)							
Overall the tool and methodology were easy to use				**x**		**4**	**80**
Representativeness of Organisation (4)							
The KM assessment output was representative of our organisational reality				**x**		**4**	**80**
Comprehensiveness (15)							
The sections of the tool covered all the issues of knowledge management in our organisation				**x**			
The KM tool covered all the mechanisms in our organisation					**x**		
The KM tool covered all the KM barriers in our organisation					**x**	**14**	**93.3**
Usefulness to organisation (10)							
The methodology helped to identify KM areas for improvement					**x**		
The KM assessment exercise was useful in improving KM practice in our organisation			**X**			**8**	**80**
Relevance to KM area (5)							
Overall an effective and comprehensive methodology and tool has been developed				**x**		**4**	**80**

Table 14.1: Illustrating HA's perception of the KM assessment tool

The total for each criterion was obtained by adding the individual scores for the questions and calculated as a percentage of the total score possible under each criterion.

The feedback from Housing Association is mostly positive. From interpretation of the output in Table 13.1, it is concluded that the tool was perceived well in all the six criteria

in which it was tested. The tool was comprehensive in outlining the KM categories, mechanisms and barriers in the organisation. Although it has been argued that it would not be entirely necessary or perhaps possible to cover all the mechanisms and barriers within organisations, it is important that the tool covers all the dimensions of KM, i.e. KM categories, mechanisms and barriers in order to have a holistic view of KM at the operations level. The comprehensiveness of the tool in covering the dimensions of KM at the operational level is important in order for the tool to offer a holistic view of KM and for its relevance as an assessment tool. Therefore the outcome that the KM mechanisms and barriers lists were found to be comprehensive by HA could be considered a "bonus".

The other five criteria were considered to be at least 80% by HA. Considering that the tool is in its infancy in terms of development this is a positive outcome. The criterion "usefulness to organisation" was negatively affected by the fact that the organisation (as a whole) had no intentions of implementing any changes. The benefit realised from this exercise was confined to the realisation that the organisation was not thinking about how to create and safeguard its knowledge assets. In fact during the debrief interview, it was found that the organisation carried out its work in an *ad hoc* manner, rarely realising the relationships that existed in terms of knowledge flows, knowledge integration, organisational process and knowledge management activities unless there was a disruption to activities. In this sense, the KM assessment tool and exercise was able to provoke discussion about the various knowledge management issues arising out of the daily activities of the organisation; in effect alerting the organisation to the benefits of well-designed KM initiatives. Given more time and resources, a more useful approach

that would provide a more representative rating for the criterion "usefulness to organisation" would be to undertake a longitudinal study of the organisation to determine the changes that have occurred as a result of the application the KM assessment tool. In fact, such a study is a natural extension of this research project, to apply it in organisations over an extended period that allows the researcher to oversee actual improvement projects and the impacts on organisational operations that come about as a result of the application of the KM assessment tool.

Although the organisation scored "ease of use" at 80%, some of the comments made about the application of the tool indicate that changes may be necessary in order to make the use of the tool less laborious and cumbersome. Although the nature of the assessment makes it necessary to cover all aspects related to KM at the operational level, the presentation of the tool to participants could be done in such a manner that the participants deal with the various aspects in a user-friendly way. For example, it was suggested by the participants that dividing the analyses of the organisational practices into segments and having separate matrices for each of the KM dimensions would make the assessment less monotonous. Separate teams in the organisations could work on the separate matrices and combine findings into one comprehensive KM assessment matrix which would be illustrative of the entire KM system of the organisation when their tasks are done. This is a common feature in traditional QFD methodology; the QFD four-phase methodology utilises matrices that inform subsequent stages of product or service design. Within the context of this research, the separate matrices would only serve the purpose of dividing the tasks of assessment to eliminate the monotony associated with populating the

KM assessment tool. It was submitted that the important issue that requires emphasis in this suggestion is that participants should be employees that have access to and use of the organisation's knowledge as well as possessing knowledge of the structural elements and knowledge-oriented process of the organisation. These organisational participants use knowledge for accomplishment of their tasks and can also provide commentary of the organisation's knowledge activity.

There was a suggestion to use numbers instead of symbols because it took time for participants to figure out the number values of the symbols when calculating the overall and percent scores for the use and effectiveness of KM mechanisms. It was reported that this added to the monotony of the task of interpreting the output of the KM assessment tool. Participants, however, recognised that the use of symbols was beneficial when analysing the whole system because it was easier to readily identify gaps or weak relationships where symbols are used as opposed to numbers.

The use of the 9-3-1 scale generated some questions from participants who questioned the suitability of this as opposed to a 1-5 or 1-10 scale. It was suggested that the 9-3-1 scale did not include intermediary associations between KM categories and mechanisms. For example, the relationship between knowledge sharing and meetings was considered to be "moderate to strong" but did not fit perfectly into either classification. In this case participants were forced into choosing between one of the two; a situation which could have been avoided by the use of a 1-5 or 1-10 scale. This situation resurrects an earlier discussion about the suitability of a 9-3-1 scale. It had been the position with regards to

scaling, that the 9-3-1 scale would be adopted because of its wide acceptance in QFD methodology. However, the 9-3-1 scale suggests that a moderate association is 3 times a weak association and likewise a strong association is 3 times a moderate association. This is clearly inconclusive from the data that organisations provide. In spite of the noted weakness, the 9-3-1 scale was adopted- only to be revised if problems with the testing emerged. Clearly the HA concern is important because it has a bearing on the accuracy of KM assessment outputs. The KM assessment output should be able to report on KM associations as accurately as possible and this needs to be facilitated by the adoption of an appropriate scale.

13.3.2 The case of ASC

The feedback provided by ASC was very useful in that it went beyond simply populating the KM assessment matrices and providing feedback on the perceptions of the participants. ASC suggested the use of Microsoft Excel to do the calculations required to interpret findings. In order to demonstrate the suitability of the software application, a completed Excel output depicting the KM practices in ASC was provided as well as the KM assessment matrices produced using QFD software. The participants argued that the Excel package was completed faster than the KM assessment matrices because of the use of numbers and not symbols as well as the fact that the figures in Excel were automatically calculated once the formulae were entered into the appropriate cells. It was argued, as in the case of HA, that the use of symbols on the KM assessment matrices consumed more time while participants associated the number values with the symbols when calculating the overall and percent scores for the use and effectiveness of KM

mechanisms. ASC participants suggested that an electronic questionnaire could also be used to populate the data. Apart from the extra contribution made by ASC, the KM assessment matrices were filled correctly; calculations were also completed correctly. This is a positive outcome for the development of the concept of KM assessment in two ways: first, the methodology was clear and straightforward such that it was possible for the participants interacting with it to appreciate its main objective and to suggest ways to improve its application and second the Excel application could be considered as an option to the KM assessment matrix without fundamentally altering the KM assessment concept.

Criteria	**No (1)**	**Poor (2)**	**Fair (3)**	**Good (4)**	**Excellent (5)**	**Total**	**%**
Clarity (15)							
The methodology was clear in articulating each step of the assessment process				**x**			
The KM dimensions and inter-relationships were well- defined				**x**			
The method proposed for prioritising the KM mechanisms was logical				**x**		**12**	**80**
Ease of Use (5)							
Overall the tool and methodology were easy to use				**x**		**4**	**80**
Representativeness of Organisation (4)							
The KM assessment output was representative of our organisational reality				**x**		**4**	**80**
Comprehensiveness (15)							
The sections of the tool covered all the issues of knowledge management in our organisation				**x**			
The KM tool covered all the mechanisms in our organisation				**x**			
The KM tool covered all the KM barriers in our organisation				**x**			**80**
Usefulness to organisation (10)							
The methodology helped to identify KM areas for improvement				**x**			
The KM assessment exercise was useful in improving KM practice in our organisation			**x**			**7**	**70**
Relevance to KM area (5)							
Overall an effective and comprehensive methodology and tool has been developed				**x**		**4**	**80**

Table 13.2: Illustrating ASC's perceptions of the KM assessment tool

The feedback provided by ASC gives an overall positive feedback of the tool. All the criteria were scored at 80% with the exception of "usefulness to organisation" which was scored at 70%. As in HA, this is the lowest rated criterion because the organisation did not plan to implement any immediate KM improvement initiatives as a result of the assessment. However, participants recognised the potential use of the methodology and commented on its value in creating debate about KM practices amongst participants.

Interestingly, the criterion "comprehensiveness of the tool" was not as highly rated as in HA. Participants reported that the KM assessment tool did not consider legislation as part of an organisation's KM system; this is a very important part of how tasks and activities are completed in ASC. Most of, if not all, the knowledge is regulated by law. Privacy laws and laws to guard against insider trading and many other regulations put in place by professional bodies and regulators affect how knowledge is managed. Participants did not feel as though the KM assessment tool reflected this. The importance of legislation and its influence on KM has been acknowledged in this thesis. Legislation is one of the KM drivers and influences decisions to undertake certain KM activities in organisations; retention of client information and disclosure of client data in Hospitals are immediate examples from this research project. In spite of this position, it is expected that organisations should consider legislation as something that influences process and what is important to the organisation. Therefore it is submitted that organisations should consider legislation as part of the influences on "importance to organisation" ratings because it determines which KM activities are important to an organisation's day-to-day activities

but not necessarily as a KM category, mechanism or barrier which are incidentally the dimensions of KM that the assessment tool is designed to illustrate.

13.3.3 The Case of Surgical Innovations

In Surgical Innovations, the application of the KM assessment tool and methodology was done by a single participant. The participant had background knowledge of KM and was therefore considered an ideal candidate for the task of assessing the organisation's KM system and help to identify develop the assessment tool further. The feedback provided by the participant was useful in two ways: first, it helped to understand the difficulties of the KM assessment process and second, it also initiated a reflection on the definitions provided for KM categories and mechanisms. The participant questioned definitions of KM categories and also provided insights into his interpretation of the same. Particularly, the difference between the KM categories development and creation was questioned as well as the suitability of the term access instead of acquisition. Eventually, it was clarified that development refers to the process of equipping employees with the right skills and knowledge required to do their tasks. The key difference is that most of this knowledge is explicit; therefore KM mechanisms that are typically associated with this category are training, seminars and short courses. In contrast, knowledge creation refers to process involved in introducing new ideas, products and services and new ways of working. Knowledge creation is associated with mechanisms such as research and development and knowledge teams. Creation is more associated with externalising tacit knowledge and innovating process.

With respect to the population of the KM assessment tool, the output shows that the methodology was followed closely. The calculations were also done correctly, a reflection that organisations are able to follow the directions for a self-assessment and to obtain meaningful output out of the assessment exercise. However, the importance ratings for knowledge identification and creation which were rated as "somewhat important" raised some questions during the debrief interview. As an innovative organisation specialising in bring new medical devices to the market, it was expected that Surgical Innovations would rate knowledge identification and creation as "extremely important" in the organisation. The interviewee disclosed that although these KM activities were important to the organisation, the KM assessment matrix reflected current attitudes in the organisation. The organisation's KM situation was such that more focus was directed towards retaining and sharing the knowledge currently in the organisation. The interviewee reported inter-departmental barriers and lack of communication amongst sales, manufacturing and design teams. As such, the organisation recognised the importance of creating new ideas for market but the current focus was to incrementally improve existing products and streamlining products to the market.

The feedback provided by Surgical Innovation showed less satisfaction with the KM assessment guide. Questions relating to the KM assessment methodology were mostly rated at 3 (fair). The feedback given by the participant showed that some explanation of KM mechanisms was required to fully understand what they actually meant. For example, the KM mechanisms team-boards, why-why analysis, observation were cited as not being fully explained. Also, the participant questioned the difference between

databases, intranets and expert systems. Clearly, this demonstrates that understanding of terms varies amongst participants and could be controlled for by providing standard definitions for KM mechanisms as well as KM categories.

The participant rated "representativeness of organisation" as the lowest criterion at 60% because of the manner in which the KM assessment tool was populated. It was argued by the participant that the ratings are too subjective such that it is not possible to accurately predict the organisational reality from the KM assessment output. These concerns are amplified by the fact that there was only a single participant therefore the outcome has a limited perspective of the entire situation. In addition, the concerns reiterate some of the noted weaknesses in traditional QFD methodology where it was noted that there is a difficulty in quantifying subjective information. An identified solution to alleviate this apparent limitation is to have multiple participants during this process.

The participant however commented on the benefits of using the assessment tool because of its ability to provoke an analysis of the manner in which knowledge flows (or does not) within the organisation. Hence usefulness to organisation received a relatively higher score of 70%. As with HA and ASC the criterion comprehensiveness of tool received the highest score. Although the participant reported that not all KM mechanisms were on the assessment tool, the categories and scope of the dimensions was found to be comprehensive. Table 13.3 shows all the responses to the questionnaire schedule as reported in Surgical Innovations.

Criteria	No (1)	Poor (2)	Fair (3)	Good (4)	Excellent (5)	Total	%
Clarity (15)							
The methodology was clear in articulating each step of the assessment process			**x**				
The KM dimensions and inter-relationships were well- defined				**X**			
The method proposed for prioritising the KM mechanisms was logical			**x**			**10**	**67**
Ease of Use (5)							
Overall the tool and methodology were easy to use				**X**		**4**	**80**
Representativeness of Organisation (5)							
The KM assessment output was representative of our organisational reality			**x**			**3**	**60**
Comprehensiveness (15)							
The sections of the tool covered all the issues of knowledge management in our organisation				**X**			
The KM tool covered all the mechanisms in our organisation				**X**			
The KM tool covered all the KM barriers in our organisation				**X**		**12**	**80**
Usefulness to organisation (10)							
The methodology helped to identify KM areas for improvement			**x**				
The KM assessment exercise was useful in improving KM practice in our organisation				**X**		**7**	**70**
Relevance to KM area (5)							
Overall an effective and comprehensive methodology and tool has been developed			**x**			**3**	**60**

Table 13.3: Illustrating Surgical Innovation's perception of the tool

13.3.4 The Case of Tyco (Manchester)

The case of Tyco supported the argument that the KM assessment tool and methodology is robust without actually being completed satisfactorily. As in Surgical Innovation, there was one participant in Tyco who incidentally had background knowledge about KM and QFD methodology. A few problems were noticed with the KM assessment matrices and the manner in which they were populated. First, the "importance to organisation" column was empty for both the KM matrices depicting use and effectiveness. Consequentially, it

was not possible to calculate overall use and effectiveness scores and by extension the percent scores. Furthermore, the "roofs" of both KM matrices were not populated, suggesting that no synergies or compromises were identified in the KM mechanisms in the organisation. This outcome in itself is difficult to imagine for an organisation like Tyco.

In the follow-up debrief, it was possible to acquire the missing information from the participant as well as to clarify the reasons some sections were not populated. A key finding was that the methodology was not strictly followed because of time pressures. The participant admitted that there was insufficient time to read through the KM assessment guide and to interact with the tool.

The outcome of the application of the KM assessment tool in Tyco highlights some of the challenges that organisations face daily. There is hardly time to reflect on KM practices given the pressures of the day-to-day activities. This outcome emphasises findings in most KM surveys (e.g. OECD, 2001; KPMG, 2001) which found that lack of time influences most organisations to manage knowledge in an *ad hoc* manner. Given this background, it places further demands on the design of the KM assessment tool to be concise, easy to use and more importantly less-time consuming such that its application is not considered an inconvenience. Rather, the application of the KM assessment tool should be a welcome exercise that enhances operational efficiency. At this stage it is important to point out a potential trade-off in the use of the KM assessment tool. This tool has been designed to be comprehensive in terms of covering KM issues at the

operational level. It should therefore be expected that a considerable amount of time will be spent in the analysis of the issues at hand. The trade-off therefore is between the comprehensiveness of the tool and being thorough in analysis of operations and the time it will take to complete the assessment. Reports from participants in the final stage of the research project show that on average about (4) days in total were spent on the assessment exercise although it took longer in organisations where multiple participants took part in the exercise given that a considerable amount of debating took place within the groups. It is important to note that the assessment took place over several weeks as participants did not have the time to complete the tasks at once and due to other work commitments. Therefore breaks in concentration and work could have impacted on the time spent on the exercises. In the final analysis, in order to realise the benefits of a KM assessment exercise, organisations should be able and willing to make the time that will enable them to do a complete and thorough job. However, the onus is on the researcher to find ways of making this assessment process less time consuming and laborious.

Regardless of the incomplete efforts of the participant in Tyco, their feedback and perception of the tool was recorded and included in the thesis (Table 13.4) as there were some important comments that could impact the final design of the tool.

Criteria	No (1)	Poor (2)	Fair (3)	Good (4)	Excellent (5)	Total	%
Clarity (15)							
The methodology was clear in articulating each step of the assessment process			x				
The KM dimensions and inter-relationships were well-defined		X					
The method proposed for prioritising the KM mechanisms was logical			x			8	53.3
Ease of Use (5)							
Overall the tool and methodology were easy to use			x			3	60
Representativeness of Organisation (5)							
The KM assessment output was representative of our organisational reality				X		4	80
Comprehensiveness (15)							
The sections of the tool covered all the issues of knowledge management in our organisation				X			
The KM tool covered all the mechanisms in our organisation			x				
The KM tool covered all the KM barriers in our organisation			x			10	66.6
Usefulness to organisation (10)							
The methodology helped to identify KM areas for improvement			x				
The KM assessment exercise was useful in improving KM practice in our organisation				X		7	70
Relevance to KM area (5)							
Overall an effective and comprehensive methodology and tool has been developed			x			3	60

Table 13.4: Illustrating the feedback from Tyco

13.6 What participants said about the tool

The following are direct quotes from the organisations. They demonstrate some of the perceptions about the KM assessment tool and guide.

It was not straight to understand, I had to read through a couple of times to make sure I was completing it right- Tyco participant commenting on the KM assessment guide.

The guide is a little bit too long. It took time to read through everything- Surgical Innovations participant on the KM assessment guide.

The process is too long and frustrating especially when people start debating and arguing about the correct weighting but we saw some good benefits from the discussions that we had. I wish some management people had participated- HA participants on the KM assessment process.

In reality many organisations do not plan or think this far ahead in terms of developing a KM strategy, maybe the tool could have directed the user with this- Tyco participants on use of the tool.

Made the organisation to take a step back and really think about KM and how it can be applied within the organisation and what as a company we should be doing- ASC on the benefits of the tool

We realised that we could be doing better in some areas after we had discussed our performance- HA on benefits of using the tool

Despite concerns about the length of the assessment process, the feedback suggested that participants acknowledged the benefits of undertaking a KM assessment exercise. From a design point of view, it is positive that there are no conceptual flaws that have been noted in the KM assessment tool. Participants were mostly concerned with the length of the

assessment process itself. Some recommendations are made in order to address these in the following section.

13.7 Conclusion

This chapter has presented findings from the final stage of the research project. It sought to establish the extent to which the KM assessment tool satisfies the initial objectives of the research project. Overall, it is concluded that the project has been successful in developing a tool that is conceptually robust and has demonstrated potential to help organisations identify and improve their operational efficiency through better knowledge management practices. The ratings in the feedback of the organisations show that the KM assessment tool is a viable technique of improving KM by all measures. In the absence of other KM assessment tools or other similar studies, it is not possible to compare these findings with others in order to critically rate this performance relative to other findings. However, it is encouraging to note that the participants found the tool to be comprehensive and overall an important aspect within the wider context of KM. In this respect the project has been successful. However, there are still some concerns that require attention, particularly the fact that the assessment is too long and monotonous. It is recommended that participants could divide the tasks of the assessment exercise into sections such that each group can do different tasks. It would also be interesting if groups could swap tasks in order to compare ratings for different relationships. Furthermore, multiple participants should be considered over single-participant because of the greater potential to solve problems and generate more discussion and debate on key issues.

14 Discussion and Conclusion

This research project has undertaken a detailed consideration for the manner in which knowledge is managed in organisations. It has acknowledged the fact that the term "Knowledge Management" is as broad as the research themes and extant literature that continues to expand the subject area into a major management philosophy. Knowledge is the subject of debate, particularly with respect to how it is created. This thesis has explored the cognitive and community perspectives of knowledge creation, ultimately leading to the conclusion that perspectives on how knowledge is created influence the manner in which researchers and practitioners manage it. Consequently, studying KM research publications produces a distinguishable divide in approaches between technological and social approaches to KM. Chapter 3 initiated the analysis of the KM landscape by describing the continuum of KM "solutions" from technological to social. It was established that the approaches to KM are influenced by one's perspective of knowledge. However, it was noted that some of the more traditional KM "solutions" are not readily identified as such in most organisations, for example, apprenticeships, manuals and team-boards, etc. These mechanisms are very often not considered under the KM "banner" which, until recently, was mostly associated with technology and IT (see, for example, Alavi and Leidner, 2001). Therefore, it was observed in the early stages of the research project that all organisations manage knowledge through various mechanisms; however, it is the degree to which the management is formalised as KM that differs from organisation to organisation. As such, a question that asks organisations

whether they practice KM or not is, in fact, one that establishes the level of formalisation of KM in those organisations.

The increase in KM literature outlining the benefits of formalising KM, for example Wiig, 1997; Rodriguez Perez and de Pablos, 2003, provides the impetus for organisations to undertake KM initiatives and formalise it as a management philosophy. However, in most research articles, KM is synonymous with knowledge sharing. Authors tend to err towards discussing KM mechanisms that facilitate or stimulate the flow of knowledge objects and the interchange of tacit knowledge amongst employees, for example see Eardley and Uden, (2008); Alavi and Leidner (2001); Robertson et al, (1996). More recently, interest has grown towards knowledge creation owing largely to Nonaka and Takeuchi (1995); Nonaka and Toyama (2003) whose SECI model (previously referred to in Chapter 3) has received wide acceptance amongst academics. Other KM activities such as retention and development have been referred to (e.g. Teece, 1998; Handzic, 2003) but have not received as much attention as knowledge sharing and creation. Moreover, there is limited overlap and consensus on the activities that constitute Knowledge Management. Considering this background of KM that is characterised by various emerging research themes, divergent ideas on knowledge and KM "solutions", limited consensus on the concept of KM activities, it is conceivable that organisations that would want to formally implement KM would find it very difficult to decide how to proceed. To that end, this research project has undertaken to make contributions that would not only assist organisations to improve their operational efficiency and to become more competitive through KM, but to make contributions towards the KM literature that undertakes to expound on the knowledge management activities and mechanisms used by

organisations in their day-to-day activities. The next section discusses the key contributions of this research project in light of the gaps that were highlighted in the literature review.

14.1 Contributions of the research project

Following a consideration of the research gaps relating to the management of knowledge in organisations, Chapter 2 stated the study's research objectives formally as being:

- To define a perspective of knowledge and KM that is relevant to organisations and KM practitioners.
- To identify the nature of knowledge and types of knowledge to be managed
- To identify the activities involved in managing knowledge and the knowledge management mechanisms organisations use.
- To develop a KM assessment tool that will facilitate the assessment of an organisation's KM capabilities and assist in aligning their KM activities with their corporate objectives leading to better use of their knowledge and operational efficiency.

Clearly the research objectives are intertwined and together encapsulate the entire process of developing a mechanism that could be used by organisations to initiate a KM programme that is tailored to its requirements and needs. It is argued that this approach to initiating KM programmes pre-empts the use of prescriptive "solutions" that do not take into consideration organisational operations or unique characteristics. To explore these

research objectives, a number of specific research questions were constructed. The research objectives will be returned to at the end of this chapter as a means of drawing together some of the key findings associated with the research questions derived from them. At this point, however, the research questions can be examined separately and in turn, followed by a discussion of some key findings and contributions to KM literature and practice.

14.1.1 Research Question One

How do organisations manage knowledge; what type of activities do they undertake in order to manage operational knowledge?

Research question one can be answered tentatively in relation to describing the practices that were found in the participating organisations. However, before embarking on a discussion of these mechanisms of managing knowledge, it is necessary to refer to the link between the research question and the first research objective. The research question necessitates a clear exposition of what is referred to when speaking of knowledge. Chapter 5 presented the first contribution of the research by submitting a definition of knowledge from an Operations Management perspective. The definition considered the two existing viewpoints of what constitutes knowledge and, in highlighting the main deficiencies associated with both, managed to propose a definition which was holistic. Knowledge was therefore defined as *the know what, know why and know how to manage organisational processes and procedures to transform inputs into goods and/or services and is embodied in the successful execution of processes, routines, directives and*

organisational practices that help to complete the transformation process. The definition has the qualification "successful execution"; what is referred to by KM authors as "knowing" (e.g. Cook and Brown, 1999). Therefore when one is said to know how to do a task, it is an indication that they possess the necessary capabilities and skills to successfully complete it. Chapter 5 further explained how a continuous interaction of explicit and tacit knowledge is required for this to be possible. A demonstration of this interaction was made with an example which briefly outlined a task that a process engineer might be required to complete. It portrays employees as knowledgeable participants in the organisational system that have to process various kinds of data and information in order to inform the decisions that are associated with their daily activities. In so doing, the data-information-knowledge progression often referred to in literature was also demonstrated. The contribution made highlights that knowledge should not be viewed as being made up of two distinct types that are mutually exclusive; it is concluded that the two, explicit and tacit knowledge are correct but partial views of reality and that the Operations Management (OM) perspective provides the holistic view that is required. In effect, the thesis does not individuate the OM perspective as separate from either tacit or explicit but presents it as a necessary encapsulation of both that is required for the holistic management of knowledge. By extension, Chapter 5 integrated extant literature and in the process identified gaps that led to the proposal for a framework for activities that might enable organisations to ensure that their employees access knowledge at the right time and place where it is required- what has been referred to in this thesis as the OKM framework. Evidence from describing organisational activities and a "survey of surveys" conducted in the KM subject area served to instantiate the OKM framework.

The OKM framework not only states the types of activities organisations need to undertake to manage knowledge but also outlines the relationships that exist between them.

The OKM perspective on knowledge and the framework for KM activities represent an incremental contribution to KM literature. The list of KM mechanisms that were identified and categorised into the various KM activities do not only answer the first research question but form a significant part of the development of a KM assessment tool; this is the main research objective. In terms of knowledge management practices, the detailed descriptions of the participating organisation's activities reveal that, at one level, these companies have much in common. Examples of seeming commonality are found in relation to having knowledge sharing mechanisms, providing some training and development, and in certain knowledge retention mechanisms. The organisations appear less alike, however, as the details of the firms are investigated more closely. Given what is already known about knowledge management and the degree of formalisation in organisations, this heterogeneity is unsurprising because variety of practices between organisations can be a feature of the predominantly informal approach to knowledge management. For example, in PW the references to knowledge were made using other words such as skills and competence, necessarily because of the lack of understanding for the concepts of knowledge and KM. KM was clearly a new phenomenon to employees in spite of the fact that KM is on the NHS agenda – perhaps an indication of the separation of policy-making and operational implementation. Still, in discovering the study organizations' particular knowledge management policies and practices, a number of further observations can be made. In effect, organisations recognise the need to develop

employee skills in order to ensure that knowledge is available as and when required. The OKM framework could be used to identify key activities that they need to be undertaking in order to derive maximum benefits from their knowledge assets. This exercise is similar to the mapping of organisations onto the OKM framework as described in Chapter 5. Findings show that organisations align with the OKM framework in line with their operational strategy. More specifically, organisations that pursue an incremental improvement strategy tend to align more with development rather than knowledge creation activities. Conversely, organisations whose success depends on the continuous introduction of new ideas, products and services would be expected to align particularly with knowledge creation activities as well as the other KM activities. If this is found not to be the case then it presents an opportunity for the organisations in question to initiate such activities. However, the organisation knows *what* it could do but not necessarily *how* to do it. The categorisation activity tentatively suggests the KM mechanisms that could be applied for each category of KM activities but organisational choices should reflect other "contextual" features of the organisation such as size, type of process, etc.

Chapter 5 therefore answers the research question and addresses the first three research objectives. The answer to this question is considered integral to answering the second, hence the aforementioned link.

14.1.2 Research Question two

What mechanism(s)/tool(s) could be used to represent operational KM practices in a manner that allows them to be analysed and improved?

The main aim of the research project was to help organisations to improve the efficiency of their daily operations and strengthen their competitiveness in the market by harnessing their available knowledge assets. The first step towards achieving this goal was to be able to establish the current KM practices of an organisation, formalised or otherwise. An assessment mechanism or tool that encapsulates dimensions of the OKM framework would be able to achieve this. Chapter 6 outlined the characteristics required for a KM assessment tool to be considered effective. It was concluded that KM assessment should include and link the following elements in order for it to be complete:

- Establish organisational current KM performance
- Determine effectiveness of KM mechanisms for organisational processes
- Establish KM requirements
- Identify areas for improvements
- Implement improvements

A review of extant KM literature conducted in Chapter 6 critiqued various KM assessment tools in order to determine their suitability for assessing organisations in line with the OKM framework. It was found that KM assessment tools focused mostly on the degree of formalisation of KM in organisations. Most tools were used by consultancy organisations and were characterised by a varying degree of sophistication from simple

questionnaires to more rounded combinations of closed and open-ended questions. However, their main failure was that they did not explicitly link operational processes, KM mechanisms, and operational efficiency; that is to say if improvements in operational efficiency were realised after application of the tools, this improvement could not be strictly attributed to the KM assessment application and the subsequent changes associated with it without consideration for other factors. The tendency with these KM assessment tools is to implicitly suggest that a formalised system of knowledge management would lead to operational efficiency and improvement of bottom line performance regardless of the KM mechanisms used. This is generally misleading. The nature of operational activities and processes in the organisations heightens the importance of how the process knowledge is managed (Gold et al, 2001; Becerra-Fernandez and Sabherwal, 2001), so it is surprising that relatively little work has been conducted within this context. Furthermore, and also in light of context considerations, the role of cultural or structural barriers in the organisations might have implications for not only whether goals are achieved but also for what those goals are; that is to say if an organisation's KM-related ambitions are not shared throughout the organisation, it cannot be assumed that the objectives for knowledge management will not be set solely by an individual or from a single perspective hence assessment of performance may be misleading.

The link between operational activities and KM mechanisms is very critical for assessing suitability of the latter (Gold et al, 2001). It is this attention to detail that most KM assessment tools miss; i.e. to critically appraise the individual relationships between KM

activities and the mechanisms that the organisation employs. Critical to such a stage of assessment would be to ask simple questions such as why do we use the KM mechanisms we use; are they effective for the type of work we do and our type of organisation; what do we hope to achieve by using this KM mechanism and how have we fared so far? Considerations for effectiveness are mostly associated with some form of measurement and quantitative analysis. So how do organisations "measure" effectiveness of KM mechanisms? KM literature has in the past associated KM effectiveness with financial measures such as return on investment (ROI) (Ahmed et al, 1999). However, the explicit link between KM and ROI has not been conclusively established as other factors could also influence the outcome; in other words the outcome could have been influenced by anything else other than good knowledge management. Ahmed et al, 1999 suggest that other indicators that include process, people and resource utilisation can be used. The only shortcoming is that these indicators are not well developed in terms of use or coverage in extant KM literature. However, the focus on process aligns with the OKM framework which takes the view that KM effectiveness can be predicated by the ease with which task/process knowledge is identified, created, developed, shared, integrated, retained and accessed in time for it to be applied to organisational processes as and when it is required. Therefore KM effectiveness is operationalised and determined by the availability of knowledge at the right time and place for application to process.

The foregoing discussion informs the view of knowledge management assessment presented in this thesis in the following ways:

- Knowledge management practices can be assessed for their suitability for particular tasks, activities or operational processes.
- Knowledge management effectiveness can be ascertained by the extent to which it facilitates the availability of process knowledge as, where and when it is required.
- The organisational context i.e. structure and culture affects the ability of the organisation to accumulate, convert, share, store and apply knowledge.

The eventual proposal and subsequent development of the KM assessment tool presented in the thesis was tailored to consider and reflect these points. The KM assessment tool that was presented has its origins in QFD methodology. For brevity this section does not necessarily outline the attributes of QFD that make it suitable as a starting point for developing a KM assessment tool. This discussion has already taken place in Chapter 7. However, it is worth noting that the contribution made towards KM assessment and understanding of knowledge management also constitutes an incremental contribution towards QFD literature. QFD is traditionally a design technique which uses the voice of the customer to inform product or service specifications in the design stage (Akao, 1983; Ungvari, 1991; Zairi, 1992). Its application outside product development was well-documented in Chapter 7; hence the attempt to apply it to the knowledge management subject area, specifically to KM assessment. Some adaptation of the QFD matrix to reflect the dimensions of KM made it possible to apply the tool initially as an assessment tool and then in the more traditional design role. The difference in this case is that the process started with an initial design template consisting of KM categories, mechanisms and barriers. Although it was acknowledged that the design was subject to modification,

this is what makes it fundamentally different to traditional QFD; the key difference is that the KM assessment tool is aimed at presenting a picture of organisational reality and not to design a new product (i.e. a KM system). The aim is to show the current KM system as it is in order to identify opportunities for improvement. Therefore, in a situation where all the basic characteristics of a service or product have been established, QFD could be applied to illustrate the exact performance or reality of an existing product using the same principle as the KM assessment tool. By extension, assuming that the proposed OKM framework is comprehensive, then a case could be made for applying QFD methodology in a strictly assessment capacity. However, this is not to claim that the initial design of the KM assessment tool is complete. In fact, the primary purpose of initial testing of the tool is to inform the modification of the initial design of the KM assessment tool. Notwithstanding, it is still important to note the differences in the two tools and highlight a different possible use for QFD methodology.

The development of the tool is done parallel to the outlining of a suitable methodology for the process. In many ways the KM assessment uses the QFD methods of interpreting the KM matrix outputs. However, other considerations have gone into the KM assessment tool because of the targeted users i.e. the organisation. It was found that organisations interacting with the tool have varying degrees of understanding for QFD tools and KM. Therefore it was imperative to develop a guide to self-assessment that describes and explains stages to the process and concepts of KM. There is, as yet no such documented assessment guide of this nature for organisations to use. This represents a contribution to both KM literature and practice. Further to this, it is worth discussing the

method of prioritizing KM mechanisms for improvements or implementation in organisations which is contained in the KM self-assessment guide. This is very important as literature suggests that prioritizing KM mechanisms that will produce results sooner rather than later is helpful towards the whole improvement process as this will garner more support amongst skeptics within the organisation (Kluge et al, 2001). The method suggested is novel as it uses simple mathematical calculations in order to inform the decision to be made by the organisation. Its strength is that it uses aspects of the KM assessment output to calculate the difficulty associated with making KM improvements. This is a departure from the conventional way of determining organisational difficulty used by QFD experts who rely mostly on their experiences and intuition. It was noted that participant organisations may not possess experience in KM or QFD, as the evidence from the thesis suggests, hence they cannot apply their experiences in making this fundamental decision. Feedback from organisations suggests that the method has its merits and was easily understood. Organisational feedback did not contain any negative comments about the proposed method, which could be an indication of one of two reasons: that those organisations are not conversant with the subject area enough and would not readily identify any weaknesses associated with its use or simply that the method is practical. Again, reference has to be made to the varying degrees of knowledge about KM and QFD amongst participants of the organisations to stress that it would be expected that any perceived weaknesses could have been reported by the more knowledgeable organisations. The proposed method is therefore considered a practical contribution towards KM literature and practice.

14.2 Methodological considerations

From the beginning of the research project, it was not obvious which research strategy would be adopted. The initial research objectives that sought to establish *what* organisations do to manage knowledge suggest that an exploratory approach was appropriate; following which an appropriate design would be adopted for the remainder of the project. This would depend on the findings of the initial stages of the project. Notwithstanding the initial focus of the research project, the ultimate goal was to be able to develop and present a KM assessment tool that represented organisational KM practices and made it possible for organisations to assess their own KM practices with a view to improving them. Consequently, there was a requirement for the research design to allow the researcher to interact with participant organisations in order to gather sufficient data that would adequately inform the development and testing of a KM assessment tool. There were two possible approaches to the *problem:* either to develop a KM assessment tool using articulations from participant organisations, i.e. to let organisations tell the researcher what they perceive to be important and what should be in a KM assessment tool and then developing a tool from the articulations; or to propose a tool based on a theoretical framework and then testing its merits in real life organisations. The first option requires for participant organisations to know what is required from a KM assessment tool; that is, they should have background knowledge of how organisations manage knowledge, the knowledge activities that are required, and a consideration for the contextual issues that impact on how knowledge is managed in organisations. However, as noted in the literature review (Chapter 3), there could be some

problems arising because of the diverse definitions of knowledge and what KM is. Therefore this was not a viable option and the second option was chosen. This choice was justified by some of the research findings; it was noted that there is a varying degree of knowledge of KM amongst organisations. In fact, as noted above in the discussion some organisations (e.g. PW) had very little knowledge of KM and it was practiced informally in the organisation. Consequently, their contributions in developing a tool from the start would have been limited. In addition, the second option aligned with the first stage of the research project which sought to establish what organisations do to manage knowledge. It is logical to suggest that the next step would be to structuralise findings and propose a KM assessment tool from the outcome. Nonetheless, using the second option to develop the tool still required adequate input from participant organisations; as such an appropriate research design was required.

Clearly the objectives of the project required different approaches to the gathering and, possibly, analysis of the data. The merits of each of the research approaches survey, case study and experimentation (see Robson, 1993) were discussed in Chapter 2. It was concluded that survey and case study methodologies had merit for particular aspects of the research project. In particular, survey methodology was appropriate for answering what and how type questions (Robson, 1993). However, within the study itself, a "survey of surveys" approach was considered and used for the following reasons: three very large surveys had been conducted by KPMG, 2002 and 2003, OECD, 2001. These studies were recent, and multi-national, covering multiple sectors and types of organisations. The breadth and scope of the studies would not have been possible to replicate in this research

project because of financial and time constraints. However, questions to do with the definitions of knowledge and the focus on KM assessment necessitated that a further exploration of organisational KM practice be conducted. Therefore, a pilot study that was aimed at prioritising the identification of KM mechanisms and activities was undertaken. Data gathering techniques were interviews, documents and observation. The contribution to the data set made by observations as a collection method needs to be discussed in the context of the subject area and also in terms of practicality. How does one observe the mental processes of assessing, integrating and application of knowledge? Further still, as noted by Knorr and Cetina (2002) there is a difficulty associated with observing people "talking" via e-mail or during teleconferences. In addition, access to some operational aspects of some of the participant organisations, for example PW was limited because of their obligations to their client's privacy. In the organisations where access was not necessarily problematic, another practical difficulty was the need for note taking while being constantly on the move. The alternative to writing notes on the move would be to write the notes at the end the day, in the process risking forgetting important information. Therefore there are some limitations that are associated with the use of observations as a data gathering option. Notwithstanding, observations gave a real-life experience of the work environment which enabled creating a vivid picture of reality during interviews. In Manufacturing Co., for example, it was possible to observe the gear cutting processes and the team areas where production data and trend charts were displayed on the team-boards. It was easier to appreciate the interviewee's articulations having experienced the environment on the shop-floor. The case can therefore be made for combining a variety

of data gathering techniques if only to enhance the researcher's understanding of the context within which events of the studies are carried out.

The case study approach was deemed appropriate for the final stage of the research project which sought the development of a tool for KM assessment. Case studies typically combine data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative or quantitative (Eisenhardt, 1989). Eisenhardt further argues that among other purposes, case study approaches are suitable for generating theory. The extent to which this research project generates "theory" is debatable, however, the development of a KM assessment tool qualifies to be considered as such in the sense that it has been developed using the feedback of various participant organisations that have applied the initial model of the tool. The major difference with cases of theory generation is that this research study applied the case study approach only after a preliminary design of the tool had been produced whereas in theory generation the research is begun as close as possible to the ideal of no theory under consideration and no hypothesis to test (Eisenhardt, 1989). Nonetheless, there is evidence to suggest that a development "of sorts" has taken place within this project and it is qualified by the presentation of the KM assessment tool and methodology that is encapsulated by the self-assessment guide. To that end it is argued that the case study approach was applied appropriately. Given the foregoing discussion, one could conclude that a mixed methodology approach was used to satisfy the objectives of this research project. Firstly, the "survey of surveys" approach which was subsequently followed by the pilot and case studies suggests that no single research strategy and design was a perfect "fit" for the

research problem; only a combination of methodologies would be sufficient to address the research objectives. However, further scrutiny of social science methodology showed that a Soft Systems Methodology (SSM) approach could be the answer required for the problem. The primary use of SSM is in the analysis of complex situations where there are divergent views about the definition of the problem- "soft problems". As noted throughout the thesis, there are many examples of such complexity involving the definitions of knowledge, KM and the tools that extant literature presents as possible solutions to the KM assessment problem. Furthermore, the development of the KM assessment tool represents an opportunity to make sense of the knowledge and organisational elements and dimensions that impact on the assessment of KM in organisations. Furthermore, there was an alignment of the research objectives and SSM as outlined in Chapter 2 therefore there were merits to the adoption of SSM. The stages of SSM were outlined in Chapter 2 and were operationalised within the thesis with the exception of rich pictures; it was not necessary within the context of the research problem to develop rich pictures. The case study approach was useful to gather context-specific organisational data that was necessary to inform the designing of the KM assessment tool as well as to build profiles of the assessed organisations. It was found that this approach served two inter-related purposes: to test the robustness of the initial design of the KM assessment tool as well as modifying it, and to gather organisational data that would inform the decisions of KM improvement. By way of review, this stage is similar to stage 5 of SSM which compares the conceptual models with the real world. The purpose is not to implement the conceptual model of the assessment tool; rather it is to use it as the basis for a discussion: how it influences changes in KM practices in organisations, how it

might be modified to reflect real life situations; identify feasible and desirable changes; make recommendations for taking action to improve the design of the tool and operational efficiency in organisations.

In the final analysis, the need to have a research design "fit" could have handicapped the outcome of the research project if allowed to. In the end, the attractiveness of techniques needs to be measured against the degree to which they fulfil research objectives regardless of research strategy fit. Given the research objectives and outcomes sought it is submitted that the strategy and techniques employed in this study where appropriate and helped to achieve the ends required.

14.2.1 Choosing participant organisations

The study had a total of 8 participant organisations albeit not all at the same time. Different organisations made contributions at various stages of the research project. As pointed out by Eisenhardt (1989), selection of cases is an important aspect of research, particularly when case study approach is central to the research strategy. It is noted that selection of an appropriate population controls extraneous variation and helps to define the limits for generalising the findings. As Pettigrew (1989) noted, given the limited number of cases which can be studied, it makes sense to choose cases such as extreme situations and polar types in which the process of interest is transparently observable. The cases chosen for this research project represent examples of contrasting organisations that give ground for comparison of outcomes. PW and PPH are both service organisations although PPH is a private organisation and PW is a public entity; hence the first contrast:

private versus public. A research article by Cong and Pandya (2003) suggested that public sector organisations were lagging behind in the implementation of KM practices despite earlier research findings that suggest KM is at the core of government tasks. Although it was not a research objective to contrast public and private KM practices, the research findings provided by the two organisations vis a vis the development of a KM assessment tool would highlight any differences between the two if any exist. Furthermore, the research project briefly examined the possibility of using the KM assessment tool as a KM practice transfer mechanism. It is likely that opportunities for KM practice transfer between the two organisations would emerge as they are both Mental Health Hospitals. Examples of such opportunities were given in the thesis. The second contrast between participant organisations is manufacturing versus service. There are two manufacturing organisations: Manufacturing Co. and Tyco. The rest of the participants are service organisations. Although this seems to skew the sample, there are other interesting contrasts between the service organisations that make them interesting. For example, CCS provides mass services while ASC provides professional services (see Slack et al, 2004). Furthermore, the organisations operate in a variety of sectors; ASC is in the financial sector, HA is in the housing and construction sector, PW and PPH are in the health sector and CCS provides services for organisations that are in the travel and financial sectors. Central to the analysis of organisations is the characterisation of processes in terms of standardisation of tasks, knowledge types and the number of interacting parts involved in completing processes (see Chapter 8). The variety of organisations chosen provides a rich mix of organisational process characteristics which when analysed for their alignment with KM practices, could highlight important aspects

and issues for the assessment of KM practices. In turn, these aspects of the analysis feed into the modification and development of the KM assessment tool; hence the final version of the KM assessment tool is the product of input from a diverse but rich input.

In the final analysis, there is clearly a very wide range of organisational types that is represented in the selection of the organisations. Referring back to the research objectives, it is noted that the key outcomes were not premised on the studying of a single categorisation of organisation. The development of a KM assessment tool was designed to be applicable to any organisational type. It is submitted that the case organisations that have been used to develop and test the tool provide sufficient grounds to support the argument that the tool is applicable regardless of organisational type and industry of operation.

14.3 Research Outcomes and Findings

The concept of KM is nothing new and yet some organisations still lag behind in awareness and knowledge. It has been noted in the discussion above that the participant organisations appreciate the importance of managing knowledge albeit without making reference to the concept. This appreciation of the importance of KM is reflected in the practice of KM although sometimes disguised as something different. Essentially what is new about KM is the act of being conscious about the existence of the KM process (Sarvary, 1999). Therefore asking whether organisations practice KM is neither necessary nor important. Questions relating to practice of KM should perhaps focus on the degree of formalisation and the level of involvement of organisational employees in the

management of knowledge. It is unsurprising that some organisations are still not familiar with the concept of KM seeing as the concept is still the subject of debate amongst academics. As noted by Dalmaris (2005), there is limited consensus on the concept of knowledge and how it is created. Therefore, the lack of progress in establishing the concepts in literature may have impacted the speed with which it is adopted in practice. Notwithstanding, the findings of the initial stages of the research project showed that organisations systematically arrange for knowledge to be available at the point of use as and when it is required. It was therefore possible to gather all the mechanisms that are used to that end, and to categorise them into KM activities/categories that reflect what is required to manage knowledge at the operational level of the organisation. It is emphasised that the focus is in providing employees interacting with a transformation process the necessary data, information, knowledge and skills required for a successful outcome. Consequently the flow of knowledge objects within the organisation is important; for example establishing where they are coming from, how they are stored, how quickly they can be accessed if they are not readily available and whether employees have the necessary skills to do what they are supposed to do. Such questions investigate the knowledge retention, sharing, development and creation practices and capabilities of participant organisations. In the process, a clear outline of the KM activities of the organisations was produced and compared to the OKM framework. The evidence supported the assertion that organisations have been managing knowledge all along even though it may have been informal but more importantly it supports the assertion that the OKM framework presented in the thesis is robust. The OKM framework is comparable to other work that has been done to explore KM activities, for example Teece (1998);

Spender and Grant (1996). One major difference is the inclusion of integrating activities in the OKM framework as a distinct KM activity. It was submitted that the combining of old and new knowledge requires the ability to archive and discard obsolete knowledge while retaining useful knowledge. In addition, employees have been portrayed as intelligent agents of the organisation that can assess the value of data and information, use and/or discard it according to its relevance to their tasks and activities. Therefore a case was made to include integrating activities as a category of KM activities. Evidence from the participant organisations suggests that integration of knowledge occurs at all levels of the organisation. For example, PW and PPH nurses are required to assess and analyse the relevance and importance of information from a variety of disciplines including psychiatry, pharmacy, and occupational therapy in order for them to do their job of formulating a care regime for clients. This requires an ability to integrate a complex and vast amount of information into a manageable care pathway that reflects the needs and requirements of the patient. Likewise, engineers in Manufacturing Co. study the history of machinery as well as output data from SPC charts, etc, in order to determine the best course of action if a piece of machinery is not functioning properly. Their decision is dependent on the ability to sort through a vast amount of machine history and to integrate that into a workable service plan for the machinery. At a higher level, integration activities involve the updating of the knowledge base of the organisation; developing new skills and considering how they impact on the processes of the organisation. PW provides an example of this with their preceptorship programme which allows students to engage real life experiences on the ward while still training; also integration activities are exemplified through the developing of training and development

pathways for employees in anticipation of how they fit in to the broader objectives of the organisation. This exercise is done through the ROAD process which has already been discussed within the thesis. Integration activities were therefore identified at three different levels which were ordered into a tentative hierarchy. The processes can occur simultaneously within an organisation implementing KM. The hierarchy is useful in that it helps to identify and understand some of the goings on in an organisation within a knowledge integration context. The first level represents the integration or fusion of tacit and explicit knowledge. This process, as stated above, involves the combining of old and new knowledge, thus sub-levels at this stage of integration necessarily include the fusion of tacit and tacit as well as explicit and explicit knowledge- similar to socialisation and combination in the SECI model (see Nonaka and Takeuchi, 1995). Nonaka and Toyama (2003) further expand on the process, adding that it is a dialectic process; a process that involves an exchange of knowledge and debate to reach an agreeable conclusion. The combination of old and new knowledge is directly linked to an organisation's ability to create new knowledge; hence knowledge integration and creation are two inseparable processes of KM. However, both processes depend on the ability of an organisation to exchange ideas, data, information and knowledge effectively. Consequently, organisations trying to enrich this first level of integration get "bogged down" trying to manage this process and spend time and money on technologies that store and transfer explicit knowledge.

According to Grant (1996), the ability of an organisation to integrate explicit and tacit knowledge depends on the depth and breadth of the knowledge. Understandably, it would

take more effort and time to integrate highly technical knowledge than it would less technical knowledge. Although this is tantamount to stating the obvious, this observation is important to KM as established by the visits to CCS. CCS had fluctuating output levels which sometimes made it necessary to hire agency employees in order to cope with work volumes. There were obvious concerns about the integration of employees into the work environment as well as the tension between training needs of agency staff and the cost-effectiveness of any such undertakings. However, having studied the nature of the work and hence the knowledge needed to carry out the tasks in CCS, it was concluded that the level of skill and knowledge needed to complete the tasks did not warrant extensive training or skill development and integration activities. It followed that the positions in which high employee turnover was experienced coincidentally had low skills and knowledge requirements hence skill development and integration became less significant. The other skills required such as basic computer literacy, communication and interpersonal skills were acquired through experience and were tacit to the incumbents therefore training for such positions focused mostly on product knowledge. Conversely, a more structured HR policy on hiring and induction of new employees would be expected where the tasks require a wide and deep knowledge and skills base (Grant, 1996) as was the case in PPH and PW. Given such a background of integration activities, it would be interesting to investigate the dynamics of knowledge integration in short-term but knowledge intensive activities such as software development and other similar projects where project teams are put together to achieve a specific task and disbanded once its objectives have been met. The demands on integration activities are likely to be far

greater as team members are likely to have a vast amount of knowledge in a variety of knowledge backgrounds.

The second level of integration represents the process of integrating new knowledge into established organisational processes. This process has not been fully explored in the extant KM literature and potentially presents a lot of research opportunities. According to Grant (1996), new knowledge is integrated into organisational practice through procedures, routines and directives although the process is not fully explicated. It is therefore gathered that the second level represents an interaction of knowledge with the business process. Knowledge is an essential input for any transformation or business process. During this interaction new relationships and associations are discovered (Cook and Brown, 1999) and are subsequently articulated and shared using various knowledge sharing mechanisms. Therefore the continued successful interaction of a knowledgeable individual with a business process is an indication of knowledge integration. Furthermore, there is a continuous interchange between the first and second level of integration in the conceptual hierarchy of integration. What barriers to the process exist or how organisations navigate the process still remains a black box. However, efforts to find the use to which knowledge is put in organisational settings have been made through use of knowledge maps (K-Maps) and process mapping techniques. All of these activities are part of the process in the second level of the integration hierarchy but are not exhaustive.

The third level of integration represents the adoption of KM thinking and acting in all organisational activities. At this level, organisational members appreciate the importance of knowledge in their work and recognise its impact on all organisational functions. Hence, they can recognise knowledge where it has been created, its use, where it should be applied and how to retain it. KM activities such as creation, storage, transfer, integration and application begin to take place spontaneously and are incorporated into the daily tasks of an employee. Success at this level of integration depends on top management commitment, social interactions and relationships and can therefore be upset by personnel additions or subtractions. The third level of integration is very important because attitudes towards knowledge sharing and socialisation have an impact on the manner in which knowledge is managed at the first level of integration. Evidence from Manufacturing Co. and PPH shows that organisational culture and the attitudes towards KM generally affected operational efficiency in both organisations. The need for financial incentives and recognition in the respective organisations encouraged a culture of knowledge hoarding which ultimately affected the adoption of KM thinking. Furthermore, the lack of explicit support for KM from top management created a "knowledge vacuum" in PPH. As noted from the interview, employees often had to make decisions in a "vacuum". From the discussion thus far, the third level of KM integration is representative of the formalisation of KM in the organisation. There is direct inter-relation amongst all three levels of integration in that they all feed into each other. For example, the conscious practice of integration activities such as combining old and new explicit knowledge in an organisation's databases (first level of integration) could be influenced by the degree to which KM is a part of the organisational management

philosophy (third level of integration). Likewise, the combination of new and existing knowledge in the first level of integration influences the nature of the interaction that takes place when an employee is working on a business process (in the second level of integration). Clearly the hierarchy of integration is conceptual, however, the evidence in the findings suggests that integration activities do take place in organisations and perhaps a more systematic management approach is required to reflect their importance to the KM process.

14.3.1 The OKM Framework

The discussion of the OKM framework has thus far focused on the inclusion of integrating activities. At this juncture it is important to comment on the alignment of the participant organisations to the framework as a means of testing the robustness of the framework and also to discover the KM strengths and weakness of the organisations. With respect to the outcomes of mapping organisations onto the OKM framework, some important observations were made. The most important outcome was that the organisations were aligned to the framework albeit with minor differences. Some of the differences were explained by reference to operational strategy as asserted by Back et al et al (2001) who state that organisations follow one of two KM strategies: advancement or survival. The advancement strategy seeks to create new knowledge and introduce innovative products/services or processes whilst the survival strategy seeks to maintain current performance. It is expected that organisations adopting a survival strategy attempt to make incremental improvements in order to maintain their competitive positions in an ever-changing business environment. In Manufacturing Co., it was noted that their KM

practices reflected an incremental improvement approach because they did not report notable knowledge creation activities. A brief appraisal of their operations and product range could be used to explain this observation. The IB5 gearbox which they produce was an improvement to a previous 4-speed gearbox. It was developed into a 5-speed gearbox in order to remain competitive. Further, there was a new improved version of the IB5 gearbox called the B6 which was waiting to go ahead for production. The technology used for the B6 is identical to that of the IB5 but is more advanced. Moreover, the MT82, a low volume product aimed at commercial vehicles was an improvement on the MT75. Evidently, advancement in Manufacturing Co. is evolutionary rather than revolutionary. Knowledge creation is therefore incremental; probably due to the fact that there is far more inertia in the gearbox industry than in the automotive industry. Similarly, the alignment exercise in CCS showed that the organisation does not engage knowledge development or creation activities. Formally training individuals is not possible in CCS because of human resource constraints. As such individuals rely on information gathered during induction and through observing other employees at work. After induction, new employees observe more experienced colleagues until they are confident enough to do the job themselves. Clearly the mapping process was useful in that some information about the participant organisations could be derived from their maps when compared to the OKM framework. Given the background of KM presented in this thesis, the OKM framework puts shape to a KM landscape which is still developing and as a result has various perspectives. Therefore there are some merits in using the OKM framework as a KM activities template and the mapping exercise as an assessment of KM practices. However, not all the differences in alignment could be attributed to different operational

strategies, i.e. advancement or survival. For example, there are no reported knowledge creation activities in PW despite the fact that they are part of the NHS which has struggled to transform itself into an economically viable entity and innovation at the operational level would aid achievement of this objective. It is therefore logical to suggest that this is merely a failure of the KM system in PW. Given this outcome, the basis for using the OKM framework as the starting point for assessing KM practices was predicated. However, the assessment produced "aggregate" representations of the KM practices in the organisations. In addition, the boxes and arrows used to illustrate the organisational KM practices are a simplistic and uncomplicated representation of a messier complex situation in real life. In spite of this, the OKM framework was good as a starting point for KM assessment and should be considered as such.

14.3.2 Developing the KM Assessment tool

The development process of the KM assessment tool was based on the outcome of the initial stages of the research i.e. it was guided by the OKM framework. A major shortcoming of an assessment based on the mapping exercise as the one referred to in the previous section was that it did not provide intricate information about the assessed organisation's KM mechanisms and their suitability for organisational processes. As reported in the thesis, there is a dearth of assessment tools of this nature. The extant KM literature has a few notable assessment tools that seek to establish the level of development of an organisation's KM practices. The difference with the assessment that is presented in this thesis is that the developed tool seeks to assess the effectiveness and

suitability of the KM mechanisms in use. For brevity, the discussion will not cover the intricate issues and reasons why other assessment tools were not adequate. This discussion was covered in Chapter 7. At this juncture the discussion will be limited to the development of the QFD idea; to include the challenges, difficulties, positive and negative aspects of its application. The first challenge involved with the use of QFD was to learn how to interact with the software. The standard software that was used had an option to use templates or to create a template. The options that the standard templates offered are a reflection of traditional QFD as they were for product development or for help in making decisions such as which college to attend or what car to purchase. The main challenge was to make the final KM assessment matrix reflect the dimensions of KM, i.e. KM categories, mechanisms and barriers. Furthermore, the outcome had to be interpreted in a manner that organisations would understand. It was logical to adopt the same principle of interpreting the KM assessment output as that used in traditional QFD as this has been used over several years and has acquired widespread acceptance. Similarly, the 9-3-1 scale was adopted for the same reasons. There was an attempt to adopt the four-phase model of the QFD but it was found that this was not necessary. The KM assessment tool was developed to illustrate an organisation's KM practices. If this could be achieved by use of a single matrix, it would make the assessment process less complicated; using a four phase model would contradict this objective. The eventual template that was used in the assessment of the participant organisations was suitable not only for illustrating the organisation's current practices but it was also used for designing an improved KM system for the organisations. There are some notable negatives with the use of the QFD software. There were limited options to change scales if this had been

deemed necessary. The scale alternatives provided for in the software were 9-3-1 and 1-5. This rigidity was also experienced when an attempt to alter the matrix structure was made. It was not possible to illustrate the inter-relationship between the KM categories for example. These relationships were briefly explored and were illustrated by the box and arrow diagram depicting the OKM framework. However, an attempt to show these relationships on the tool was not successful. Furthermore, the calculations that were made by the software were incorrect. As a consequence, participants had to do manual calculations in order to derive meaning from the KM assessment output. It was found that this exercise was tedious and monotonous. In fact, all organisations reported that the calculations took too long to complete and cross-check. The feedback by ASC however, provided an alternative to the use of the QFD software without changing the KM assessment concept. In addition to completing the KM assessment template produced by the QFD software, ASC participants produced a KM assessment output using Microsoft Excel in order to show the individual relationships between KM categories and mechanisms as well as to automatically calculate the figures. The only difference was that in the Excel model, figures and not symbols were used. There was no reported drawback associated with the use of figures instead of symbols. It had been suggested that the use of symbols would be more ideal particularly for the stage when organisations start to investigate the KM assessment tool for key relationships and patterns. It was argued that the use of symbols makes patterns more conspicuous than numbers. This feedback from ASC is positive not only because it advances the KM assessment concept but also because it is evidence that the concept is clear and easily understandable such that participants can make contributions towards its further development.

There is an important implication that is associated with the use of the 9-3-1 scale which was used to illustrate the effectiveness of KM mechanisms. As noted earlier in the thesis, this scale suggests that a moderate rating is mathematically 3 times more than a weak rating. Likewise, a strong rating is portrayed as being 3 times the value of the moderate rating and 9 times more than a weak rating. This is an unintended outcome of the scale chosen. The key outcome that was sought from the use of the scales was to alert organisations to KM mechanisms that are not being applied as effectively as they should and to make improvements. Using the same principle, it would be possible to alert organisations to KM mechanisms that are surplus to organisational requirements. As noted in Manufacturing Co. it is possible to over-commit resources in terms of time and personnel to KM mechanisms where the returns do not justify the resources consumed. For example, the time that was devoted to meetings was found to be impeding other operational activities. As such the assumption that the more a KM mechanism is used, the more effective it becomes is not necessarily true for all cases. This seems to be a flaw in some KM publications. In contrast, the research findings support Gold et al's (2001) argument that KM mechanisms' use and practice should be interpreted with awareness of the organisation's goals and their operating environment. Presented another way, to understand KM practices it is necessary to engage the context in which those practices are being deployed. Therefore it is conceivable that reducing the resources devoted to some KM practices would represent an improvement to the KM system. Returning to the use of the 9-3-1 scale, recent publications (for example, Crostack et al., (2006)) recognise the problems associated with scaling albeit not specifically the 9-3-1 scale but

including also the 1 to 5 and the 1 to 10 scales. Their argument is based on the fact that calculations that are associated with the weighted customer requirements in the QFD matrix are flawed. They suggest employing Analytic Hierarchy Process (AHP) as a method of acquiring greater accuracy. The outcome is that the weighted customer requirements are included in the calculations not as an absolute value of a defined interval scale but in the form of relative figures between 0 and 1. The relative weightings result from making comparisons of the pairs in order to achieve increased quality outcomes. Within this research project, the problems that were associated with quantifying subjective data had been recognised as a potential weakness. There were concerns that *effectiveness* would be difficult to determine given the complexity that is associated with such a construct in KM terms. As such, this development with the calculations associated with QFD further compromises the outcome in terms of the accuracy of the figures produced by the KM assessment tool. However, speaking strictly in the context of KM assessment and making organisations aware of deficiencies in their KM practices and finding solutions to improve them, the method that was adopted was useful as reported by participant organisations. Furthermore, KM assessment outputs were confirmed to be representative of organisational reality and were confirmed during interviews. Participants commented on the value of the KM assessment exercise in terms of identifying areas for improvement and finding possible KM mechanisms for such improvements within the KM assessment tool. It is considered, therefore, that the accuracy of the figures may be questioned but not the concept of KM assessment and improvement. This is not to disregard the developments in the on-going evolution of QFD, but to assert that the weaknesses that result from them do not invalidate the KM

assessment concept. In fact, it is considered that scaling issues could be included as aspects of the KM assessment tool that can be further developed as part of the on-going evolution of the KM assessment tool.

14.3.3 Developing the KM assessment Guide

Assessing an organisation's KM practices using the KM assessment tool requires that the process be undertaken in a methodical manner in order to attain the required outcome. Although the method of assessment is based on a well-established concept of QFD, the process is not easily understood and requires careful consideration. A good example is the application of the KM assessment tool in Tyco (Manchester) where the application of the KM assessment tool produced less than desirable outcomes because the methodology that was attached to the KM assessment tool was not followed. It is worth referring to some findings that necessitated the modification of the assessment process and led to the refining of the KM assessment guide. The most important aspect that changed in the assessment process was the inclusion of a second assessment matrix that illustrated the level of use of KM mechanisms in organisations. As pointed out in section 14.3.2 the level of use of a KM mechanism does not determine how effective it is for organisational processes. Level of use was determined by the resources devoted to KM mechanisms i.e. time, financial input, frequency of use and number of employees. Evidence from organisations suggested that there was confusion between the two terms use and effectiveness. To allay the possibility of this happening, the KM assessment guide has included a stage that required participants to determine which KM mechanisms they use

as well as the level of use. The extra stage in the assessment process added other positives to the overall objective; it made it possible to compare participant ratings of use and effectiveness for KM mechanisms. The result is that participants can revise the manner in which they conduct particular activities in order to be more efficient. Effectively, the juxtaposition of the effectiveness and use matrices represents a preliminary gap analysis.

The other developments within the KM assessment guide pertain to the determining of organisational difficulty to implement changes and improvements. The changes made to this aspect in the use of QFD methodology have already been discussed in relation to the theoretical contributions made by the research project and do not require repeating. The organisations that tested the new methods found the methods to be logical as evidenced by the 80% rating given by all organisations. Overall, high ratings were reported for all the criteria that organisations were asked to rate the tool in. Therefore the tool does not require any major conceptual changes to it. Perhaps issues to do with making the assessment task less monotonous and tedious require more attention.

Evidence also suggests that use of multiple participants in populating KM assessment matrices yields more in terms of debate and knowledge about organisational processes and context. The feedback from HA and ASC where multiple participants took part in the assessment showed that the population of KM assessment matrices produced different perspectives of the organisational context, in the process highlighting important aspects of the operations. Although the downside was that most inter-relationships between KM

categories and mechanisms took longer to rate, the outcome was found to be well-rounded and therefore reflective of the organisation's reality. Comparing this outcome to the formative stages of the assessment tool where feedback was provided by single participants, the value of multiple participants cannot be overstated. Feedback was sometimes inconsistent or incomplete leading to further questions and follow up interviews. It is therefore recommended that where possible, an organisation should engage multiple participants in the assessment process as it is more productive and provides a well-balanced perspective of the organisation.

14.4 Practical Research Limitations

There are a number of limitations to account for regarding the execution of the study. It is submitted however that the practical limitations, such as they are, do not fundamentally weaken the study because they can mostly be controlled for by the variety of data collection methods employed.

This research focused predominantly on the development of a KM assessment tool. The second stage of the research project where the initial theoretical design of the tool was applied for the first time required an in-depth interaction with organisations. Of the three organisations involved at this stage, it was not possible to observe the processes in PW first hand as was the case in PPH and Manufacturing Co. due to issues of client privacy. In PPH access was restricted to areas where clients cannot be accessed therefore it was limited in a sense. Sufficient access was gained, however, through interviews with

management and other documentary evidence. While it is important to acknowledge the potential limitation of this shift in data collection approach, it does not undermine the study because the desired information was still accessed.

The research focused on the operational level of organisational activity. Within this level of the organisation, the research project outlined the key issues at hand i.e. to determine suitability of KM mechanisms for operational activities and improving efficiency of operations through better management of knowledge assets and objects. As such the scope of the study offered benefits in terms of the detail that was gathered with respect to the development of a KM assessment tool for the operational level, but there is a trade-off to be made regarding the wider picture of knowledge management in organisations. Studies in KM risk over-focus on specific aspects e.g. on technology or social aspects to the detriment of the organisation's wider context. It is argued however, that within the operations perspective, the research project has encapsulated the soft and hard perspectives and mitigated against this over-focus.

14.5 Future work and research

This research project has laid the foundation for further research in KM assessment. The following areas have been identified for further work and research:

- Chapter 12 briefly indicated that there is potential to use the KM assessment tool as a basis for comparing and transferring KM practices. Examples of KM practice transfer were provided using PW and PPH. The KM assessment tool can be further developed into a tool to establish best practice and applied to

benchmarking. Self-assessment and benchmarking are interconnected (Zairi, 1996) and extending the use of the tool towards research of this nature is a natural progression.

- The KM assessment tool has been shown to have potential as a design tool (see Chapter 12). In this research project, the application of the tool has been in organisations that already have existing KM systems regardless of formalisation. However, its potential as a design tool for organisations that have not yet started operations could not be established. This fits perfectly into the traditional applications of QFD methodology and therefore has a high success potential as a research area.
- The true value of the KM assessment tool can be predicated on further studies of a longitudinal nature. It is submitted that the before and after (use of the KM assessment tool) KM context of an organisation can be analysed in order to ascertain the merits of the assessment and improvement exercise. Again this is a natural progression from the initial development of the tool that has been presented in this research project.

14.6 Concluding remarks

This research project has identified key knowledge management activities and mechanisms that impact on operational activities. The subsequent categorisation of KM mechanisms was presented as the OKM framework. The development of the KM assessment tool presented in this thesis was guided by this framework. It is submitted that the work presented covers the key KM dimensions that influence operational efficiency,

i.e. KM categories, mechanisms and barriers. These dimensions of KM were condensed into a KM assessment tool that has been presented as a mechanism whose application can improve the manner in which organisations manage their knowledge assets and ultimately improve operational efficiency. As such, it is submitted that the key objective of undertaking the research project was achieved. The undertakings of the research activities were however not without difficulties and challenges as acknowledged in section 14. 4. However, these limitations were found not to have a significant impact on the outcome of the project objectives. The potential uses and benefits of the KM assessment tool are many; not least to provide a platform for organisations to maximise the returns from their knowledge assets and become more competitive in an increasingly unpredictable business environment.

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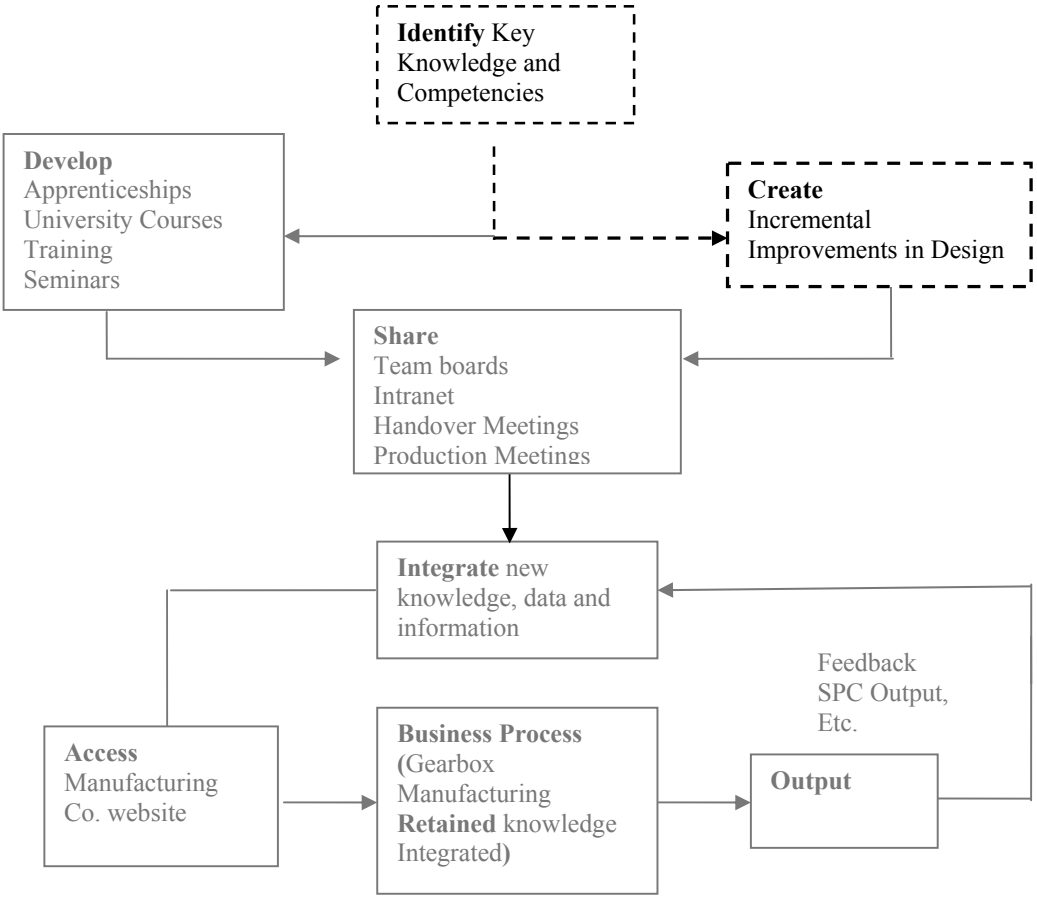
Appendices

Appendix 1: Mapping Manufacturing Co. onto the OKM framework



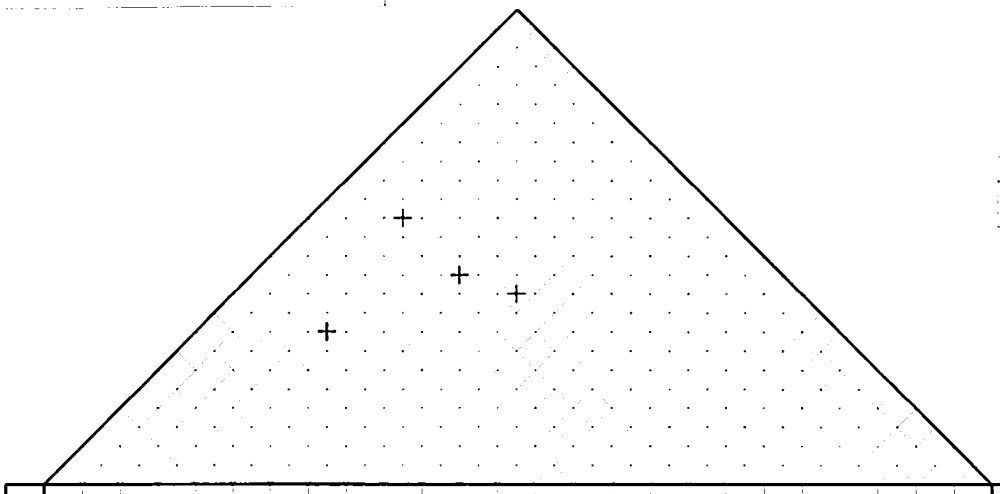
Showing Aligning of Manufacturing Co. and Proposed KM Framework

A1 General Notes

The broken boxes represent categories of KM activities that were not found in Manufacturing Co. It is therefore found that Manufacturing Co. had limited to no activities in knowledge creation and identification

Appendix 2: KM Assessment Output from PPH

KM Assessment PPH



Tradeoffs

Synergy + 1.0
Compromise – -1.0

Importance

Extremely Important ■ 5.0
Very Important ◢ 4.0
Somewhat Important □ 3.0
A little important ⌟ 2.0
Not Important 1.0

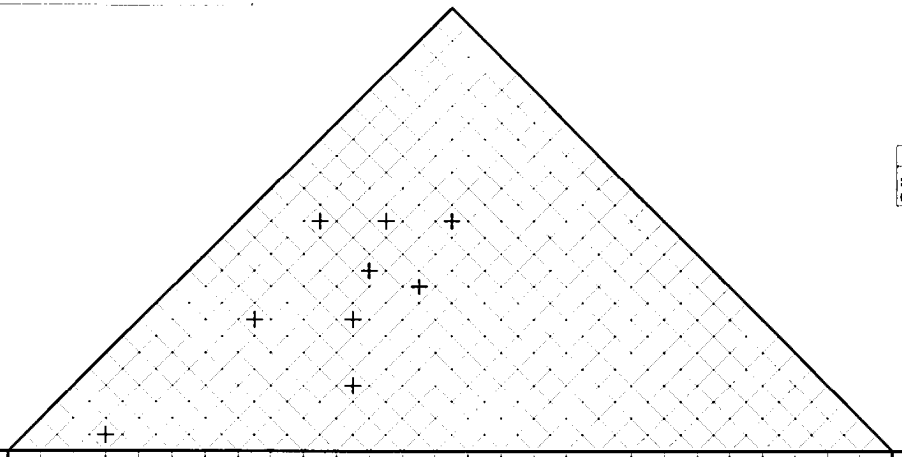
		Importance of the Criteria	Apprenticeship	Trainee ships and Internships	Induction	Meetings	Mentoring, Coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Handover Sessions	Intranet	Team-boards	Why-why Analyses	Research and Development	Short courses	Seminars	Observations	Training	Knowledge Mapping	Email, Bulletins, Memos	Expert Systems	Job Aids	Books, Manuals	KM BARRIERS	Knowledge hoarding	Lack of time	Lack of IT skills	Lack of infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of penalty	Fear of idea robbery	High cost of investment	Total KM Barrier score	
		1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification	1	□																											1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	1
Knowledge Development	2	□			●		●	●											●	●									1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	2
Knowledge Creation	3	□																											1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	3
Knowledge Sharing	4	■						●		●			●	●						●				●			●		1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	4
Knowledge Retention	5	■										●	●																1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	5
Knowledge Access	6	◢										●	●																1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	6
Knowledge Integration	7	◢			●																								1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	38.0	7
	8																																							8
	9																																							9
	10																																							10
Overall Effectiveness	1		27.0	27.0	101.0	81.0	69.0	99.0	27.0	73.0	43.0	99.0	159.0	77.0	27.0	27.0	27.0	27.0	61.0	99.0	27.0	33.0	27.0	67.0	27.0	27.0	80.0														
Percent Effectiveness	2		2.0	2.0	7.3	7.8	5.0	7.1	2.0	5.3	3.1	7.1	11.5	5.6	2.0	2.0	2.0	2.0	4.4	7.1	2.0	2.4	2.0	4.8	2.0	2.0	5.8														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25														

Standard 9-3-1

Strong ● 9.0
Moderate 3.0
Weak 1.0

Appendix 3: KM Assessment Output depicting a "Desirable" KM system for PPH

DesirableKM System: PPH



Importance
Extremely Important ■ 5.0
Very Important ◢ 4.0
Somewhat Important □ 3.0
A little important ◺ 2.0
Not Important ▽ 1.0

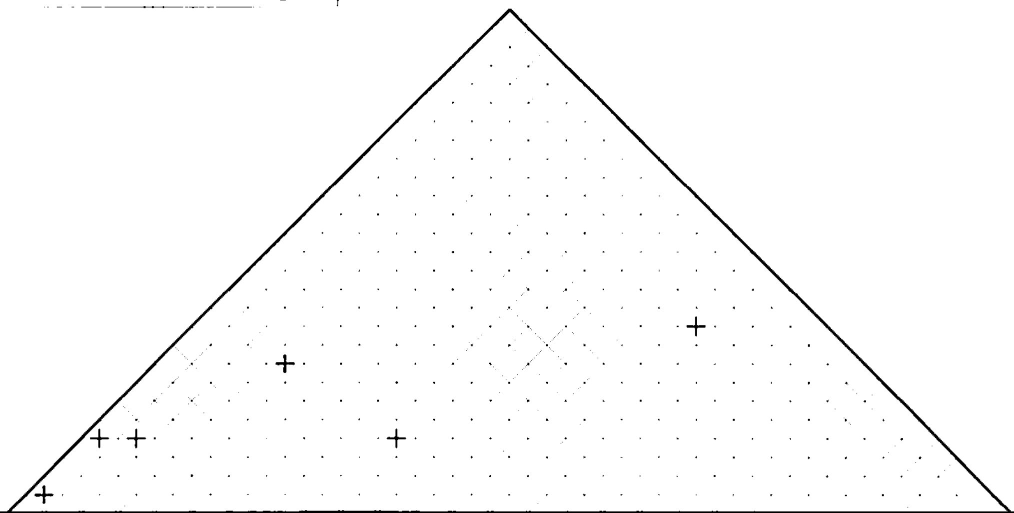
Tradeoffs
Synergy + 1.0
Compromise – -1.0

Standard 9-3-1
Strong ● 9.0
Moderate ○ 3.0
Weak ▽ 1.0

		Importance of the Criteria	Apprenticeships	Traineeships and Internships	Induction	Meetings	Mentoring and Coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Handover sessions	Intranet	Team-boards	Why-why Analysis	Research and Development	Short Courses	Seminars	Observation	Training	Knowledge Mapping	E-mail, Memos, Bulletins	Expert Systems	Job Aids	Books, Manuals	Communication Committees	Knowledge transfer Team	KM BARRIERS	KM Barriers score	Knowledge Hoarding	Lack of Time	lack of IT skills	Lack of Infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of penalty	Fear of idea robbery	High cost of investment	
		1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification	1	◢	▽	▽	▽	●	○	○	●	▽	○	○	○	○	○	▽	●	▽	○	○	○	▽	●	▽	▽	▽	▽	▽	○		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	1
Knowledge Development	2	◢	▽	▽	●	○	●	●	○	○	○	▽	○	○	○	○	○	▽	●	○	●	○	○	○	▽	▽	○	○	●		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	2
Knowledge Creation	3	◢	▽	▽	○	○	○	○	●	○	▽	▽	○	○	▽	▽	●	▽	○	○	○	○	○	▽	▽	▽	▽	▽	○		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	3
Knowledge Sharing	4	■	▽	▽	●	●	●	●	○	●	○	●	●	●	▽	●	○	▽	●	●	●	○	○	●	▽	▽	●	●	●		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	4
Knowledge Retention	5	■	▽	▽	▽	○	●	▽	●	○	●	●	●	○	●	○	○	▽	○	○	○	▽	●	▽	▽	○	○	▽	▽		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	5
Knowledge Access	6	■	▽	▽	●	●	●	○	○	○	●	●	○	●	●	●	○	▽	○	●	○	○	●	▽	▽	○	○	○	○		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	6
Knowledge Integration	7	◢	▽	▽	○	○	○	○	●	○	●	○	○	○	●	○	●	▽	○	○	○	○	○	▽	▽	▽	▽	●	○		38.0	1.0	1.0	1.0	9.0	9.0	3.0	9.0	1.0	1.0	1.0	1.0	7
	8																																										8
	9																																										9
	10																																										10
	1																																										
KM Barrier score	2		38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0														
Organisational Competence	3		4.0	4.0	7.0	7.0	7.0	7.0	5.0	7.0	5.0	7.0	7.0	7.0	3.0	5.0	4.0	1.0	3.0	7.0	6.0	4.0	4.0	6.0	1.0	4.0	7.0	6.0	6.0														
Organisational Difficulty= KM barrier score/organisational competence score	4		9.5	9.5	5.4	5.4	5.4	5.4	7.6	5.4	7.6	5.4	5.4	5.4	12.7	7.6	9.5	38.0	12.7	5.4	6.3	9.5	9.5	6.3	38.0	9.5	5.4	6.3	6.3														
Overall Effectiveness	5		31.0	31.0	178.0	177.0	207.0	137.0	195.0	105.0	166.0	169.0	153.0	153.0	169.0	140.0	165.0	31.0	137.0	153.0	140.0	75.0	177.0	71.0	31.0	61.0	99.0	121.0	137.0														
Percent Effectiveness	6		0.9	0.9	5.2	5.2	6.1	4.0	5.7	3.1	4.9	5.0	4.5	4.5	5.0	4.1	4.8	0.9	4.0	4.5	4.1	2.2	5.2	2.1	0.9	1.8	2.9	3.5	4.0														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27														

Appendix 4: KM Assessment Output for Manufacturing Co.

KM AssessmentManufacturingCo



Importance	
Extremely Important	■ 5.0
Very Important	◢ 4.0
Somewhat Important	□ 3.0
A little important	⌐ 2.0
Not Important	▷ 1.0

Tradeoffs	
Synergy	+ 1.0
Compromise	− -1.0

Standard 9-3-1	
Strong	● 9.0
Moderate	○ 3.0
Weak	△ 1.0

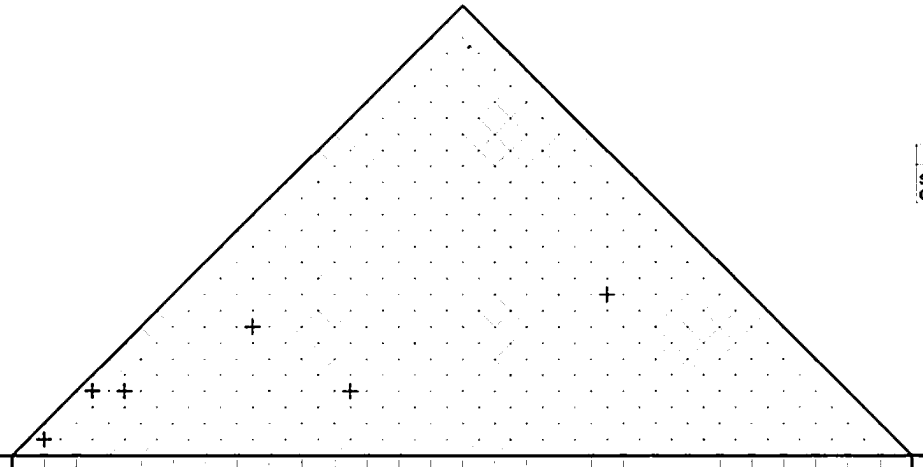
		Importance of the Criteria	Apprenticeship	Traineeships and Internships	Induction	Meetings	Mentoring, Coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Handover Sessions	Intranet
		1	1	2	3	4	5	6	7	8	9	10	11	12	13
Knowledge Identification	1	□	△	○	△	○	△	△	△	△	○		●	△	△
Knowledge Development	2	□	△	●	△	○	○	○	△	△	△		△	△	△
Knowledge Creation	3	□	△	●	△	△	○	●	△	△	△	△	△	△	△
Knowledge Sharing	4	■	●	○	△	○	●	●	△	△	○	●	△	△	○
Knowledge Retention	5	■	●	●	△	△	○	○	△	△	△	●	●	○	●
Knowledge Access	6	□	●	●	△	△	●	●	△	○	○	●	●	△	●
Knowledge Integration	7	□	●	○	△	○	○	○	△	△	○	○	○	△	○
	8														
	9														
	10														
Overall Effectiveness	1		162.0	168.0	26.0	54.0	126.0	144.0	26.0	72.0	66.0	156.0	150.0	36.0	114.0
Percent Effectiveness	2		7.6	7.9	1.2	2.5	5.9	6.8	1.2	3.4	3.1	7.3	7.0	1.7	5.3
			1	2	3	4	5	6	7	8	9	10	11	12	13

		Team-boards	Why-why Analyses	Research and Development	Short courses	Seminars	Observations	Training	Knowledge Mapping	Email, Bulletins, Memos	Expert Systems	Job Aids	Books, Manuals	Knowledge Transfer Team	Chief knowledge officer
		14	15	16	17	18	19	20	21	22	23	24	25	26	27
Knowledge Identification	1	○	△	△	○	○	△	△	△	△	△	●	○		
Knowledge Development	2	○	○	△	△	△	△	△	△	△	△	○	○		
Knowledge Creation	3	○	○	△	△	△	△	△	△	○	△	○	○		
Knowledge Sharing	4	○	△	△	○	△	△	△	△	○	△	●	○		
Knowledge Retention	5	○	●	△	△	△	△	△	△	○	△	●	●		
Knowledge Access	6	○	○	△	△	△	○	△	△	○	△	●	●		
Knowledge Integration	7	○	○	△	△	△	△	○	△	○	△	●	●		
	8														
	9														
	10														
Overall Effectiveness	1	78.0	92.0	26.0	48.0	26.0	62.0	54.0	26.0	66.0	26.0	198.0	126.0		
Percent Effectiveness	2	3.7	4.3	1.2	2.3	1.2	2.9	2.5	1.2	3.1	1.2	9.3	5.9		
		14	15	16	17	18	19	20	21	22	23	24	25	26	27

	KM BARRIERS	Knowledge hoarding	Lack of time	Lack of IT skills	Lack of infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of penalty	Fear of idea robbery	High cost of investment	Total score KM Barriers	
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification		9.0	9.0	9.0	3.0	9.0	9.0	3.0	1.0	1.0	9.0	1.0	63.0	1
Knowledge Development		9.0	9.0	9.0	3.0	9.0	3.0	3.0	1.0	1.0	1.0	1.0	49.0	2
Knowledge Creation		9.0	9.0	9.0	3.0	9.0	3.0	3.0	1.0	1.0	1.0	3.0	51.0	3
Knowledge Sharing		9.0	9.0	9.0	3.0	9.0	9.0	3.0	1.0	1.0	9.0	1.0	63.0	4
Knowledge Retention		3.0	3.0	9.0	3.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	29.0	5
Knowledge Access		9.0	1.0	9.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	45.0	6
Knowledge Integration		9.0	3.0	9.0	3.0	9.0	3.0	1.0	1.0	1.0	1.0	1.0	41.0	7
														8
														9
														10

Appendix 5: KM Assessment Output depicting a "Desirable" KM system for Manufacturing Co.

Desirable KM system
Manufacturing Co.



Importance
Extremely important ■ 5.0
Very important ◢ 4.0
Somewhat important □ 3.0
A little important . : 2.0
Not important ⋮ 1.0

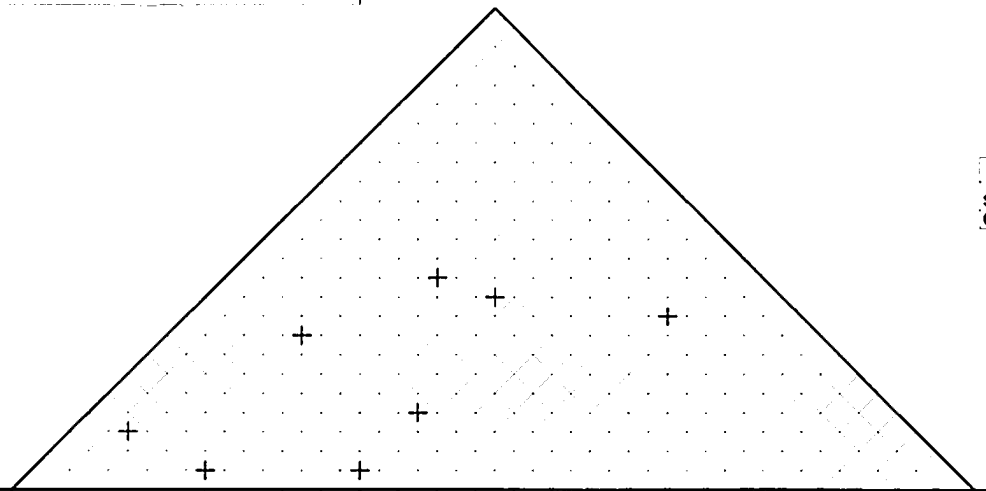
Tradeoffs
Synergy + 1.0
Compromise – -1.0

Standard 9-3-1
Strong ● 9.0
Moderate ○ 3.0
Weak ¯ 1.0

		Importance of the Criteria	1 Apprenticeship	2 Traineeships and Internships	3 Induction	4 Meetings	5 Mentoring, Coaching	6 University Courses	7 Process Mapping	8 Networking	9 Corporate Websites	10 Databases, Repositories	11 Employees	12 Handover Sessions	13 Intranet	14 Team-boards	15 Why-why Analyses	16 Research and Development	17 Short courses	18 Seminars	19 Observations	20 Training	21 Knowledge Mapping	22 Email, Bulletins, Memos	23 Expert Systems	24 Job Aids	25 Books, Manuals	26 Knowledge Transfer Team	27 Chief knowledge officer	28 Data Management Application	KM BARRIERS	1 Knowledge hoarding	2 Lack of time	3 Lack of IT skills	4 Lack of infrastructure	5 No incentives	6 Time consuming	7 Lack of management support	8 Fear of job loss	9 Fear of penalty	10 Fear of idea robbery	11 High cost of investment	12 Total score KM Barriers	13
Knowledge Identification	1	◢	○			●	○		●				●				●									●						9.0	9.0	9.0	3.0	9.0	9.0	3.0	1.0	1.0	9.0	1.0	63.0	1
Knowledge Development	2	□	●	●			●																								9.0	9.0	9.0	3.0	9.0	3.0	3.0	1.0	1.0	1.0	1.0	49.0	2
Knowledge Creation	3																●														9.0	9.0	9.0	3.0	9.0	3.0	3.0	1.0	1.0	1.0	3.0	51.0	3
Knowledge Sharing	4	■	●	●	●	●	●	●			●		●	●	●	●			●							●					9.0	9.0	9.0	3.0	9.0	9.0	3.0	1.0	1.0	9.0	1.0	63.0	4
Knowledge Retention	5	■	●				●		●		●	●			●				●							●	●				3.0	3.0	9.0	3.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	29.0	5
Knowledge Access	6	◢	●	●		●		●	●			●	●	●	●	●			●	●			●			●	●			●	9.0	1.0	9.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	45.0	6
Knowledge Integration	7	□	●	●		●					●															●	●				9.0	3.0	9.0	3.0	9.0	3.0	1.0	1.0	1.0	1.0	1.0	41.0	7
	8																																									8
	9																																									9
	10																																									10
KM Barrier score	1		48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0													
Organisational Competence	2		8.0	7.0	5.0	7.0	6.0	5.0	5.0	6.0	7.0	6.0	6.0	6.0	7.0	7.0	6.0	3.0	6.0	5.0	6.0	6.0	3.0	6.0	2.0	7.0	6.0	0.0	0.0	6.0													
Organisational difficulty = KM barrier score/organisational competence score	3		6.0	6.9	9.6	6.9	8.0	9.6	9.6	8.0	6.9	8.0	8.0	8.0	6.9	6.9	8.0	16.0	8.0	9.6	8.0	8.0	16.0	8.0	24.0	6.9	8.0	0.0	0.0	8.0													
Overall Effectiveness	4		195.0	171.0	91.0	174.0	153.0	124.0	159.0	73.0	145.0	126.0	156.0	135.0	159.0	129.0	113.0	27.0	121.0	105.0	81.0	73.0	105.0	67.0	27.0	207.0	153.0	0.0	0.0	75.0													
Percent Effectiveness	5		6.3	5.5	2.9	5.6	4.9	4.0	5.1	2.3	4.7	4.0	5.0	4.3	5.1	4.1	3.6	0.9	3.9	3.4	2.6	2.3	3.4	2.2	0.9	6.6	4.9	0.0	0.0	2.4													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28															

Appendix 6: KM Assessment Output for PW

KM Assessment Psychiatric Ward



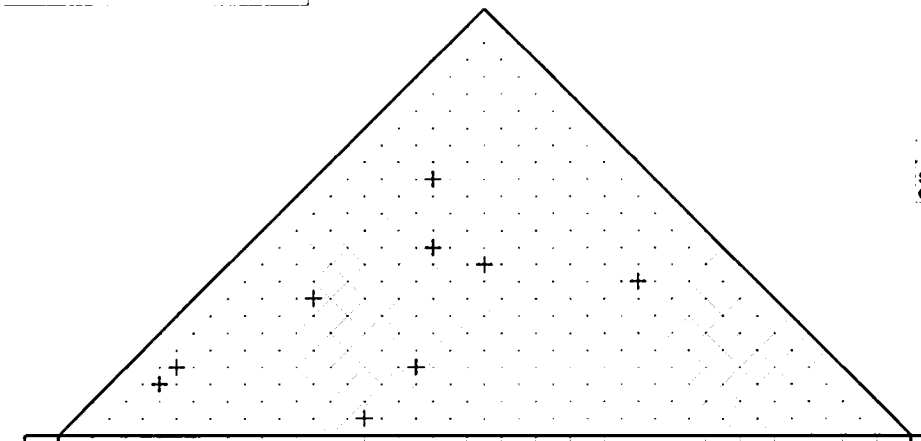
Importance
Extremely Important ■ 5.0
Very Important ◢ 4.0
Somewhat Important □ 3.0
A little important ⌟ 2.0
Not Important 1.0

		Importance of the Criteria	Apprenticeship	Traineeships and Internships	Induction	Meetings	Mentoring, Coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Handover Sessions	Intranet	Team-boards	Why-why Analyses	Research and Development	Short courses	Seminars	Observations	Training	Knowledge Mapping	Email, Bulletins, Memos	Expert Systems	Job Aids	Books, Manuals	KM BARRIERS	Knowledge hoarding	Lack of time	Lack of IT skills	Lack of infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of penalty	Fear of idea robbery	High cost of investment	Total score KM Barriers	
		1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification	1	□																											1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	1
Knowledge Development	2	■		●	●		●	●											●			●	●						1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	2
Knowledge Creation	3	□																											1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	3
Knowledge Sharing	4	■		●		●	●							●								●							1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	4
Knowledge Retention	5	◢										●	●																1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	5
Knowledge Access	6	◢				●								●															1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	6
Knowledge Integration	7	□																											1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	7
	8																																							8
	9																																							9
	10																																							10
	1																																							
Overall Effectiveness	2		27	107	73	105	115	67	27	27	27	67	89	121	27	45	27	27	84	47	85	127	27	27	27	53	53														
Percent Effectiveness	3		1.8	7.1	4.8	7.0	7.6	4.4	1.8	1.8	1.8	4.4	5.9	8.0	1.8	3.0	1.8	1.8	5.6	3.1	5.6	8.4	1.8	1.8	1.8	3.5	3.5														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25														

Standard 9-3-1
Strong ● 9.0
Moderate 3.0
Weak 1.0

Appendix 7: KM Assessment Output depicting a "Desirable" KM system for PW

Desirable KM System Psychiatric Ward



Tradeoffs

Synergy + 1.0
Compromise – -1.0

Importance

Extremely Important ■ 5.0
Very Important ◢ 4.0
Somewhat Important □ 3.0
A little important ◺ 2.0
Not Important ○ 1.0

		Importance of the Criteria	Apprenticeships	Traineeship and Internships	Induction	Meetings	Mentoring and coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Hand-over Sessions	Intranet	Team-Boards	Wh-why Analysis	Research and Development	Short Courses	Seminars	Observations	Training	Knowledge Mapping	E-mail, Memos, Bulletins	Expert Systems	Job Aids	Books, Manuals	KM Barriers	Knowledge Hoarding	Lack of Time	Lack of IT Skills	Lack of Infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of idea robbery	High cost of investment	Lack of KM knowledge	KM Barrier score	
		1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification	1	□							●								●						●						1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	1
Knowledge Development	2	■		●	●		●	●											●		●	●							1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	2
Knowledge Creation	3	□							●								●												1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	3
Knowledge Sharing	4	■		●	●	●	●	●		●		●	●	●		●			●	●	●	●							1.0	1.0	1.0	1.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	27.0	4
Knowledge Retention	5	◢							●		●	●	●		●								●						1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	5
Knowledge Access	6	■				●			●		●	●	●	●	●	●				●			●						1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	6
Knowledge Integration	7	◢		●					●		●				●		●												1.0	1.0	1.0	3.0	9.0	9.0	1.0	1.0	1.0	1.0	1.0	29.0	7
	8																																							8
	9																																							9
	10																																							10
KM Barrier score	1		28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0														
Organisational Competence	2		0.0	8.0	6.0	8.0	7.0	8.0	3.0	7.0	5.0	7.0	6.0	7.0	5.0	6.0	4.0	0.0	7.0	7.0	7.0	6.0	3.0	6.0	0.0	6.0	6.0														
Organisational difficulty=KM barrier score/organisational competence score	3		0	3.5	4.7	3.5	4.0	3.5	9.3	4.0	5.6	4.0	4.7	4.0	5.6	4.7	7.0	0	4.0	4.0	4.0	4.7	9.3	4.7	0	4.7	4.7														
Overall Effectiveness	4		29	154	133	147	133	141	171	103	159	155	141	142	159	135	147	29	139	147	133	133	159	29	29	55	55														
Percent Effectiveness	5		1.0	5.2	4.5	5.0	4.5	4.8	5.9	3.5	5.4	5.2	4.8	4.8	5.4	4.6	5.0	1.0	4.7	5.0	4.5	4.5	5.4	1.0	1.0	1.9	1.9														

Standard 9-3-1

Strong ● 9.0
Moderate ○ 3.0
Weak ▽ 1.0

Appendix 8: A Guide to Knowledge Management (KM) System Self-Assessment for Improvement

A8.1 Introduction

The following is a guide for organisations wishing to assess their KM systems both formal and informal with the purpose of implementing improvements. The aim of this guide is to provide a step-by-step manual for using the KM assessment tool. The self-assessment process can be divided into three main stages which are:

1) Determining the current state of the KM system in an organisation.
2) Designing a desired KM system for the organisation.
3) Performing a gap analysis and developing a plan to close the gap.

Two KM matrices are required for the first stage of the assessment process. The first KM matrix illustrates the level of use for the KM mechanisms in terms of the following:

- Time devoted to KM mechanisms
- Frequency of use or occurrence
- Number of employees devoted to KM mechanism

The second KM matrix illustrates the effectiveness of each of the KM mechanisms in the organisation's KM system. Having two KM matrices populated in the initial stages aids

the analysis of the current KM system by highlighting those KM mechanisms where the organisation is not extracting maximum benefits as it should from the consumption of resources such as time, money, etc. invested in certain KM mechanisms.

In the second stage of the assessment process, a third KM matrix is populated to represent a desired KM system for the organisation. The desired KM system is derived from an analysis of the organisational context i.e. background information, daily operations and work routines; focusing on the core activities and what is important to the organisation. The third stage is a gap analysis that is performed to identify the differences between the current KM system and the desired and subsequently outlining what actions the organisation needs to take in order to transition towards the desired KM system.

A8.2 The KM Assessment Tool

The tool is a variant of the traditional 4-phase QFD tool which is used for product development. The KM assessment tool used has three key sections: KM categories, KM mechanisms and KM barriers as shown in Appendix 1. Each cell on the QFD matrix represents a relationship or association. The following are the relationships that will be illustrated on the KM assessment tool.

A8.2.1 KM Categories and mechanisms

In the first KM matrix to be populated, each cell which is an intersection between a KM category and mechanism represents a weighting for the use of the KM mechanism in the

category. The weighting assigned to each cell should reflect the use of the KM mechanism relative to the size and scale of operations in the organisation.

Table 13.1 is a key for the symbols used to illustrate this relationship.

Symbol	Relationship
●	Strong (9)
○	Moderate (3)
▽	Weak (1)

Table A8.1: Key for relationship between KM categories and mechanisms

For example, if the cell where knowledge sharing (KM category) and meetings (KM mechanism) intersect has an *empty circle, the interpretation of their relationship is that the use of meetings for knowledge sharing is moderate. An empty cell would mean that meetings are not used for knowledge sharing in the organisation.

In the second KM matrix, each cell which is an intersection between KM category and mechanism represents a weighting for the effectiveness of the KM mechanism in the category. For example, a black circle in the cell which is an intersection between knowledge sharing (KM category) and meetings (KM mechanisms) means that the effectiveness of meetings in knowledge sharing is strong.

* Should reflect the organisation's situation as it is

A8.2.2 KM Categories and barriers

Each cell which is an intersection between KM categories and barriers represents the perceived impact of the KM barrier on the knowledge category. The relationship between KM categories and barriers is defined by the 9-3-1 scale as follows:

Symbol	Relationship
9	Strong
3	Moderate
1	Weak

Table A8.2: Key for relationship between KM categories and barriers

For example, a *9 weighting for a relationship between "Lack of IT skills" (KM barrier) and knowledge retention (category) means that "lack of IT skills" has a strong impact on knowledge retention in that organisation. The weighting represents the organisation's current state. An empty cell would mean that "lack of IT skills" is not a KM barrier in the organisation.

A8.2.3 KM mechanisms and KM mechanisms (Tradeoffs)

The "roof" of the KM assessment tool represents the inter-relationships between the KM mechanisms. The cells in the "roof" are used to identify where the KM mechanisms

* Should reflect the organisations situation as it is

support or impede each other. For each of the cells in the roof the following possibilities exit:

- Improving one KM mechanism causes the other to improve (synergy)
- Improving one KM mechanism causes the other to deteriorate (compromise)
- There is no perceived relationship between the two KM mechanisms.

Tradeoffs are represented by the following key:

Symbol	Relationship
-	Compromise
+	Synergy

Table A8.3: Key for inter-relationships between KM mechanisms

A8.2.4 Importance to Organisation

Further to these relationships, there is a column which depicts the relative importance of each of the KM categories from the organisation's perspective. This measure is shown in the column alongside the KM categories. Table 13.4 shows the symbols used and their corresponding values.

Symbol	Importance Weighting
	5
	4
	3
	2
	1

Table A8.4: Showing the importance weightings of KM categories

A8.2.5 Organisational Competence

Another important dimension of this KM assessment methodology is organisational competence. It represents the aptitude of an organisation to implement a KM mechanism as part of its KM system. In order to calculate the score for this measure, the following criteria are taken into consideration:

1) Ability to pay for the cost of implementation (KM mechanism)
2) Time to implement (KM mechanism)
3) Prior use of KM mechanism
4) Synergy/Compromise relationships (with other KM mechanisms)

Table 13.5 is a key illustrating how the score for organisational competence is reached.

FACTOR	Organisational Competence (score)		
Ability to pay	High =2	Medium =1	Low =0
Time to implement	Long =0	Medium =1	Short =2
Prior use of KM mechanism	Not used =1	Used =2	
Synergies/compromise	Compromise =-1	Synergy =1	None =0

Table A8.5: Showing the factors affecting the organisational competence score

The higher the organisational competence score, the higher the aptitude to implement the KM mechanism and vice versa.

A8.3 Key Stages of the KM Assessment process

The following are the key stages in conducting a KM assessment exercise:

- A documentation of the organisational context in terms of the organisation's purpose, environment, what is important to the running of the business, and operational strategy should precede any other activities because it determines the outcomes of the evaluation of an organisation's KM system; whether the system is effective or not.
- Assessment of the organisation's current KM system captures the KM system of an organisation as it currently exists. Therefore this stage reports on the current KM operations and processes of an organisation.
- Designing a desired KM system- The designing of a KM system that theoretically represents an ideal KM system for the organisation from the organisational context established in stage one.

- Gap analysis between current and desired KM systems is a comparison of the organisation's current and its desired KM systems. This stage identifies KM operational gaps between the current and desired systems and areas that require improvement.
- Action plan - A plan to transition from the current to the desired KM system. This stage should identify and prioritise the ideas for improvement generated in gap analysis.

Figure A8.1. is a pictorial representation of the process of self assessment.

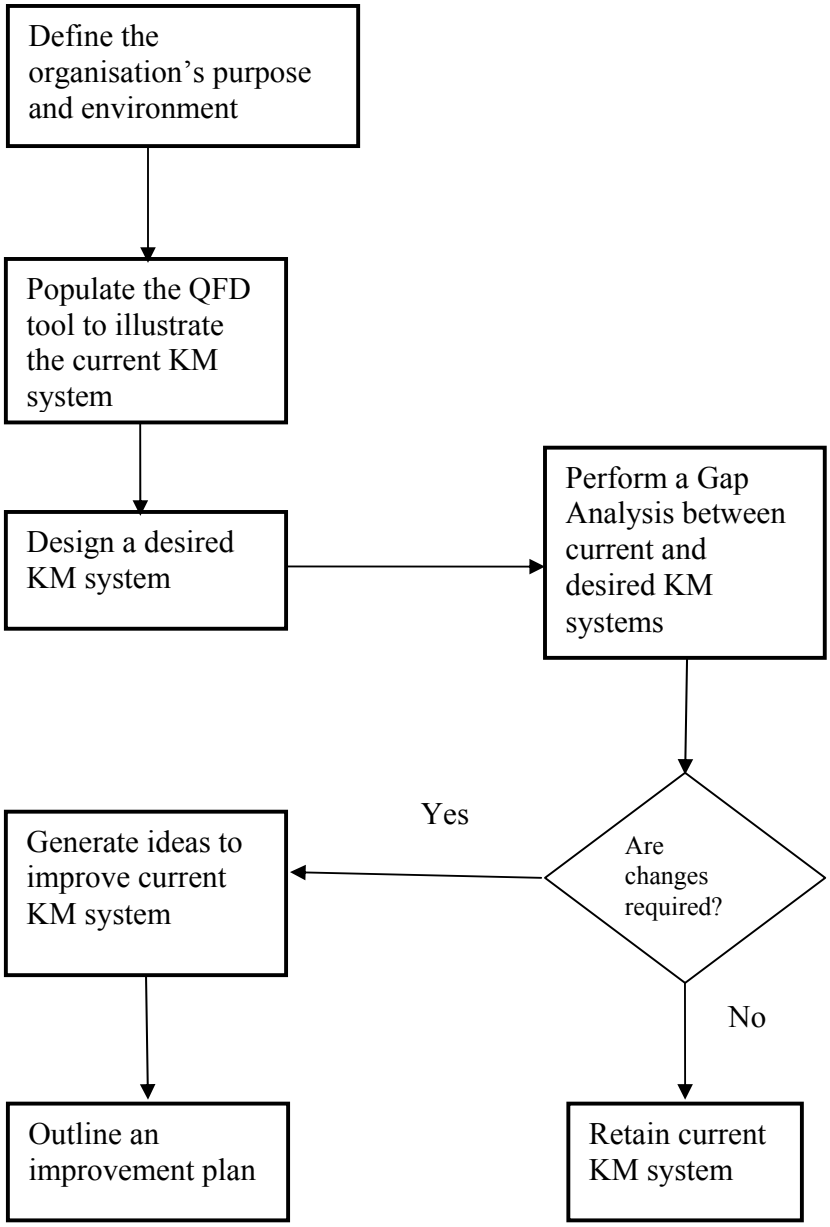


Figure A8.1: Process Map for Assessment

A8.4 Assessing the current KM system

The main objective of this stage is to populate the KM assessment tool with information that is a reflection of the organisational situation in the following sequence:

A8.4.1 Current KM system: Level of Use

i. Assign scores/weightings to the "importance to organisation" column for each of the seven KM categories. The figure quantifies the relative importance of each of the KM categories from the organisational perspective.

NB: The weightings/scores assigned should reflect the situation in the organisation as it is for the tool to be useful.

ii. Assign scores/weightings for the use of each of the KM mechanisms in each of the KM categories. Enter the corresponding symbol in the appropriate cells of the KM assessment tool/matrix.

iii. Assign scores/weightings for the perceived impact of KM barriers on the KM categories. Enter the corresponding figure in the appropriate cells of the KM assessment tool/matrix.

iv. Identify synergies and compromises amongst the KM mechanisms and record the relationships in the appropriate cells in the "roof" of the KM assessment tool/matrix.

v. Calculate overall use score for each of the KM mechanisms (See example provided by Table A8.6.

KM Categories	Importance to PPH	*Use of Meetings	Overall Use (Importance of Category * use of meetings)
Identification	3	9	27
Development	3	9	27
Creation	3	9	27
Sharing	5	9	45
Access	4	3	12
Retention	5	3	15
Integration	4	9	36
Overall Use			**189**

Table A8.6: Calculation of the level of use of Meetings.

vi. Calculate the relative use of each of the KM mechanisms by dividing the overall use score (of each mechanism) by the sum of the overall use scores for all the KM mechanisms then multiplying the answer by 100, as shown:

$$\frac{n}{\Sigma\ n} \times 100$$

Where n= the overall use of a KM mechanism; and Σ n= the sum of overall use for all the KM mechanisms.

NB. The relative use score for the KM mechanisms is an important measure because it gives an indication of the proportion of time, effort or resources devoted to each KM mechanism relative to the whole KM system.

* Not part of initial case study data

A8.4.2 Current KM system: Effectiveness

Note: A second KM matrix is required for the following steps.

vii. Copy the score/weightings for the "importance to organisation" column assigned in KM matrix 1 onto KM matrix 2.

viii. Assign scores/weightings for the effectiveness of each of the KM mechanisms in each of the KM categories. Enter the corresponding symbol in the appropriate cells of the KM assessment tool.

ix. Copy the scores/weightings for the perceived impact of KM barriers on the KM categories assigned in KM matrix 1 onto KM matrix 2.

x. Copy the identified synergies and compromises amongst the KM mechanisms from KM matrix 1 to KM matrix 2.

xi. Calculate overall effectiveness score for each of the KM mechanisms (See example provided by Table A8.7.

KM Categories	**Importance to PPH**	**Effectiveness of Meetings**	**Overall Effectiveness (Importance of Category * strength of relationship)**
Identification	3	3	9
Development	3	3	9
Creation	3	3	9
Sharing	5	3	15
Access	4	3	12
Retention	5	3	15
Integration	4	3	12
Overall Effectiveness			**81**

Table A8.7: Calculation of the Overall Effectiveness of Meetings.

xii. Calculate the relative effectiveness of each of the KM mechanisms by dividing the overall effectiveness score (of each mechanism) by the sum of the overall importance scores for all the KM mechanisms then multiplying the answer by 100. The formula for this calculation is shown below.

$$\frac{n}{\Sigma\ n} \times 100$$

Where n= the overall effectiveness of a KM mechanism; and Σ n= the sum of overall effectiveness for all the KM mechanisms.

NB. The relative effectiveness score for the KM mechanisms is an important measure because it gives an indication of the extent of each KM mechanism's contribution to the KM system.

A8.4.3 Interpreting the Current KM assessment output

i. Compare the current KM matrix outputs for use and effectiveness of KM mechanisms and identify inconsistencies of scores.
ii. Determine the most effective KM mechanisms from overall and relative effectiveness scores.
iii. Identify the most developed KM categories from the number of relationships between KM categories and mechanisms with strong effectiveness
iv. Establish the relationship/pattern between the most effective KM mechanisms and KM categories. See Table A8.8 for a worked example using data from PPH case

KM Mechanisms	KM Categories where effectiveness is strong	KM Categories where effectiveness is moderate	KM Categories where effectiveness is weak	KM Categories rated as Important to Organisation	Number of matches between important categories and KM mechanisms where effectiveness is strong
Employees	Sharing Retention Access	Identification Development Integration	Creation	Sharing Retention Access Integration	3/4
Induction	Development Integration	Sharing Access	Identification Creation Retention	Sharing Retention Access Integration	1/4
Databases	Retention Access		Identification Development Creation Sharing Integration	Sharing Retention Access Integration	2/4
Seminars	Development Sharing	Access	Retention Integration Identification Creation	Sharing Retention Access Integration	1/4
University Courses	Development Sharing	Access	Identification Creation Integration Retention	Sharing Retention Access Integration	1/4

Table A8.8 Summary of Findings from QFD Matrix (PPH)

A8.4.4 General Notes

- After stage one is complete it will be possible to observe inconsistencies in the following:

  1) Between "importance to organisation" weightings assigned to KM categories and the number of strong associations it has with appropriate KM mechanisms in the organisation.

2) Between the "importance to organisation" weightings assigned to KM categories and their relationships with the "key" KM mechanisms in the organisation.

3) Between the use of and effectiveness of KM mechanisms in the organisation.

- Having two KM matrices populated in the initial stages (one for use and the other for effectiveness) highlights areas where the organisation is not benefiting as it should from the consumption of resources such as time, money, etc. used towards certain KM mechanisms.

- A key which illustrates the various symbols and numbers to be used to populate the different sections of the KM assessment tool is provided on the blank KM assessment tool. Symbols make it possible to:

    1. View all the relationships between the various elements at once.
    2. Make it visually clear whether or not a problem exists.
    3. Make it visually clear whether or not a problem is localised or more broad ranging
    4. Look at specific combinations, determine essential factors and develop an effective strategy for solving the problem.

- Where KM mechanisms are not used in the organisation, leave the cell blank so as not to misrepresent the organisational reality.

- A consultative approach to assigning the scores/weightings for the various relationships on the KM assessment tool gives a more representative picture of the reality in the organisation.
- It is possible to conclude whether a current KM system is the outcome of careful design methodology or if it has evolved to a "non-ideal" state over time after careful analysis of the current KM matrices outputs.

A8.5 Designing a desired KM system

i. Construct a general characterisation of processes in the organisation; the data, information and knowledge used in the organisation based on an organisational context i.e. background information, daily operations and work routines.

ii. Identify the key KM requirements of an organisation based on characterisation of processes and knowledge in the organisation. Focus should be directed towards core activities and what is most important to the organisation.

iii. Use KM requirements to inform the assigning of scores/weightings for "importance to organisation" for KM categories on the desired KM system matrix.

iv. Use the KM requirements to inform the scores/weightings for the effectiveness of KM mechanisms in the KM categories on the desired KM matrix.

v. Repeat directions from section 13.4.3 to extract meaning from the desired KM system matrix.

A8.5.1 General Notes

- This stage of the self-assessment process requires that relevant information is provided on:

a) Number of employees; teams and teamwork; and the organisation's structure.

b) Work routines, procedures, organisational values, culture and beliefs.

c) Types of data, information and knowledge used in the operation; how this flows (or doesn't) in the organisation; what are the sources.

- Population of the desired KM system matrix could be informed by unsolicited, anecdotal observations. This is the case in the event that the assessment exercise is conducted by an outsider to an organisation

A8.6 Gap Analysis

i. Compare the current and desired KM systems making note of :

- Similarities and differences in the relationships between KM categories and mechanisms between the KM matrices outputs.
- Differences in scores/weightings for KM categories' "importance to organisation"
- Similarities and differences of the overall and relative effectiveness scores of the KM mechanisms.

A8.6.1 General Notes

- Where possible identify the factors influencing the differences in KM matrix output**.**

A8.7 Action Plan for transition to desired KM system

i. Identify specific KM mechanisms to be improved or introduced

ii. Calculate rank priority using KM barriers, organisational competence and organisational effectiveness of KM mechanisms

iii. Construct a "priority KM matrix" which highlights KM mechanisms targeted for improvement and/or new KM mechanisms for addition to the KM system.

iv. Determine organisational difficulty to implement changes

v. Implement changes starting with the KM mechanisms with the lowest organisational difficulty score

A8.7.1 General Notes

a) Organisational difficulty is determined using two factors:

- KM Barriers - Represent the obstacles to implementing KM in an organisation. The value of this variable needs to be as low as possible in the organisation.
- Organisational Competence - A high organisational competence figure means the organisation has the aptitude to implement a KM mechanism. Therefore the value of this variable needs to be as high as possible. The two variables (organisational competence and KM barriers) determine the organisational difficulty of

implementing KM mechanisms. Table A8.8 shows an example of how organisational competence was calculated for PPH while Table A8.9 shows a key for assigning the scores.

	Prior Use	**Time required**	**Synergies/ compromises**	**Ability to pay for cost**	**Total score**
KM Mechanisms					
Intranet	1	0	1	1	3
Database/Repositories	2	2	1	2	7
Process Mapping	1	1	2	2	6
Mentoring and coaching	2	2	1	2	7
Why-why analysis	1	0	1	2	4
Meetings	2	2	1	2	7
Knowledge Mapping	1	1	1	1	4

Table A8.9 Example of assessment of PPH

Key

FACTOR	**Organisational Competence (score)**		
Ability to pay for cost	High =2	Medium =1	Low =0
Time to implement	Long =0	Medium =1	Short =2
Prior use of KM mechanism	Not used =1	Used =2	
Synergies/compromise	Compromise =-1	Synergy =1	None =0

Table A8.10: Showing how scores are assigned for KM mechanisms

- The "organisational difficulty" score determines the complexity of the task of implementing each of the KM mechanisms deemed necessary to improve. It takes into consideration the barriers to KM in an organisation as well as the

organisational competence. The organisational difficulty score is obtained by dividing the KM barrier score by the organisational competence score.

- The KM barrier score is obtained from the KM assessment tool. Refer to desired KM system for PPH for example.

A8.7.1.1 Prioritising KM mechanisms

In situations where an organisation is highly competent and the KM barriers are low, the KM mechanism is regarded as a priority choice for the organisation. Where the organisational competence is low but the KM barriers are high, the choice should be to reject the KM mechanism.

A8.7.1.2 Trade-offs

In situations where both the organisational competence and KM barrier scores are either high or low, it is inconclusive whether a KM mechanism should be prioritised or not. A trade-off occurs where the organisation decides whether it wants to implement a KM mechanism in which it has high competence but will encounter many barriers or to implement a KM mechanism in which it has low competence but will encounter low KM barriers. The choice to be made depends on whether the KM mechanism is regarded to be highly effective or not in the organisation's assessment of its KM system.

Possible combinations are illustrated by Table A8.11

Organisational competence	KM Barrier score	Organisational Difficulty =KM Barrier score/organisational competence	Effectiveness score	Choice
High	Low	Low	High	Priority
Low	High	High	Low	Reject
High	High	Inconclusive	Low	Trade-off
Low	Low	Inconclusive	High	Trade-off

Table A8.11

An organisation can use the guideline provided to make a priority list of KM mechanisms that it should implement first. As shown by the Table A8.11, it is desirable that an organisation has a high competence score and a low KM barriers score. The matrix below illustrates how the decisions to implement or not to implement KM mechanisms should be reached

Organisational Competence	KM Barriers: Low	KM Barriers: High
High	**Priority**	**Trade-off**
Low	**Trade-off**	**Reject**

A8.8 Conclusion

This chapter has presented a refined methodology for the KM assessment exercise. There have been notable changes to the initial approach used in the three case organisations. Some modifications were made to the initial methodology to reflect the lessons that were learned in the three case study organisations. The most notable modifications include the addition of a second KM assessment matrix in the first stage of assessment and obtaining feedback from multiple respondents in a consultative manner. The nature of the feedback that respondents provide needs to be an accurate reflection of the organisational reality in order for the output to be useful. Therefore extreme care is required for the manner in which ratings of relationships are assigned, hence the emphasis on the consultative approach to populating KM assessment matrices.

KM Categories Defined

Knowledge Identification- This may represent the most important stage of a KM initiative. Operations depend on knowledge and identifying the knowledge that drives the key processes of an organisation is paramount. KM activities need to be directed towards value-adding processes, hence the importance of this category. Most knowledge deficits are identified through monitoring the processes and determining what knowledge is required for improvement. However, knowledge requirements can also be determined when formulating operational strategy for future undertakings.

Knowledge Development- Refers to activities undertaken to equip individuals with the right know how, know what and know why to do their jobs effectively. Knowledge development activities need to be influenced by identification of need.

Knowledge Creation- Knowledge is created when knowledge workers interact with their work environment (Cook and Brown, 1999). Sometimes they discover new ways of doing their jobs unexpectedly or when solving a problem. This sort of knowledge creation is called incremental knowledge creation. Organisations create new knowledge for new opportunities through Research and Development (R&D) and develop new products and services as a result. This type of knowledge creation is called breakthrough knowledge creation.

Knowledge Retention- Is necessary to safeguard an organisation in the event that skilled or knowledgeable employees leave the organisation. Knowledge retention is mostly associated with the storage of explicit, structured knowledge in repositories and databases. However, new thinking has established Communities of Practice (CoP's) as knowledge retention mechanisms among other things.

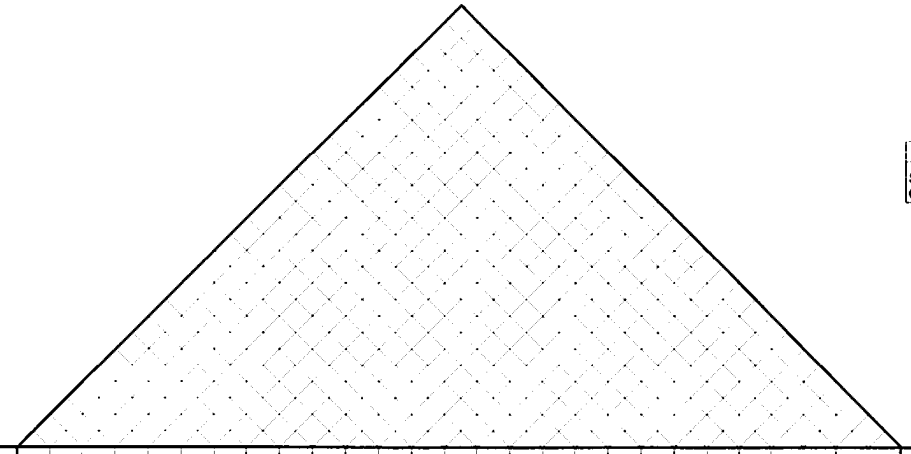
Knowledge Access- The knowledge access category is formed by mechanisms that facilitate the retrieval of data, information and knowledge at the time of need and application to business process. It is closely linked to storage and retention of knowledge. It follows that the storage format of data, information or knowledge determines how quickly it can be retrieved and used as and when it is needed. In the framework for KM initiatives, it is posited that KM should make knowledge available to the right people at the right time and place.

Knowledge Sharing- Refers to the exchanging of data, information, ideas and knowledge amongst individuals in an organisation. Knowledge is shared in the hope that it is integrated by individuals and in the process enhances their ability to interact with the business process. Knowledge sharing literature has addressed the cognitive and community approaches where technology use has been contrasted to the community approach which emphasises interaction and socialisation between groups of individuals to facilitate tacit knowledge transfer (for example see, Swan et al., 1999).

Knowledge Integration- Refers to the embedding of created knowledge into day-to-day practice. This is achieved through construction of procedures, routines and directives (Grant, 1996) which are then used as job aids in the form of manuals, tree diagrams, flow charts, etc and allows use and re-use of created knowledge. Performance measures and feedback mechanisms form an integral part of knowledge integration as they give insight into how well new knowledge is impacting on process outputs. Performance measures are objective means that give organisations indications on how well they are performing e.g. in quality, costs, or profits. It is contended that these are an indication of how knowledge is being used. It is therefore imperative that organisations have set objectives, clearly defined measures and feedback loops for new KM initiatives.

Appendix 9: KM Assessment Output from the HA

HousingAssociationDesirable



Importance
Extremely Important ■ 5.0
Very Important ◢ 4.0
Somewhat Important □ 3.0
A little important ◺ 2.0
Not Important ▫ 1.0

Tradeoffs
Synergy + 1.0
Compromise – -1.0

Standard 9-3-1
Strong ● 9.0
Moderate ○ 3.0
Weak ▽ 1.0

		Importance of the Criteria	Apprenticeship	Traineeships and Internships	Induction	Meetings	Mentoring, Coaching	University Courses	Process Mapping	Networking	Corporate Websites	Databases, Repositories	Employees	Handover Sessions	Intranet	Team-boards	Why-why Analyses	Research and Development	Short courses	Seminars	Observations	Training	Knowledge Mapping	Email, Bulletins, Memos	Expert Systems	Job Aids	Books, Manuals	Knowledge Transfer Team	Chief knowledge officer	KM BARRIERS	Knowledge hoarding	Lack of time	Lack of IT skills	Lack of infrastructure	No incentives	Time consuming	Lack of management support	Fear of job loss	Fear of penalty	Fear of idea robbery	High cost of investment	Total score KM Barriers	
		1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	1	2	3	4	5	6	7	8	9	10	11	12	13	
Knowledge Identification	1	□	▽	▽	●	○	●	○	●	○	○	●	●	○	○	▽	▽	○	○	○	○	●	▽	▽	▽	●	▽	○	▽		1.0	1.0	3.0	3.0	3.0	1.0	9.0	1.0	1.0	1.0	1.0	25.0	1
Knowledge Development	2	◢	▽	▽	○	○	●	●	●	○	○	●	●	○	○	▽	▽	○	●	○	○	●	○	▽	▽	○	○	○	▽		3.0	3.0	1.0	1.0	1.0	3.0	9.0	3.0	9.0	3.0	3.0	39.0	2
Knowledge Creation	3	◺	▽	▽	○	●	●	●	●	○	○	●	●	○	○	▽	▽	○	○	○	○	●	○	▽	▽	○	○	▽	▽		1.0	3.0	1.0	1.0	9.0	3.0	9.0	3.0	9.0	1.0	3.0	43.0	3
Knowledge Sharing	4	◢	▽	▽	○	●	●	○	○	○	○	●	●	○	○	○	○	○	○	●	○	●	○	▽	○	○	○	○	▽		1.0	1.0	1.0	9.0	3.0	3.0	9.0	3.0	3.0	1.0	1.0	35.0	4
Knowledge Retention	5	◺	▽	▽	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	●	●	○	●	○	○	○	▽		1.0	1.0	1.0	3.0	3.0	1.0	3.0	1.0	1.0	1.0	3.0	19.0	5
Knowledge Access	6	◢	▽	○	○	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	●	○	▽	▽	▽	▽	○	▽		1.0	3.0	3.0	3.0	3.0	1.0	9.0	1.0	1.0	1.0	3.0	29.0	6
Knowledge Integration	7	◢	▽	▽	○	●	●	●	●	▽	▽	●	●	▽	▽	○	○	○	○	○	○	●	●	▽	▽	▽	▽	▽	▽		3.0	3.0	1.0	9.0	3.0	3.0	3.0	3.0	1.0	1.0	9.0	39.0	7
	8																																									8
	9																																									9
	10																																									10
KM Barrier score	1		32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7													
Organisational Competence	2		0.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	6.0	6.0	7.0	6.0	4.0	0.0	6.0	6.0	6.0	6.0	0.0	6.0	0.0	6.0	6.0	6.0	0.0													
Organisational difficulty = KM barrier score/organisational competence score	3		0.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	4.7	4.7	5.5	5.5	4.7	5.5	8.2	0.0	5.5	5.5	5.5	5.5	0.0	5.5	0.0	5.5	5.5	5.5	0.0													
Overall Effectiveness	4		23.0	31.0	39.0	31.0	51.0	51.0	51.0	65.0	45.0	57.0	27.0	35.0	49.0	41.0	23.0	23.0	45.0	61.0	57.0	39.0	23.0	57.0	23.0	23.0	45.0	23.0	23.0													
Percent Effectiveness	5		2.2	2.9	3.7	2.9	4.8	4.8	4.8	6.1	4.2	5.4	2.5	3.3	4.6	3.9	2.2	2.2	4.2	5.9	5.4	3.7	2.2	5.4	2.2	2.2	4.2	2.2	2.2													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27														

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Importance	
Extremely important	■ 5.0
Very important	◢ 4.0
Somewhat important	□ 3.0
A little important	▽ 2.0
Not important	▷ 1.0

	1	2	3	4	5	6	7	8	9	10
Knowledge Identification										
Knowledge Development										
Knowledge Creation										
Knowledge Sharing										
Knowledge Retention										
Knowledge Access										
Knowledge Integration										
KM Barrier score	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
Organisational Competence	0.0	6.0	6.0	6.0	6.0	6.0	7.0	6.0	4.0	6.0
Organisational difficulty = KM barrier score/organisational competence score	0.0	5.5	5.5	5.5	5.5	5.5	4.7	5.5	8.2	5.5
Overall Effectiveness	23.0	31.0	39.0	51.0	51.0	65.0	57.0	41.0	23.0	31.0
Percent Effectiveness	0.0	5.5	6.5	8.5	8.5	10.8	9.5	6.8	3.8	5.2

Standard 9-3-1	
Strong	● 9.0
Moderate	○ 3.0
Weak	▽ 1.0

	Importance of the Criteria	1	2	3	4	5	6	7	8	9	10
1	Apprenticeship	◁	◁	◁	◁	◁	◁	◁			
2	Traineeships and Internships	◁	○	◁	◁	◁	◁	◁			
3	Induction	◁	◁	◁	○	◁	◁	○			
4	Meetings	◁	◁	◁	○	◁	◁	◁			
5	Mentoring, Coaching	◁	○	○	○	◁	○	◁			
6	University Courses	◁	○	○	◁	◁	○	◁			
7	Process Mapping	◁	○	○	○	◁	○	◁			
8	Networking	○	○	○	○	◁	○	○			
9	Corporate Websites	○	◁	○	◁	◁	◁	○			
10	Databases, Repositories	◁	○	○	◁	◁	○	◁			
11	Employees	◁	◁	◁	○	◁	◁	◁			
12	Handover Sessions	◁	◁	◁	◁	◁	◁	◁			
13	Intranet	◁	○	○	○	◁	◁	◁			
14	Team-boards	◁	○	○	○	◁	◁	◁			
15	Why-why Analyses	◁	◁	◁	◁	◁	◁	◁			
16	Research and Development	◁	◁	◁	◁	◁	◁	◁			
17	Short courses	◁	○	◁	◁	◁	○	◁			
18	Seminars	○	○	◁	◁	◁	○	◁			
19	Observations	○	○	◁	○	◁	○	◁			
20	Training	○	◁	◁	◁	◁	○	◁			
21	Knowledge Mapping	◁	◁	◁	◁	◁	◁	◁			
22	Email, Bulletins, Memos	○	○	○	○	◁	◁	◁			
23	Expert Systems	◁	◁	◁	◁	◁	◁	◁			
24	Job Aids	◁	◁	◁	◁	◁	◁	◁			
25	Books, Manuals	○	○	◁	◁	◁	○	◁			
26	Knowledge Transfer Team	◁	◁	◁	◁	◁	◁	◁			
27	Chief knowledge officer	◁	◁	◁	◁	◁	◁	◁			

	KM BARRIERS	1	2	3	4	5	6	7	8	9	10
1	KM BARRIERS										
2	Knowledge hoarding										
3	Lack of time										
4	Lack of IT skills										
5	Lack of infrastructure										
6	No incentives										
7	Time consuming										
8	Lack of management support										
9	Fear of job loss										
10	Fear of penalty										
11	Fear of idea robbery										
12	High cost of investment										
13	Total score KM Barriers										

Tradeoffs	
Synergy	+ 1.0
Compromise	- -1.0

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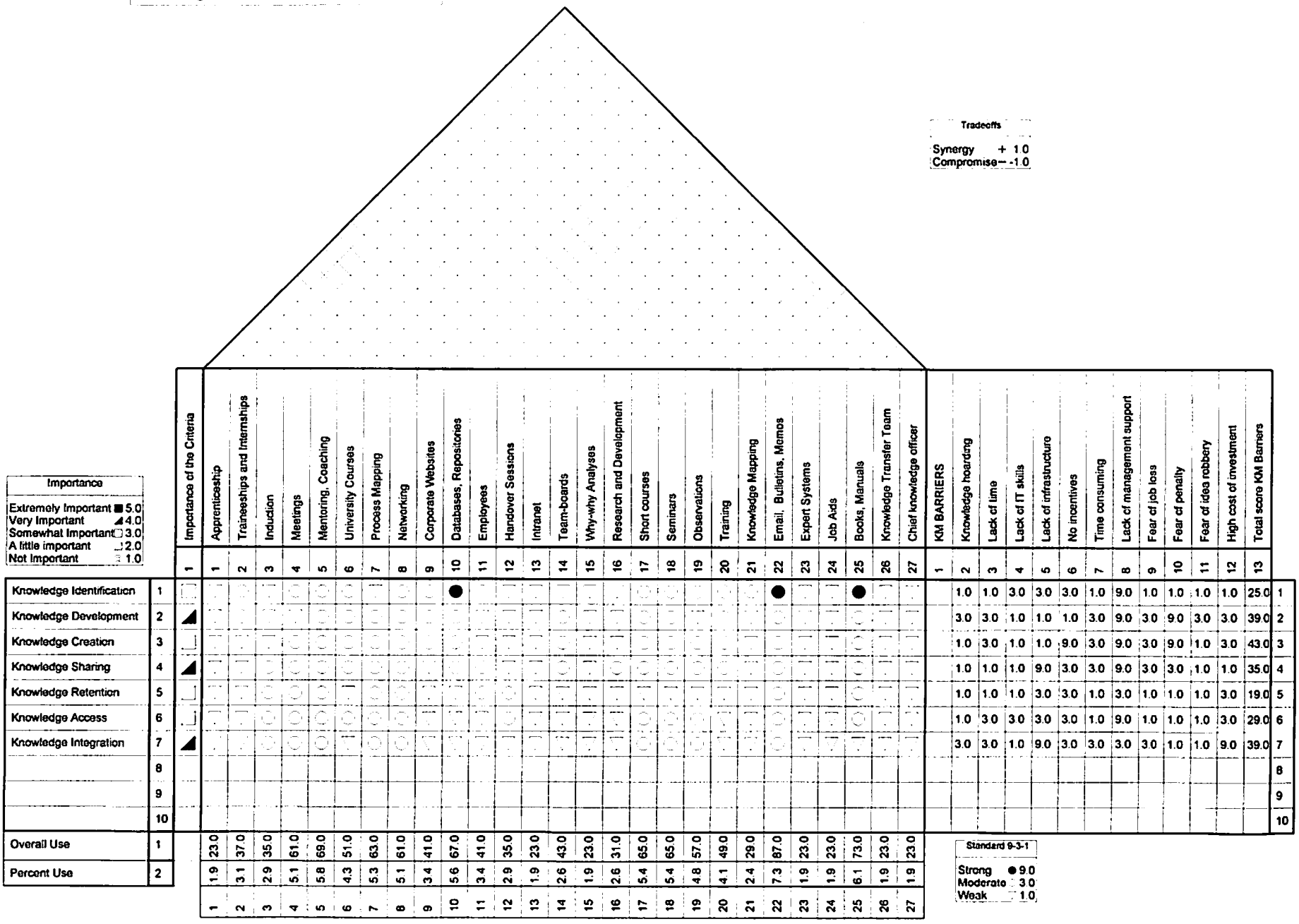


Appendix 10: Feedback from ASC; Perceptions of the Tool

Questionnaire for Organisations that have applied the KM Assessment Tool: Feedback from ASC

Directions: Read the statements below and evaluate your organisation's experience. The scale is as follows: 1= no 2= poor 3= fair 4= good 5= excellent

A) The KM Assessment Methodology

	Score
The methodology was clearly in articulating each step of the assessment process	**4**
The KM dimensions and inter-relationships were well defined	**4**
The methodology helped to identify KM areas for improvement	**4**
The method proposed for prioritising the KM mechanisms for improvements was logical	**4**

2) Did you experience any problems with the application of the methodology?

Yes

3) If the answer to question 2 is "Yes" could you please explain the nature of these problems in the space provided?

The tables were difficult to fill in manually.

4) Are there any improvements that could be made to make the methodology more user-friendly? Please use the space below to answer the question.

- **Electronic questionnaire. This would help with all the calculations being done automatically after putting in the data.**
- **Alternatively a spreadsheet can help as well.**

B) The KM Assessment Tool

Directions: Read the statements below and evaluate your organisation's experience. The scale is as follows: 1= no 2= poor 3= fair 4= good 5= excellent

	Score
The sections of the tool covered all the issues of knowledge management in our organisation.	**4**
The KM tool covered all the mechanisms in our organisation	**4**
The KM tool covered all the barriers in our organisation	**4**
The KM assessment output was representative of our organisational reality	**4**
The KM assessment output was meaningful to our organisation	**4**
The KM assessment exercise was useful in improving KM practice in our organisation	**3**
Overall an effective and comprehensive methodology and tool has been developed	**4**

2) Are there any KM related issues that the tool did not address but are part of your organisation's KM system? Yes

3) If the answer to question 2 is "Yes" could you please list the issues pertaining to your organisation that are not covered by the tool?

Most of, if not all, the knowledge is regulated by law. Privacy laws and laws to guard against insider trading and many other regulations put in place by professional bodies and regulators affect how knowledge is managed.

4) Did you experience any problems with the use of the tool? No

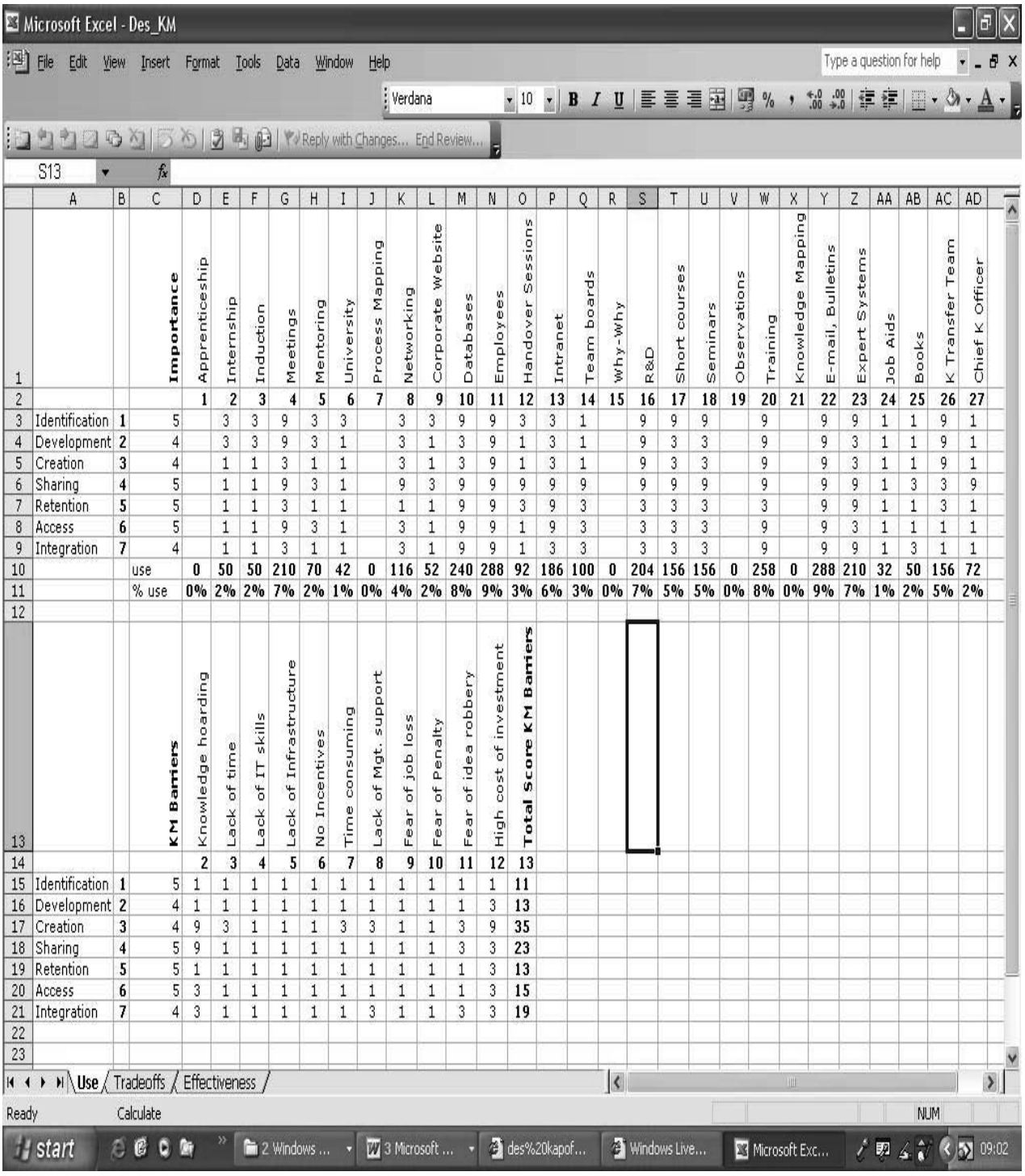
5) If the answer to question 4 is "Yes" could you briefly describe the problems?

6) How would you address these problems?

7) What is the most valuable aspect of the tool? How did your organisation benefit?

Using the tool made us aware of how knowledge is being managed in the company. Some of the things we were doing were not being effective and we never had the opportunity to ask why we continue to do them. Sometimes we just did things because it is the way things are done. So the tool made us start to think about the best ways to do things.

KM Assessment Output in Excel Format: ASC Feedback



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1			Importance	Apprenticeship	Internship	Induction	Meetings	Mentoring	University	Process Mapping	Networking	Corporate Website	Databases	Employees	Handover Sessions	Intranet	Team boards	Why-Why	R&D	Short courses	Seminars	Observations	Training	Knowledge Mapping	E-mail, Bulletins	Expert Systems	Job Aids	Books	K Transfer Team	Chief K Officer
2				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
3	Identification	1	5		3	3	9	3	3		3	3	9	9	3	3	1		9	9	9		9		9	9	1	1	9	1
4	Development	2	4		3	3	9	3	1		3	1	3	9	1	3	1		9	3	3		9		9	3	1	1	9	1
5	Creation	3	4		1	1	3	1	1		3	1	3	9	1	3	1		9	3	3		9		9	3	1	1	9	1
6	Sharing	4	5		1	1	9	3	1		9	3	9	9	9	9	9		9	9	9		9		9	9	1	3	3	9
7	Retention	5	5		1	1	3	1	1		1	1	9	9	3	9	3		3	3	3		3		9	9	1	1	3	1
8	Access	6	5		1	1	9	3	1		3	1	9	9	1	9	3		3	3	3		9		9	3	1	1	1	1
9	Integration	7	4		1	1	3	1	1		3	1	9	9	1	3	3		3	3	3		9		9	9	1	3	1	1
10			use	0	50	50	210	70	42	0	116	52	240	288	92	186	100	0	204	156	156	0	258	0	288	210	32	50	156	72
11			% use	0%	2%	2%	7%	2%	1%	0%	4%	2%	8%	9%	3%	6%	3%	0%	7%	5%	5%	0%	8%	0%	9%	7%	1%	2%	5%	2%
12																														
13			KM Barriers	Knowledge hoarding	Lack of time	Lack of IT skills	Lack of Infrastructure	No Incentives	Time consuming	Lack of Mgt. support	Fear of job loss	Fear of Penalty	Fear of idea robbery	High cost of investment	Total Score KM Barriers																
14				2	3	4	5	6	7	8	9	10	11	12	13															
15	Identification	1	5	1	1	1	1	1	1	1	1	1	1	1	11															
16	Development	2	4	1	1	1	1	1	1	1	1	1	1	3	13															
17	Creation	3	4	9	3	1	1	1	3	3	1	1	3	9	35															
18	Sharing	4	5	9	1	1	1	1	1	1	1	1	3	3	23															
19	Retention	5	5	1	1	1	1	1	1	1	1	1	1	3	13															
20	Access	6	5	3	1	1	1	1	1	1	1	1	1	3	15															
21	Integration	7	4	3	1	1	1	1	1	3	1	1	3	3	19															
22																														
23																														