A methodology and diagnostic management tool for the coordination of Organisational Knowledge Management

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Abstract

Since the late 1980s there has been a greater awareness of the need to manage organisational knowledge resources, which are seen as vital to the value proposition of any organisation. This has resulted in the development of a multiplicity of Organisational Knowledge Management (OKM) approaches, systems and processes.

OKM as a concept is however experiencing a prolonged period of practitioner and academic dissatisfaction, which is impacting its credibility. Commentators claim that this emanates from the fact that a general model, as a diagnostic mechanism for the field, has not yet emerged, an indicator of immaturity in the field and a destabilising influence on practitioner confidence. This research sets out to explore OKM, with the aim of understanding and attempting to help address this dissatisfaction.

The literature review focuses on environmental drivers of OKM as a concept from both practitioner and academic perspectives. This highlights a need for (1) an agreed definition of purpose for OKM systems and (2) a general diagnostic model or framework for those systems that identifies common constructs across sectors or geographic locations. In turn, these require appropriate research evidence.

The research reported on in this thesis utilises Soft Systems Methodology as a framework for enquiry. By means of a meta-analysis of literature, the enquiry progresses to a descriptive survey, with findings being illustrated and analysed through fractal analysis. The data is then compared against a sample of models from the field before being translated into a new OKM diagnostic model and supporting toolkit, using logic modelling and a Participatory Integrated Assessment Tool. The application of these to a case study, carried out within in a large multinational organisation, is reported on and evaluated.

Findings are that 'self-similarity' exists across existing views of OKM; that the need for knowledge to be used as an organisational resource is a persistent one; that a methodology can be developed that reacts to the needs of academics and practitioners in responding to the challenges from the field; that a proposition for a

general organisation diagnostic model is possible; that a robust evidence-based definition for the concept, as well as a general diagnostic model for the coordination of organisational knowledge resources is needed and are provided; and that such a general diagnostic tool, such as has been developed in the research on which this thesis is based, can be applied within an organisation to identify gaps in systems designed to coordinate organisational knowledge resources.

Declaration

I declare that this body of work is solely my own. This research has generated several papers that were published under joint authorship (Appendix 12), where I was the lead author. It should be noted that the research in these papers contains a minimum 95% contribution from myself, which has been verified by my PhD supervisors and can be attested through statements from my co-authors, if required. In addition, I have not used any material within this thesis that is the work of any of my co-authors.

David Griffiths
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Acronyms used in the research

ADB	Asian Development Bank
AL	Action Learning
AR	Action Research
ANT	Actor Network Theory
ASHEN	Artefacts, Skills, Heuristics, Experience, Natural Talent
CATWOE	Customer, Actor, Transformation, Weltanschauung, Ownership, Environment
HEIs	Higher Education Institutions
HR	Human Resources
IC	Intellectual Capital
KBV	Knowledge-Based View
K-Core	Knowledge-Core
KIO	Knowledge Intensive Organisations
KM	KM
KRs	Key Recommendations
LLIS	Lessons Learned Information System
NASA	North American Space Agency
OCL	Operation Client Lead
OGC	Office for Government Commerce
OKM	Organisational Knowledge Management
OECD	Organisation for Economic Cooperation and Development
PIAT	Participatory Integrated Assessment Tool
PC	Project Coordinator
PM	Project Manager
Q	Question
QI	Quality Investigation
RA	Research Assistant
RBV	Resource-Based View
SECI	Socialisation, Externalisation, Combination, Internalisation
SMART	Specific, Measurable, Achievable, Relevant, Time-related
SOP	Standard Operating Procedures
SSM	Soft Systems Methodology
UK	United Kingdom
US	United States

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Part 1: Introduction and Literature Review

Chapter 1: Introduction

"Out of intense complexities intense simplicities emerge" Winston Churchill

1.0 Thesis structure

Chapter	Aim	Outcome
1: Introduction	To develop an overview of the research, including the problem statement, research questions and claims	A better understanding of the aim of this thesis and the problems facing the Organisational Knowledge Management field
2: Context setting	To provide an insight into Organisational Knowledge Management environments, examples of current practice, using Siemens, the US Space Agency, W.L.Gore and Asian development Bank, and issues of dualism versus duality	The context for Organisational Knowledge Management systems has been set and understood in such a way as to allow the reader to understand the rationale for the journey to be taken in the literature review (Chapter 3)
3: Literature review	To unpack the main concepts addressed in this research, including: the concept of knowledge; knowledge as a resource; knowledge as a value creating resource in the Knowledge Economy; human agency; strategies for managing knowledge resources; a historical perspective on Knowledge Management; defining Knowledge Management; theoretical foundations for Knowledge Management; systems thinking; critical success factors within Organisational Knowledge Management systems; adult learning theory and links between knowledge and learning; existing Knowledge Management models; issues with current Knowledge Management research	Overview of the body of knowledge that underpins Organisational Knowledge Management systems, as well as the challenges and the position of this research in relation to the existing body of knowledge.
4: Methodology	To provide an overview of *methodology*, comprising combinations of methods and their application, including interpretation of output underpinned by the logic of the enquiry (Olsen and Morgan, 2005). This explores pragmatism, mixed methods, hypothetico-deductive reasoning and Soft Systems Methodology	Underpinning assumptions have been made clear, along with the rationale for the research design from the pragmatist view of the researcher. An understanding is developed; demonstrating that the problems surfaced in Chapter 3 can be addressed by using Soft Systems Methodology.
5: Methods	To provide an overview of *methods* as the mechanisms for data collection (Morgan, 2005). This includes a meta analysis of	Strengths and limitations of an unusual blend of research methods are set out, as well as the way in which the researcher has worked to

	Knowledge Management literature and models, descriptive survey, fractal analysis, logic modelling and a case study	overcome issues identified in Chapter 3, regarding the lack of breadth, depth, credibility and trustworthiness in some Organisational Knowledge Management literature.
6: Findings	Using the methods outlined in Chapter 5 the researcher presents four common functions and twelve constructs for Organisational Knowledge Management Systems. These are compared against existing models and an evidence-based definition of purpose for Organisational Knowledge Management systems is presented. A new general Organisational Knowledge Management systems model is presented and a diagnostic Participatory Integrated Assessment Tool is developed. A proposition for a new general Organisational Knowledge Management systems model is presented and then tested in a single case study in a large multinational organisation	Demonstration that there is credible and trustworthy evidence for commonality or 'self-similarity' across organisational Knowledge Management disciplines. Existing models can have gaps in their construction. A new model addresses identified gaps in existing literature, models and frameworks. A general diagnostic tool can be designed with this model at its core. The credibility and trustworthiness of the research process is improved through the operationalisation of the model and diagnostic toolkit in a case study setting.
7: Discursive conclusion	To revisit the research questions and claims introduced in Chapter 1 to demonstrate their progression. Recommendations are presented on the basis of the findings and research limitations are surfaced and discussed	The value of the research findings is asserted in relation to progression of the initial claims made in Chapter 1. Limitations and their implications are transparent and others have enough information to test the findings.

Table 1.0: Thesis structure

1.1 A point of departure

As will become clear, this research is interested in Knowledge Management (KM) from the perspective of organisational processes that exist to coordinate internal knowledge resources. However, Knowledge Management can be used as a term to describe a wide variety of activity (see p. 63), from data curation through to artificial intelligence, or even 'personal' knowledge management, based on an individual's personal knowledge flows. Therefore, to bring focus to this thesis, the term Organisational Knowledge Management will be used to differentiate my focus from those mentioned above.

This research began formally in September 2008. However, my interest in Organisational Knowledge Management (OKM) has emerged over twenty years of international experience in operations and project management. This gave me an insight into the importance of knowledge resources to an organisation, while also giving me first hand experience of stakeholder resistance to the development of OKM activity and systems, mainly brought about by a lack of understanding of and a bias towards technology driven 'solutions' for the management of knowledge resources.

My interest was furthered by persistent reports of practitioner dissatisfaction emerging from international consulting companies, such as Bain & Associates in the United States. As an operations and project manager I was often frustrated by an apparent lack of credible diagnostic models or tools available for the management of knowledge resources.

This led me to the notion of a 'general' OKM model, as a representation of a business system; one designed as a diagnostic management tool for the coordination of knowledge resources, without a specific organisation in mind. My PhD research and this thesis are the outcomes.

1.2 The Problem

A number of writers (for example Rigby and Gillies, 2000; Lambe, 2011) regard OKM, as an organisational system for the coordination of internal knowledge resources, as under-performing over a number of years, across sectors, size of organisation and geographic locations, which brings into question its ability to provide value to organisations.

These views are reflected in a 2006 commercial survey that, limitations notwithstanding, looked into 25 strategic management tools utilised by 1221 global executives: OKM ranked 22nd for satisfaction and received the lowest rating of all tools within respondents from large organisations (Rigby and Bilodeau, 2007). A downward trend over time is evident: in a 2009 survey of 1430 global executives, by the same company, using the same methods, OKM ranked 24th out of 25 for satisfaction (Rigby and Bilodeau, 2009). A 2010 report (Rigby, 2010) revealed OKM to be at its lowest level of usage since the late 1990s, though OKM was also predicted to experience growth over the coming years; an unanswered question is why this growth might occur given the level of dissatisfaction? This research provides a response to that question through an exploration of the drivers of the Knowledge Economy (see p. 49).

Opinions as to why this dissatisfaction is occurring are varied. Watson and Hewett (2006) believe it to be because organisations see technology as a *solution* to be applied across the organisational knowledge resource environment. This research agrees that this would be problematic, in situations where, as illustrated in the KEn Diagram (Figure 1, p. 26), and the case examples (p. 28-35), it often involves knowledge resources residing within the individual or group that are too complex to be captured in explicit form. This is a longstanding view, with authors speaking of "technology evangelists" that portray technology-based OKM 'solutions' as an enabler without explaining what it is that is being enabled or the relationship it has to wider OKM functions (Stewart, 1997). The influence of technology is visible in the rise in popularity of technology-based OKM 'solutions' where, for example, revenue from KM "search and discovery" software designed to streamline knowledge work, grew 19% to $2.1 billion in 2008 (Feldman, 2009). This view of knowledge as an explicit object only responds to one end of the KEn Diagram (p. 26).

Lambe (2011), amongst others, believes dissatisfaction to be caused by OKM being in a state of disorder, with no clearly defined architecture for its application and therefore it could be proposed that organisations cannot perform effective diagnostics on OKM activity or systems because its purpose is not clear. This 'disorder' in OKM has been discussed for over a decade: "[KM is] too scary a problem to tackle: too fuzzy; too controversial; too theoretical" (McElroy, 2000, p. 44). My research finds this to be the case and, in response, is particularly interested in general 'architecture for application' for OKM systems.

Others signpost OKM's immaturity as a concept as the problem; for example, Snowden (2002) positioned OKM in version 3.0, with version 1.0 emerging during the late 1980s to mid 1990s. This is a popular view, and one that is in conflict with the research in this thesis, with many authors reporting that OKM emerged around 1986 (for example, Wilson, 2002). It has also been described as a 'fad' (Stewart, 2002; Ray, 2005). These positions are in sharp contrast to discussion in Chapter 3 (p. 58), where my research posits that OKM has emerged over a period of 250 years and first became visible in its current form in 1974 (Table 3.2, p. 58).

1.3 Research strategy

At the outset of this research, I began by probing the general organisation environment, exploring literature to understand environmental drivers that bring about the need for OKM and the subsequent activities that fall within the scope of its systems. The vast extent of Knowledge Management activities discussed in the literature led me to define my interest as OKM, focusing on Knowledge Management in organisations and, specifically, systems for the coordination of internal knowledge resources. Through this I discovered a pattern of dissatisfaction that was consistent over a number of years (Rigby and Gillies, 2000; Rigby and Bilodeau, 2007; 2009; Rigby, 2010).

I then began to explore whether the need for OKM was a persistent one or whether it was indeed a 'fad'. I moved on to what is meant by 'knowledge as a resource', exploring strategies around knowledge as an object and knowledge as a process, and the implications for organisations that polarise to one view over the other. This brought me to literature on the coordination of organisational knowledge resources, which stimulated questions as to the suitability of the term 'Knowledge Management' and problems associated with a lack of agreed *evidence based definition* for its purpose.

It emerged that there is a lack of consensus with regard to what an organisation should look to coordinate to maximise the contribution of OKM to organisational value. At the same time it appeared that often authors did not take into account the complex nature of internal organisational environments and the implications for their OKM business systems.

The timeliness of this study is underlined by the fact that as my work progressed several writers started to call for a general KM systems model as a means to mature the OKM field (for example, Heisig, 2009; Lambe, 2011). Lambe (2011) argued that this is needed to better inform user expectations.

> "[There is a need for] a broad integrative and multidisciplinary approach to describe the underlying concepts and drivers for KM, and to tease out the implications for KM as a purposeful discipline for creating social and organisational value" (p. 177)

Literature such as this drove my enquiry towards the possibility of an evidence-based[1] model - or framework - as a tool for conducting diagnostics into systems designed for the management of knowledge resources inside organisations.

In understanding the challenges for the OKM field, I considered concerns around the general rigour of OKM research, the suggestion being that too much literature is constructed via a single narrative, or is not sufficiently underpinned by theory, resulting in incomplete system processes that negatively impact the transferability of findings – "relatively few articles are based on rigorous research, and most KM practice is not well informed by theory" (Edwards *et al.* 2003, p. 49). This led me to explore combinations of research methods that could be brought together to address these potential deficiencies that have been recognised for the past twenty years.

1.4 Research questions

Continuing on this trajectory, I identified two research questions:

1. Does demand exist for a new Organisational Knowledge Management system model for the coordination of knowledge resources and why?

[1] Discussion on what is considered 'evidence-based' in the context of this thesis is presented in Chapter 3

2. Is it possible to create a general model for OKM systems designed without a specific organisation or sector in mind, which can then be deployed as a diagnostic tool to identify weaknesses in Organisational Knowledge Management systems?

These were then broken down into eight sub-questions:

1.4.1 Sub questions

1. Is there a persistent demand for OKM systems for the coordination of knowledge resources?
2. Can a methodology be applied that responds to the challenges of exploring a general model in the field of OKM systems?
3. Are there common constructs within OKM systems designed for the coordination of knowledge resources?
4. Is it possible to derive from the organisation of these constructs an evidence-based definition for the purpose of OKM systems designed to coordinate knowledge resources in organisations?
5. Can a proposition for a general model for OKM systems for the coordination of knowledge resources be developed?
6. Can common constructs that organise within the scope of OKM systems be modelled?
7. How might a general OKM system model be developed for use in an organisation?
8. How might a general OKM system model be operationalised to identify gaps in organisation processes designed to coordinate knowledge resources?

1.4 Claims and data emerging from research questions

Claim 1 (Research Sub-Question 1): The need to coordinate knowledge resources in an organisation is a persistent one. This is brought about by the need to establish an evidence base for investment of time and money in OKM systems. This resulted in a systematic literature review (see p. 58), which was compared against the findings of a second analyst (Lambe, 2011), who published a similar, though limited enquiry.

Claim 2 (Research Sub-Question 2): Soft Systems Methodology (SSM) and hypothetico-deductive reasoning can provide a framework for evidence-based research into OKM systems. Issues of dissatisfaction, discussed in Chapter 3 (see

p. 99), with regard to breadth and depth in existing OKM research, are addressed using SSM and hypothetico-deductive reasoning in tandem. This allows the researcher to generate commensurability amongst research methods when exploring OKM systems (Chapter 4, see p.125). This provides a rich field of data that allows the researcher to improve credibility, reliability and transferability. It is suggested that this methodology is seemingly unique in relation to existing OKM literature. This assists in developing a way to look at existing research with fresh eyes.

Claim 3 (Research Sub-Question 3): It is possible to identify general constructs and functions for OKM regardless of discipline or geographic locations. The need for the identification of OKM constructs is introduced across Chapter 3 (for example see p. 54; p. 66-67; and p. 76-82). The research then uses the methodology proposed in Claim 2, giving voice to practitioner and academic opinions in an extensive meta-analysis (see p. 183) and descriptive survey (see p. 197), with the findings being mapped using fractal analysis to demonstrate self-similarity in the data (see p. 210)

Claim 4 (Research Sub-Questions 3 and 4): An evidence-based definition of purpose for OKM systems is possible. The need for an evidence based definition of purpose for OKM systems was identified in Chapter 3 and a response developed using a meta analysis of OKM literature (see p. 183), which was compared with results of a survey (see p. 197), to surface self-similarity or commonality across OKM systems designed to coordinate knowledge resources (see p. 210), leading to the development of the following evidence-based definition or purpose statement for these systems (see p. 193).

Claim 5 (Research Sub-Questions 6): The development of a proposition for a general model for OKM systems is reasonable. The proposition for a general model was developed in response to theorists who have been calling for a general model as a representation of Organisational Knowledge Management systems (Spender, 1996; Mekhilef and Flock, 2006; Heisig, 2009; and Lambe, 2011). The following is introduced in Chapter 4 (see p. 163):

> "The K-Core model is an OKM systems model that can be used in organisations, regardless of sector or geographic location, to identify gaps in systems for the coordination of knowledge resources through the application of a PIAT as a structured diagnostic method"

The proposition is developed based on the outcomes of fractal analysis (p. 209), which is developed, using a Logic Modelling approach, into a falsifiable object, the K-Core model (see Figures 8a through 8c, p. 151-152), to represent OKM system domains focused on the coordination of knowledge resources (Figure 1, p. 26). This model is then used to inform a Participatory Integrated Assessment Tool (see p. 157), which is operationalised as a diagnostic tool to probe existing internal OKM systems.

Claim 6 (Research Sub-Questions 6): Common constructs that organise within OKM systems for the coordination of knowledge resources can be modelled. As described in Claim 5, the outcomes of the meta analysis and fractal analysis are developed into an illustration of common functions and constructs that organise within the scope of Organisational Knowledge Management systems. This process produces a new model, the Knowledge Core (Figures 8a through 8c, p. 151-152).

Claim 7 (Research Sub-Questions 7 and 8): The K-Core model, developed as a general OKM diagnostic model for the coordination of knowledge resources, can be applied. This extends Claims 5 and 6, bringing credibility and trustworthiness to earlier claims. Organisations now have access to an evidence-based diagnostic tool that can identify gaps in existing systems that could be impacting the value contribution of knowledge resources to the organisation. There are concerns as to the use of the diagnostic tool being limited by the tacit knowledge that resides within me as the researcher, a problem discussed in Chapter 7 (see p. 302).

Chapter 2: Context setting

“Welcome to the most ‘successful’ fuzzy idea in the history of management” (McElroy, 2000, p. 43)

2.0 Introduction

In this Chapter the KEn Diagram (Figure 1) is introduced as a means to describe the internal organisational environment for knowledge resources in the context of this thesis. Key concepts are introduced that will be unpacked in the literature review (Chapter 3). To assist in developing context, four examples of OKM in practice are provided that include a European multinational Information Technology company, the US Space Agency, a United States chemical company and a Middle Eastern bank.

2.0 The KEn Diagram

A fundamental interest in pursuing this research was in how organisations organise around the concept of knowledge as a resource (see p. 47). The KEn Diagram (Figure 1) was developed to enable that discussion.

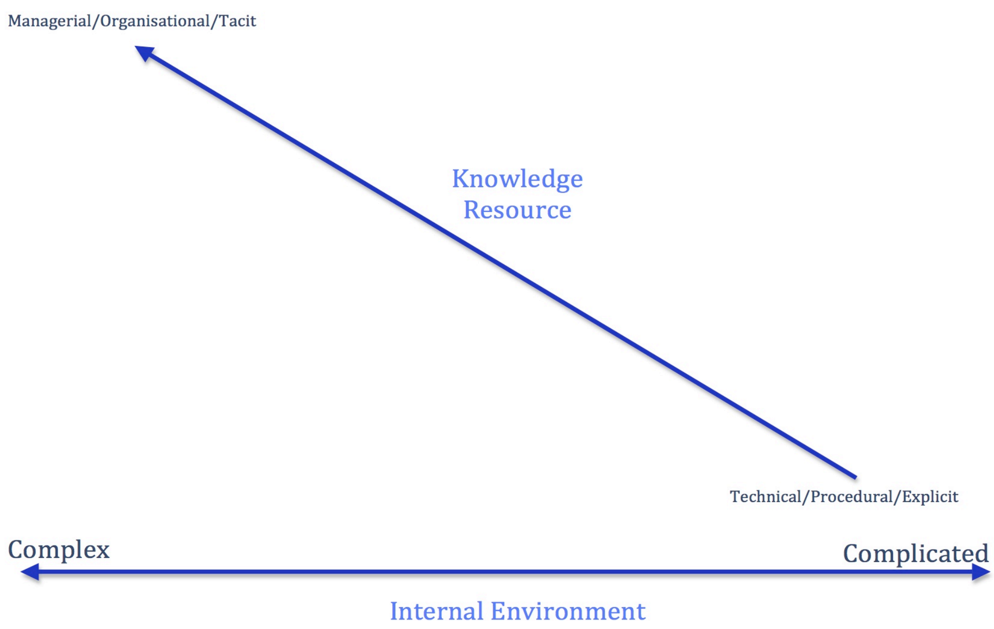


Figure 1: The Knowledge Environment (KEn) Diagram

The knowledge resources that can exist inside an organisation are represented in the diagonal continuum, technical, procedural or explicit and managerial, organisational or tacit (see p. 43 and 46 for definitions); these resources becoming more managerial, organisational or tacit as the knowledge environment moves towards a more complex state. It is argued that people bring agency to this environment (see p. 51), regardless of whether the knowledge resource is technical or managerial, and are therefore a limiting factor as organisations look to acquire, create, develop and share knowledge resources.

Complicated knowledge resources will be explained in this thesis as being explicit (see p. 43), technical or procedural knowledge (see p. 46 for definitions). These types of resources can be externalised (or separated) from people, can be written into procedures, for example Standard Operating Procedures, and are often described as objects (see p. 40). Variables contained in these resources are relatively clear, as is cause and effect (see p. 68-75).

Complex knowledge resources are presented as tacit (see p. 43), managerial or organisational knowledge. These resources are often 'black boxed', where they are within (or cannot be separated from) the person and are often described as a process (see p. 40); the knowledge is said to be inexpressible and is non-linear, where cause and effect is not always clear. Kahneman (2011) simplifies this, stating that cause and effect allows for an explanation, where the outcome could have been known beforehand, where as in complex situations this is difficult (see p. 68-75).

Organisational knowledge resources can comprise varying degrees of the tacit and the explicit (see p. 43 for definitions). For example, in a 2006 case study into OKM processes within the Israel aircraft industry (Dayan *et al.*) knowledge was claimed to exist both within people and externally, in databases. In the latter, knowledge was highly technical, procedural or ordered; for example, airframe manuals containing maintenance procedures. Here, if a process deviates from the norm, cause and effect can be identified and rectified through quality control/assurance processes. At the other end, looking towards managerial or tacit knowledge, there was a need to capture managerial expertise, caused by people retiring from the organisation. This expertise, problem-solving, for example, is complex and difficult to externalise through procedures, making it problematic for storage in a database and therefore the organisation looked towards human interaction, or the use of 'Communities of Practice' (see p. 33), to share or embed knowledge resources in the organisation.

To summarise, at the complicated end of the KEn Diagram (Figure 1) knowledge can be articulated or made explicit, taking an example from the world at large, a recipe for baking bread. Travelling away from this point, knowledge becomes more difficult to articulate; for example, the decision making process that organisations go through when entering new markets or reorganising a division.

OKM in the context of this thesis is therefore defined as the sum of the organisational systems designed to coordinate knowledge resources, whether objects or processes, in any given environment.

2.1 KM inside organisations

This section introduces examples of operational activity to help contextualise KM when applied inside organisations.

2.1.1 Siemens

In 2002, Davenport and Probst published the Knowledge Management Case Book, an in-depth case study of Siemens AG, an international electronics engineering and manufacturing company. Siemens focus on social and technological OKM systems through 'ShareNet', an IT-enabled KM platform. This came about, as they were interested in knowledge repositories, stocks of explicit information or knowledge that could be accessed by their global workforce to assist in developing continuity of service provision or standard operating procedures. What was established was predominantly an information portal, designed to quickly connect the global workforce with information that could expedite solutions to common problems. However, Siemens realised that people acted as 'gatekeepers' to information or knowledge, both in uploading the necessary information or knowledge required to solve any given problem and in the accessing and applying that information or knowledge in the best interests of the organisation and its clients. Siemens had to evolve its thinking, realising that while procedural information was relatively 'easy' to capture and store, more complex problems required person-to-person contact that moved processes away from databases to ways of connecting people, allowing conversations and a sharing of practice between those who held the knowledge with those who needed to access that knowledge. "ShareNet…demonstrates the importance of finding the right balance between IT solutions for capturing explicit codified knowledge and leaving enough room to allow direct personal exchange of more implicit forms of knowledge" (p. 59).

This case is introduced to demonstrate the use of knowledge as a resource, as part of a service/production driven problem-solving solution; it also demonstrates that the environment can require that the system evolve towards a more people-based, social solution. This case emphasises a key opinion of this thesis, in that the human element is required for success across the KEn Diagram (p. 26), whether in the acquisition and storage of resources or in the application of the knowledge once it is captured within the organisation.

This focus on problem-solving has led many organisations to invest in methods to capture and store lessons learned from (for example) projects; staff then access and apply the information or knowledge, thereby refreshing and developing organisational knowledge stocks. However, this research argues that quite commonly the human element, as identified by Siemens, can be forgotten and the system degenerates into a data dump, with resources being left to stagnate.

2.1.2 NASA

A good example of such stagnating internal knowledge resources comes from NASA (North American Space Agency) who in 1999, responding to knowledge lost from the Apollo missions during the 1960s and being faced with an aging workforce, as is the case with many organisations, developed a knowledge sharing system, implemented via the 'Lessons Learned Information System' (LLIS). "If we want to go to the moon again, we'll be starting from scratch because all of that knowledge has disappeared. It would take at least as long and cost at least as much to go back" (DeLong, 2004, p. 11-12). In 2012 (Martin) a United States Government report recommended that after 13 years the system should be abolished. It was reported that NASA's LLIS had received over $750,000 of funding on an annual basis and yet it was still unsuccessful. Key findings suggested that NASA had weakened its policy requirements for use and development of the system, a key coordination tool that set the context for its staff to engage with the LLIS and without this motivation, staff disengaged and the system went into decay.

> "…Program and project management policies issued in 2002 and 2005 required managers to provide lessons learned for input to LLIS "throughout the project lifecycle, for example, at major milestones." In contrast, NASA's current policy, in effect since 2007, does not explicitly require the use of LLIS and does not require project managers to identify or archive lessons learned until project conclusion or closeout" (p. iii)

This reinforces my position put forward in this research, in that people-based processes, such as context-setting policy directives, influence the success of OKM systems. Though not directly stated in the NASA report, the problem could be one that is strongly subscribed to in this research, and similar to that recognised by Siemens, in that as the domain becomes more complex it becomes more difficult to capture knowledge as an explicit resource.

> "The Chief Engineer and Chief of Safety and Mission Assurance issued a letter in February 2009 encouraging active participation by NASA senior leaders in institutionalizing and sharing lessons learned across the Agency…In contrast to the formal policy, the letter encouraged NASA leaders to convene workshops to discuss and capture lessons learned immediately after completing individual elements of a project's work while memories were fresh, rather than waiting until the end of the project's mission. However, according to the Chief Engineer the letter did not result in a measureable improvement of the Centres' use of the LLIS process to institutionalize lessons learned" (p. iv)

A common theme in the report is the lack of organisation definition and strategy for the LLIS; as a consequence, business processes were under-developed, especially when considering feedback processes, such as ongoing monitoring and evaluation.

This is a good example of the lack of recognition for a construct that needed to be managed, in this case feedback loops, or in the previous example, human resource policy, and the system's failure. In this thesis, I argue that these omissions cause system failure and user dissatisfaction. I also argue that this can be avoided through an evidence-based diagnostic tool (see p. 158, which, in NASA's case, could have brought more value to the US government's $10 million investment in the system.

> "Since…March 2005, the Chief Engineer has completed an Agency-wide assessment of the lessons learned process just once, in 2010. We found that assessment to be inadequate because it did not review and evaluate whether the Centre-level Lessons Learned Committees administered and oversaw the lessons learned process or whether the Committees promoted use of lessons learned throughout a project's life cycle" (p. iv)

A possible issue for NASA is their fundamental view of knowledge resources in this case; 'Information' (see p. 40) in LLIS perhaps indicating the treatment of knowledge resources as objects (see p. 52), which does not taken into account the needs of the human resources that interact with the system. This can be in the form of motivation to engage with the LLIS or even the interface design of technical platforms that require human involvement. It seems as if NASA have ignored the influence of human agency (see p. 51) upon their systems, which I argue to be a critical error in underpinning strategy for the management of organisational knowledge resources (see p. 52).

> "Users told us they found LLIS outdated, not user friendly, and generally unhelpful, and the Chief Engineer acknowledged that the system is not operating as originally designed. Although we believe that capturing and making available lessons learned is an important component of any knowledge management system, we found that, as currently structured, LLIS is not an effective tool for doing so" (p. v)

The NASA case demonstrates that even when considering knowledge resources as being technical, procedural or explicit, it is still not possible to remove people-based processes from systems, to do so creates a situation where knowledge stocks stagnate and potentially decay. I consider this to be an undesirable state, as they are no longer contributing value to the organisation (see Figure 4, p. 56).

2.1.3 W.L.Gore

A contrast in OKM approach can be found in W.L. Gore and Associates, most famous for developing Gore-Tex (Cohen, 2007). There is often a belief that knowledge resources are developed at the desk, accessing knowledge stocks in databases or information portals, but while W.L.Gore see the value in these 'foundational' knowledge resources, it is the value associated with enabling social interaction that has also informed the design of their OKM systems; a position that finds strong agreement within this research.

Within W.L.Gore, consideration has gone into the organisational structure, where no single business unit exceeds 200 employees, the organisation believing that beyond this point it is not possible to establish collaborative relationships; this is arguable, as these are internal relationships and networks for collaboration, which will extend beyond Gore's recommended 200 if external, but still business-centric, relationships are considered. W.L.Gore has also focused on space, limiting the physical design of its buildings to a single floor, as they believe that multiple floors create barriers to social processes that encourage the sharing of knowledge resources. To complement this they also ensure that company policy and procedures allow employees time and space to meet – this includes work programme policies that give the employee scope to explore interests that take them outside of their core remit, but benefit both the individual and the company. This resonates strongly with the findings contained in this thesis, where these aspects would be seen as important within any OKM system. In this way, the organisation is attempting to stimulate the ongoing development of their tacit knowledge resources, through social processes that encourage networking, collaboration and social problem-solving. This is enabled through the following Human Resource directives, which acknowledges the human agency within OKM systems, which stands as a positive example of system design when considering the outcomes of this research (see Chapters 6 and 7):

- "[Provide] environments that make it easy for co-workers to communicate directly and form close working relationships.
- [Demonstrate] trust and respect by giving workers autonomy.
- [Ensure] fairness of recognition and reward" (Cohen, 2007, p. 243)

W.L.Gore believe that many organisations invest in open physical spaces to encourage social knowledge exchange, as part of an OKM system, but it is their focus on the human resource perspective that brings about success. The findings of the research in this thesis accord with this position (see Chapters 6 and 7).

2.1.4 Asian Development Bank

Communities of Practice (CoP) is an example of a socially driven OKM approach, which is, frequently surfaced in OKM literature as a response to the need to coordinate people-driven managerial/organisational/tacit knowledge resources (see the KEn Diagram p. 26). I see CoP as a means by which to develop methods to engage with people and issues of human agency (see p. 51). In 2008 the Asian Development Bank (ADB) published guidance on developing CoP (Serat, 2008), based on the original work of Etienne Wenger (1998).

The ADB CoP is a good example of work in the area of Adult Learning Theory, which I propose to be a key element in OKM systems thinking (see p. 82). It creates a shared domain where groups of people can share work-related knowledge to meet their needs and that of the organisation. For ADB it is about sharing knowledge to further the delivery of high quality services to end-users. This happens through social interaction via either technology-based platforms or face-to-face engagement; in the case of ADB it is predominantly a technology-based CoP, allowing staff to post on bulletin boards and access a library of historic resources – within their explicit knowledge resources, such as bulletin board responses, there is still a human aspect, such as the curation and quality assurance of artefacts. This demonstrates my belief that technology is an enabler for OKM systems, regardless of a complicated or complex context. However, as will become apparent in Chapter 3, being an enabler does not make technology an OKM 'solution'.

ADB's community is built on core principles (Table 2.1) that demonstrate the need for a clear frame of reference in order for the community to succeed.

What is the Value of Communities of Practice?	Community of Practice Success Factors
• Communities of practice identify, create, store, share, and use knowledge • They decrease the learning curve of new employees • They enable professional development • They reduce rework and prevent reinvention of the wheel • They permit faster problem solving and response time to needs and inquiries • They illuminate good practice • They spawn new ideas for products and services • They enable accelerated learning • They connect learning to action • They make for organizational performance improvement	• **Strategic relevance**—the strategic relevance of the domain, which lets the community find a legitimate place in the organization • **Domain**—directly related to real work • **Membership**—experts are involved • **Activities**—relevant to the members and the domain, with the right rhythm and mix • **Governance**—clear roles and expectations • **Facilitation**—a dedicated, passionate, skillful, and well-respected coordinator • **Culture**—a consistent attitude to sharing and collaboration • **Incentives**—a desire to participate • **Reward and recognition**—the organizational environment is adapted to support participation • **Information technology**—an appropriate medium of communication that adds value and helps deliver work programs • **Time**—members are given time and encouraged to participate • **Longevity**—needed both for communication and to build up trust, rapport, and a true sense of community • **Measurement**—how do we know a community of practice is successful?

Table 2.1: The Asian Development Bank (ADB) Community of Practice core factors (Serat, 2008, p. 2)

What is interesting is that, as with previous examples, there is a clear need to engage with human resources through policy and/or procedural frameworks, in order to be able to coordinate the knowledge resources within the CoPs. This sits well with my findings in this thesis, discussed in Chapters 6 and 7. There are also wider issues that are complex in nature, such as the requirement to develop a culture that encourages 'a consistent attitude to sharing and collaboration'. This, again, aligns with the findings of this research (see Chapters 6 and 7 and the position of people as *catalysts* in OKM systems), in that ADB would have to engage with policy and procedures across their HR cycle, from job design, recruitment, induction and ongoing professional development. This means that CoP require a deep understanding of the constructs that organise to produce the whole, as opposed to only being concerned with a single element, for example, the technical aspects of the system.

What is more interesting, and in sharp contrast to what is stated in theory (see p. 92), is that ADB believe in capturing tacit (managerial) knowledge resources in explicit or 'documented' form (Figure 2). I will present a position that, based on the work of Polanyi (1969), this, if the intention is for 'total' capture, which is not clear, cannot happen (see p. 92). The caveat to this is that ADB appear to be interested in "developing operational processes" (Step 3 in Figure 2), which my research does consider to be codifiable. However, I would argue the problem of transfer from tacit to explicit remains, when considering Steps 1 and 2 in Figure 2. Regardless, ADB speaking of the explicit and the tacit within the same space again demonstrates a management process for organisational resources that includes both extreme aspects of the KEn continuum.

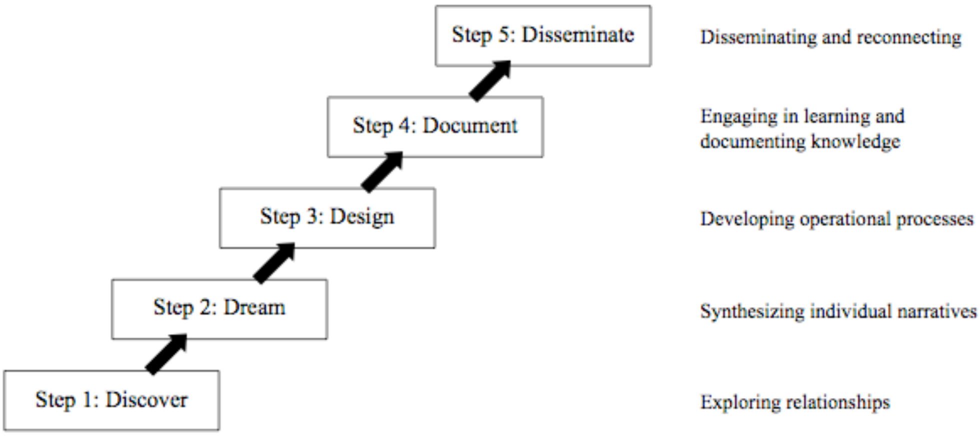


Figure 2: ADB Model for designing sustainable Communities of Practice (Serat, 2008, p. 3)

2.1.5 KM inside organisations: Summary

These cases provide a broad, though limited example of OKM systems activity. OKM systems encompass more than a single process, or activity, and therefore these examples are usually one sub-system, where the whole system would potentially compass CoP (as in the case of ADB) with a Lessons Learned database (as with NASA). The problem presented in this research is that too often these sub-systems are treated in isolation without consideration of the whole (see p. 68). A key message supported by the research in this thesis is that knowledge resources exist in explicit (object) and tacit (process) forms across these cases.

What emerges, and what this research responds to, is the challenge that faces organisations in defining what constitutes a knowledge resource (objects, such as databases, and/or people, with a focus on the coordination of social processes) and what management constructs exist within the scope of an OKM system focused on the coordination of these knowledge resources. If these constructs are not recognised then there is a danger that critical or limiting constructs could be missed; potentially resulting in system failure, which could then produce user dissatisfaction. For example, with NASA, their failure to adequately recognise this, missing feedback processes and policies for the engagement of human resources, potentially caused their LLIS programme to be cancelled at a cost of almost $10 million.

Wider evidence for this is presented through the 2011 KM Observatory Survey (Griffiths and Moon), with responses from 354 Knowledge Management professionals from 53 countries. Findings demonstrated that only 24% of respondees linked their knowledge resource needs to human resource policy, a potential influencer of human agency (see p. 51); that only 39% defined knowledge resources; and only 37% communicated that definition to their staff. Furthermore only 28% of respondents were 'highly satisfied' or 'satisfied' with the contribution of OKM systems to their organisation's strategic needs, which dropped further, to 24%, when discussing the OKM system's contribution to operational needs. The NASA case is a good example of the disconnect between the nature of organisational knowledge resources and the way in which they are managed. In terms of this research it demonstrates that if aspects of the management process are missed, such as consideration for human agency, then systems do fail.

2.2 Dualism and duality

The conclusion of the research contained in this thesis is that OKM literature often presents dualisms. A dualism is one of a simple black and white position juxtaposed in a space that has a tendency to polarise opinion to one position or the other. In contrast, duality takes the same black and white positions and harmonises them within the same space, reminiscent of the Asian approach to Ying and Yang (Fang, 2009).

> "…Opposites – existing side by side and even within each other, [allow] the situation, context and time to determine what is appropriate" (p. 158)

The literature review (Chapter 3) surfaces conflicts that seem to demand either/or choices, which, I argue, are not representative of the environment that OKM systems operate in, as demonstrated in the previous case examples, with key arguments summarised below:

Knowledge as a product V Knowledge as a process (for example, see p. 40)
Explicit V Tacit (for example, see p. 43)
Resource-Based View (RBV) V Knowledge-Based View (KBV) (see p. 52)
Eastern ideology V Western Ideology (see p. 68)

Some suggest these challenges to be embedded in cultural biases:

> "There is a normative bias in Western civilisation in favour of explicit and well-structured knowledge and there are permanent efforts to automate human skills" (Lundvall, 2006, p. 2)

Of course, this is an over simplification, as there are many Western authors who advocate the socialisation of people, through, for example, the development of CoP to enhance the value of knowledge as a process (Wenger *et al.*, 2002). However, the divergence between tacit (managerial or organisational) and explicit (technology driven technical or procedural) approaches is pronounced in the literature and I argue that this is not appropriate. Organisational knowledge resources have varying degrees of the explicit as they travel between complicated and complex domains.

There is therefore a need to guide the development of OKM systems, not by focusing on one extreme of the KEn Diagram or the other, but by focusing on the points between that bring about a blend of the tacit/the explicit in knowledge resources. My research in this thesis points to duality as the best approach in the design and development of OKM systems (see Chapter 4).

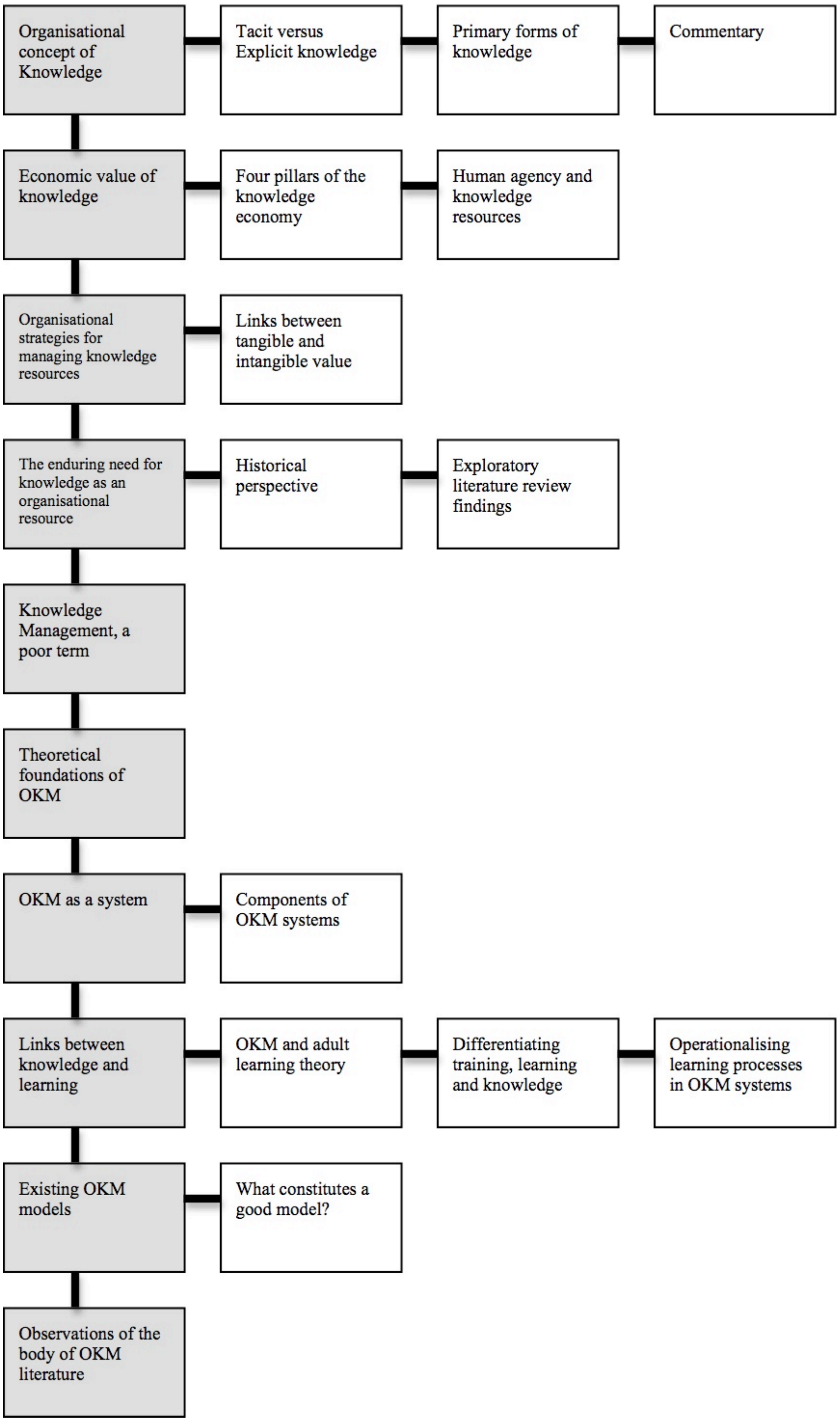
2.3 Summary

This section set out the context for the literature review and signposts key aspects of OKM systems that need to be explored. This includes how knowledge is defined as an organisational resource, how theory can inform strategies for the management of these resources and whether knowledge resources are objects, processes or both. Potential problems have been highlighted, where organisations treat knowledge resources as objects and in processes that rely on the transfer of social or tacit resources into explicit form. The examples also clearly demonstrate that people are limiting elements in the acquisition, storage, sharing and development of knowledge resources, whether in engaging with technology, as in the case of NASA, or, as in the case of ADB, where they *are* the resource to be managed.

This leads to other questions that need to be explored: how does systems thinking impact the design and development of OKM activity; if systems can fail, as with NASA, if they do not account for all the constructs that fall within their scope, in this case, people, then are there gaps in the models that organisations might use as diagnostic tools; do academics and researchers see OKM in the same way; what should an organisation look to coordinate as they design and/or develop OKM systems? These are some of the issues and questions that the following literature review responds to.

Chapter 3: Literature review

3.0 Literature Review structure



3.1 Introduction

In this Chapter a clear account will be given of the OKM systems domain. It opens with discussion on the concept of knowledge as a resource in organisations. This progresses to an exploratory literature review that establishes that organisations have been interested in knowledge as a resource for well over 250 years. This is followed by organisational strategies for the management of knowledge resources, introducing the Resource-Based and Knowledge-Based Views of the organisation and the strengths of weaknesses of each will be explored. The concept of OKM is then critically evaluated, beginning with its definition before progressing to its theoretical foundations. The discussion (or review) then progresses to systems thinking and the implications for OKM systems, with a critical focus on the difference between complicated and complex system domains and the constructs that emerge within the scope of OKM systems, where, again, strengths and limitations of current approaches are reviewed. Links between knowledge, learning and training emerge in the literature and these are explored. Existing OKM models are critically engaged and the question, 'what constitutes a good model' is addressed. Finally, observations of the wider body of OKM literature are discussed, including the implications for researchers in the OKM domain.

3.2 Concept of knowledge

Mingers (2008) identified the lack of definition of knowledge in organisations as a weakness, where theorists fail to establish a situated definition of knowledge and thereby take an overly-simplified view of its value. This lack of definition of knowledge causing problems for organisations is in agreement with my findings in this research and is therefore the starting point for this literature review.

Zhu (2010) debates whether knowledge is an object, something external to the person (ordered, technical knowledge) (much like a traditional camera image showing an image of how the world more or less is, which can then be held, moved around and shared), or a process (managerial knowledge), something within the person, "always in the making, enabling you to accomplish what you want to achieve in specific situations to make real something you value, to bring favoured changes to the world" (p. 179). This foregrounds a potential dualism, where organisations could be wrongly led to the conclusion that OKM systems involve choices of 'either/or' between product and process views, which, as demonstrated in the case examples (see p. 28-35), is not correct.

There is no agreed business-centric definition of knowledge (Bhatt, 2000; Heisig, 2009; Lambe, 2011), leaving some to claim that organisations are "content to leave the problem of knowledge as something of a black box" (Allix, 2003, p. 1). Spender (1996) stated that a failure to debate this issue contributes to poor practice, which I agree with, in the context of this research. He claims that too many OKM theorists have adopted a positivist view of knowledge, one that focuses on knowledge as a product or object, leaning towards technology driven solutions, which is in conflict with the actual knowledge resource needs of organisations. The nature of knowledge resources is evident in the case examples (see p. 28-35) and, as will become clear, an exclusively positivist approach would cause problems for organisations looking to create value from their OKM systems (see p. 52).

Some authors take an ontological view when describing organisational knowledge (Gruber, 1993), arguing it to exist in three states: *Knowledge-as-data*, *Knowledge-as-meaning* and *Knowledge-as-practice*. This is an interesting, but not popular position and one that is perhaps overly ambiguous in terms of organisational application. More popular is the idea of knowledge as part of a hierarchical flow: *Data – Information – Knowledge – Understanding – Wisdom* (Ackoff, 1989); though there is debate as to whether this should be inverse, where knowledge is needed before information can be constructed (Tuomi, 2000). This hierarchy can be mapped against the KEn Diagram (p. 26), where raw data exists in the complicated domain, and wisdom within the complex. However, even in this hierarchy the definition of knowledge remains illusive: research involving 45 leading scholars from 16 countries provided 130 variations in definition (Chaim, 2007). What this means is that even when applying accepted organisational 'knowledge' models, there should be caution, for the concept of knowledge and its relevance as a resource is still not clear.

One widely stated definition is that, “data is raw numbers and facts, information is processed data, and knowledge is authenticated information” (e.g. Alavi *et al.*, 2001, p. 109). Lambe (2011) cautioned that viewing knowledge as emergent from data gives authority to knowledge as a static object that can be externalised from the person; the same words of caution emerge in my findings in this research. Roth (2003) aligns with this, believing knowledge to be a dynamic phenomenon, activated by an ‘actor’. This moves the concept of a knowledge resource away from being considered as an object to something existing within people, meaning that people become the human resource to be coordinated. This idea of people as the activators of knowledge is strongly supported by me in this research, a position emphasised in OKM practice through the earlier case examples (p. 28-35).

In talking of *activation* it is necessary to differentiate *knowledge* from *knowing*. Nonaka and Takeuchi (1995), see ‘knowing’ as knowledge in action. ‘Knowing’ is the activation of knowledge through application, aligning with Aristotelian concepts of *Phronesis* (the practical knowledge of doing) and *Sophia* (the ability to reflect). This positions the person as the active protagonist in the application of knowledge (Quintas, 2002), which influences the discussion of human agency later in this Chapter (see p. 51)

Sarah and Haslett (2003) and Wilson (2002), amongst others, argue knowledge to exist within the human mind, with the externalisation of what is known inside the mind being classified as information. Chaim (2007) disagreed, stating that if this were correct then the concept of KM should be expunged from the field of Information Science. Given his statement places ‘knowledge’ in the field of ‘information’ science, I propose that he is correct.

Chaim (2007) captured the essence of the argument, asking “is Albert Einstein’s famous equation 'E=MC2' information or knowledge?” (p. 479). There is no agreement, but the differentiation between knowledge being held within the person and information existing outside the person could be useful to this research when considering explicit knowledge resources within the complicated domain (see p. 26 and 52). Progressing, the discussion of knowledge in OKM literature often leads to Nonaka *et al.*'s body of work and 'tacit' and 'explicit' knowledge.

3.2.1 Tacit and Explicit knowledge

In OKM literature, a business-centric definition of knowledge, and subsequent links to what constitutes a resource, emerges when it is considered as either an *object* (explicit) or *process* (socially based and tacit). This is widely credited to Ikujiro Nonaka, the most cited author in KM literature between 1998 and 2007 (Ma and Yu, 2010).

Nonaka and Takeuchi (1995) argued for two types of knowledge – Explicit being described as *knowing what*, or codifiable (technical knowledge within the KEn Diagram, see p. 26); tacit being *knowing how,* or knowledge that exists within the mind of the individual or group, which is difficult to articulate or extract (managerial knowledge within the KEn Diagram); the management of which is more centred on processes for social interaction, such as CoP (see p. 33). A less popular form of knowledge, *implicit*, also surfaces in literature, described as a form of tacit knowledge, differentiated by its potential to be made explicit (Frappaolo, 2008). This is confusing as it suggests that there are varying degrees of tacitness within the category of 'tacit' knowledge and it is not clear at what point tacit knowledge becomes less tacit, to the point that it can be made explicit. I will focus solely on *tacit* and *explicit* as I consider that there is justified debate (for example see p. 92) as to whether tacit knowledge can be made explicit and therefore whether implicit knowledge is even a viable concept. It is also recognised that an alternate approach might consider knowledge as codified (already externalised), codifiable (potential to be externalised) or non-codifiable (cannot be externalised). This would align with the KEn diagram (see p. 26) and would soften the argument around whether tacit knowledge can be made explicit.

OKM literature often makes it seem as if the terms *tacit* and *explicit* originated from Nonaka's work. This is incorrect, as Polanyi used them in 1969. Nonaka *et al.*

receive often-ignored criticism, where it is suggested that they misinterpreted or manipulated the founding work of Polanyi (for example Wilson, 2002); Polanyi (1969) stated that tacit knowledge is inexpressible, whereas Nonaka *et al.'s* work (e.g. 1995) relies on the conversion of the tacit to the explicit (see Figure 5, p. 92). Also, it has already been argued (see p. 42) that explicit knowledge is information and therefore perhaps people are only speaking of knowledge and information (Wilson, 2002). Interestingly, Nonaka *et al.* (2000) stated, "The KM that academics and people talk about often means just 'information management'" (p. 6).

> "A lot of us when KM started back in 1995 argued very strongly that it got off to a bad beginning. Basically down to two models. One goes, Data, Information, Knowledge, Wisdom...which created this hierarchical concept, with the net result of which is good information management programmes got relabelled as KM…and actually couldn't deliver on expectations...The other model that got it wrong was Nonaka's SECI [Socialisation, Externalisation, Combination, Internalisation] model…this was the model that launched a thousand failed KM initiatives. Because it focused on making tacit knowledge explicit. Something that in practice is not possible and in theory is not possible" (Snowden, 2010, www.cognitveedge.com)

The opinion here is that Nonaka's body of work needs to be treated with caution, for even when accepting Nonaka and Takeuchi's (1995) view of tacit and explicit knowledge, issues remain. For example, Alavi *et al.* (2001) argued that Nonaka and Takeuchi's (1995) work could lead to the conclusion that tacit knowledge holds a higher value than explicit knowledge. The authors arguing that without the building blocks of explicit knowledge, tacit knowledge could not exist. This thesis does not attempt to resolve these arguments, but reports on them to highlight the caution required in the handling of established thinking in the OKM field.

Nonaka's body of work is debated, but, given his popularity within the field, it cannot be disregarded. Therefore, in an attempt to conform to a common language, I accept his definitions of 'tacit' and 'explicit' as an entry point for discussion of organisational knowledge resources. This is justified, where authors who have criticised Nonaka's work (e.g. Wilson, 2002) stop short of addressing challenges of operational knowledge definition, defaulting to the language of tacit and explicit as put forward by Nonaka *et al.*

While *tacit* and *explicit* knowledge categories progresses a business-centric definition of knowledge that can begin to be linked to organisational resources, it still falls short of providing a clear signpost towards types of knowledge resources, which is needed in order to develop OKM systems that respond across the KEn Diagram (see p. 26). This is a position supported by Spender (1996):

> "If we are to move towards a dynamic knowledge-based theory of the firm, we must go beyond the argument…that organisational knowledge is of two static types, explicit and tacit….we need to reach behind the process of knowledge creation which leads to competitive advantage and understand the process itself must be adaptable" (p. 48)

3.2.2 Primary forms of knowledge

A business-centric classification emerges via the *Primary* types of knowledge: *Know What* (descriptive knowledge); *Know How* (technical knowledge); *Know Why* (reasoning knowledge); *Know Who* (social knowledge) (Holsapple and Joshi, 2004). Others have suggested that *Know-Where* should also be considered (Sanchez, 2004) and *Know When* (Mingers, 2008), which, not finding a counter argument in literature accessed for this research, is accepted in this thesis. This schema can be applied across the KEn Diagram (see p. 26), regardless of technical (object) or managerial (process) context, which could help guide organisations in their design of systems for the management of knowledge resources, and it addresses the concerns of Spender (1996), above.

Without over-reaching into unnecessary debate, this schema originates from Ryle (1949), where *knowing what* is declarative knowledge that provides an understanding of facts and *knowing how* is the technical knowledge that provides understanding of how to do things; drawn from the Aristotelian view, where *Episteme* is seen as *knowing what* and *Techne* is seen as *knowing-how*. This has provided a platform for recent research, where descriptions moved beyond *know what, know how, know why* knowledge to *Propositional Knowledge*, *Experiential Knowledge, Performative Knowledge* and *Epistemological Knowledge* (Dueck, 2001; Greenwood and Levin, 2005). Ryle's (1949) work was progressed by Mingers (2008) in discussing the multiple forms of knowledge – in which he moves the discussion to: Propositional Knowledge ("generally explicit and propositional", p.71) Experiential Knowledge ("memories, some aspects of which may be tacit embodied", p. 71) Performative Knowledge (personal experience or embodied knowledge) and Epistemological Knowledge ("explicit, discursive, 'objective', open to debate", p. 71); Table 3.1 (p. 47) synthesises this discussion.

These knowledge forms gain currency, in terms of a business-centric application, through Antonacopoulou (2006), who, in research into the banking sector, discussed two distinct types of knowledge being utilised in the work place: *Technical knowledge* (know-what or explicit knowledge), found in resources such as manuals or books; and *Managerial knowledge* (know-how, tacit or technical tacit knowledge), which emerges when existing knowledge cannot provide answers due to a change in environment or context, residing more within the individual or group. This is supported through authors such as Revans (1980), who suggested that learning takes place when propositional or founding knowledge is considered insufficient and is challenged via questioning (see p. 86). A disappointment is that Antonacopoulou (2006) did not extend her enquiry to encompass social or reasoning knowledge, which could have provided a rich insight into knowledge activities that contribute to *knowing* in organisations.

These two knowledge descriptors (managerial and technical) have been adopted as working definitions within the KEn Diagram (see p. 26), while also accepting American variations of the terms: 'procedural' (explicit) or 'organisational' (tacit) knowledge (Moon *et al.*, 2011). It is posited here that these descriptors (technical and managerial, encompassing 'Know-What/How/Why/Who and Where) align with knowledge resources as they exist within organisations, insofar as a terminology that could better establish a context for OKM system development. This is supported by the Organisation for Economic Cooperation and Development (OECD): "different kinds of knowledge are distinguishable in the knowledge-based economy including know-what, know-why, know-how and know-who" (Clarke, 2001, p.189).

Knowledge Types	Definitions	Operational Example
Tacit	Knowledge is rooted in actions, experience, and involvement in specific context	Best means of dealing with specific customers
Cognitive tacit	Mental models	Individual's belief on cause-effect relationships
Technical tacit	*Know-how* applicable to specific work	Using the field of medicine and health as an example, surgery skills
Explicit	Articulated, generalised knowledge [*Know-what*]	Knowledge of major customers in a region
Individual	Created and inherent in the individual	Insights gained from a completed project
Social	Created/inherent in collective actions of a group [*Know-who*]	Norms for inter-group communication
Technical	*Know-how*	Follow on example: How to administer a particular drug
Causal	*Know-why*	Follow on example: Understanding when the drug works
Conditional	*Know-when; Know-where*	Follow on example: Understanding when to prescribe the drug

Table 3.1: Adapted view of knowledge definitions (from the work of Alavi *et al.* (2001) and Mingers (2008))

3.2.3 Commentary on an operational definition of knowledge

There is not a single business-centric definition of knowledge. It is illusive, which could bring into question the ability of an organisation to manage it. It is accepted that the concept of organisational knowledge resources cannot be delineated through static definitions, such as *tacit* and *explicit* (Spender, 1996). I therefore propose that broader definitions of, *Know-What*, *Know-How, Know-Why, Know-Where, Know-When* and *Know-Who* in fact direct organisations towards a resource for management. This leads to the framing of knowledge as a value generating resource within an organisation.

3.3 The economic value of knowledge

The knowledge economy is a general term with multiple definitions, many of which describe an economy driven by the use, diffusion and creation of organisational knowledge resources. It is also the environment within which organisations transact (Barkham, 2008). This informs the context for the internal knowledge resource environment as set out in the KEn Diagram (see p. 26) and requires further explanation.

> "The idea of the knowledge driven economy….describes a set of new sources of competitive advantage which can apply to all sectors, all companies and all regions, from agriculture and retailing to software and biotechnology" (Leadbeater, 1999, p. 4)

In 2005 the OECD Deputy Secretary General (Asgeirsdottir) stated competitive advantage to be grounded in the ability of an organisation to harness knowledge in order to exploit the uniqueness of the organisation. It is this 'uniqueness' that is of interest to me in the context of this research, as firms seek out competitive advantage.

> "Running an efficient organisation...is unlikely on its own to offer lasting competitive advantage...Instead the focus of management will be on the areas of business, from innovation to customer service, where personal chemistry or creative insight matter more than rule or process" (The Economist Intelligence Unit, 2006, p. 5)

The knowledge economy is characterised by the emergence of intellectual capital as a core value proposition to organisations (Dicken, 2011). This is evidenced by the value of intangible resources as a contributor to organisational market value, which have dramatically increased over the last 80 years; representing, on average, 30% of company valuation in 1929, to recent times where companies, such as Google and Microsoft, have declared their intangible assets to be worth as much as 90% (Ash, 2001). Further to this, intellectual capital was found to account for 78% of the value on the S and P [Standard and Poor's] 500 companies (Call, 2005). And in 2010 Choi and Jong's analysis of the stock market performance of 79 United States companies across service, manufacturing and financial sectors, between 1998 and 2003, found that the mere announcement of a strategy to manage knowledge resources could positively impact an organisation's market value (Choi and Jong, 2010). These findings pose a problem for organisations focused on developing OKM systems that respond only to technical knowledge resources, where the evidence suggests that the market value of organisations is being significantly impacted by managerial knowledge resources. To appreciate these findings there is a need to understand what constitutes the Knowledge economy.

3.3.1 Four Pillars of the knowledge economy

Economic value exists within what the OECD (Asgeirsdottir, 2005) describe as the four pillars of the knowledge economy (Figure 3, p. 50): *Innovation* (or knowledge creation); *New Technologies*, linking technology progress to growth in productivity; *Human Capital*, which is seen as essential to harness the benefits of the first two pillars; *Enterprise Dynamics*, *Dynamic Capacity, agility* or *Adaptive Capacity*. Dynamic capability is seen as existing within the competencies and capability of the individual, team or group. Agility is embedded in the ability of people to react to an emergent situation, contribute to its resolution and then disperse. The organisation's adaptive capacity is then informed by dynamic capability and agility, allowing the organisation to flex according to environmental demands (Dicken, 2011).

This informs the following position in terms of this thesis: the basis of the knowledge economy is human capital, which is the catalyst for organisational value; supporting the findings of Call (2005), where intangible assets provide a significant contribution to an organisation's market value. Importantly, people are also the activating agent for knowledge; the socialisation of human resources, and the access to, and enabling of, information through technology, being a key to innovation and the development of dynamic capability (Asgeirsdottir, 2005). As such, while technology is a founding aspect of the pyramid, it is not possible to enable it without people. Therefore human capital is seen as an essential aspect of the knowledge economy and OKM systems, which aligns with the views of authors such as Dicken (2011).

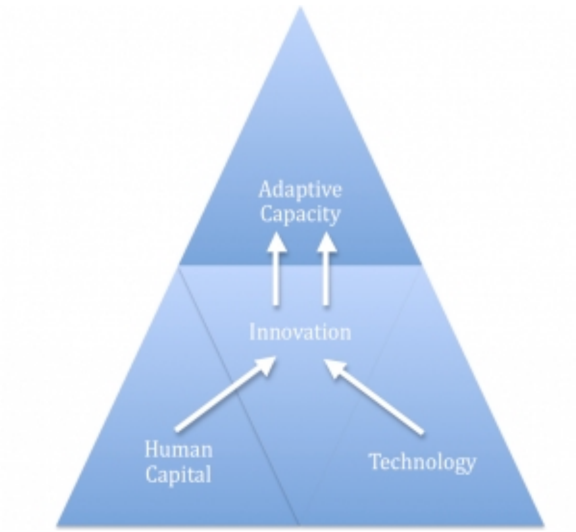


Figure 3: Knowledge economy drivers (Griffiths and Koukpaki, 2010)

> "Technology alone is not enough. It's technology married with the liberal arts, married with the humanities, that yields the results that makes our hearts sing." (Jobs, cited in Dediu, 2011)

Some have warned of focusing on human resources and missing the value of organisational processes, which, when combined with people and resources, such as Information Technology, allow the firm to exceed the sum of its parts (Kakabadse *et al.,* 2003). This indicates that while knowledge resides within the person, technology contributes to organisational value, enabling human resources to combine and exceed the sum of their individual parts. Considering this, technology cannot be seen as only being important within the technical end of the KEn Diagram (see p. 26), as it also exists as an enabler for the managerial or process view of knowledge resources, as discussed in the case examples (Chapter 2, see p. 28-35).

I subscribe to the position of human resources being a limiting influence upon knowledge resource acquisition, construction, sharing and development, whether at the technical or managerial end of the KEn Diagram (see p. 26). This leads to human agency (Bandura, 1989) and its influence upon OKM systems.

3.3.2 Human agency and OKM

In terms of OKM, knowledge within the individual cannot be regulated or controlled by means external to that individual (Fuchs, 2004), a position that I support in this research. This thesis is concerned with the management of the knowledge environment for the coordination of knowledge resources and not the cognitive process that takes place in the mind of the person. However, in discussing knowledge resources within the managerial end of the KEn Diagram (see p. 26), which involves people as the resource, as well as the idea that people regulate the acquisition, construction, sharing and development of knowledge resources at either end of the diagram (Fuchs, 2004), it becomes necessary to discuss the cooperation of people and the concept of human agency (Bandura, 1989).

> "Knowledge….is a process and relationship between active human agents that participate in a self-organizing social system and co-ordinate their subjective knowledge in such a way that objective knowledge emerges" (Fuchs, 2004, www.tlainc.com)

Fuchs (2004) is suggesting that information is converted to knowledge via a social system involving people, upon where 'objective' knowledge emerges in explicit or tacit form within the system. Bandura (2001) states that an agent, the person, has 'agency', in that they influence the system via independent thought and intentional action. "People set goals for themselves, anticipate the likely consequences of prospective actions, and select and create courses of action likely to produce desired outcomes and avoid detrimental ones" (p. 7). In this way people are increasing the complexity of OKM systems, evident in the differentiation between complicated (technical) and complex (managerial) knowledge resources, where in the latter the agent becomes the actual resource. Therefore, in terms of OKM, it is necessary to take into account regulating tools that influence agency within the system. This means that when developing systems for the coordination of knowledge resources there is a need to consider mechanisms that influence the agency provided by people. Organisations therefore have to consider human resource policy and procedure as a regulating influence upon human agency within OKM systems. "People construct outcome expectations from observed conditional relations between environmental events in the world around them, and the outcomes given actions produce" (Bandura, 2001, p. 7).

Fuchs (2004) asks whether human agents should be kept outside OKM systems, as their intervention could 'harm' the system – his definition of 'harm' is not clear, but he seems to imply that people can make the system more complex, as they cannot be 'controlled'. Fuchs responds by concluding that they cannot be isolated from OKM systems, a position that is supported in the findings of this thesis (Chapters 6 and 7). The consequences of not considering human agency in OKM systems is presented in the NASA LLIS example (see p. 29), where a lack of human resource policy was cited as one of the reasons for its failure, at a cost of almost $10 million. This also moves OKM thinking from that of complicated 'hard' (technical) systems to complex 'soft' (social) systems (see p. 68). Before exploring this there is a need to conclude the discussion on knowledge resources and explore underpinning strategic theory for their management, in order to discover influences upon OKM systems design and development.

3.4 Organisational strategies for the management of knowledge resources

Before progressing, it is necessary to define the term, 'resource' in the context of an organisation; it is widely debated and no agreed definition exists (Kraaijenbrink *et al.,* 2010). However, the following has been chosen, as it aligns with the interpretation of the concept used within this research: "A firm's resources will be defined as stocks of available factors that are owned or controlled by the firm" (Amit and Schoemaker, 1993, p.35)

The management of organisational knowledge resources requires a theoretical foundation from which to operate. Two approaches dominate the literature: The Resource-Based View (RBV) and Knowledge-Based View (KBV). Many use the two as interchangeable terms, but they are different (Spender, 1996) and the choice conveys underpinning assumptions as to the way in which knowledge is valued and managed by the organisation.

The RBV observes *costly to copy* resources as a fundamental source of competitive advantage (Wernerfelt, 1986). In terms of this thesis, this is significant and initially directs the management of knowledge resources towards the managerial end of the KEn Diagram (see p. 26), where knowledge has not been externalised or turned into an object that could be easily accessed or copied, a position aligned with that of Spender and Marr (2005), who argued for the same. Furthermore The Economist Foresight 2020 Report (The Economist Intelligence Unit, 2006), incorporating a survey of 1656 executives from 100 countries, stated:

> "Two broad trends that will effect companies across sectors: (1) Competitive advantage will increasingly depend not on routine, easy to automate processes, but on unpredictable, hard-to-automate *knowledge-workers.* (2) Companies will shift their IT spending, HR strategies and organisational structure to make those workers more productive. Managing both these trends is in essence marrying soft skills with hard targets, will be the defining boardroom challenge of the coming years" (p. 5)

However, while the RBV seeks *costly to copy* resources, it also encourages the concept of knowledge as a transferable commodity, one where codification is encouraged, so that knowledge resources may be measured and controlled (Spender, 1996). Lambe (2011) agrees, stating that the RBV encourages the treatment of knowledge as a static object. This is a problem for me, in this research, in terms of the need to develop OKM systems that respond to knowledge resources as both objects and processes. It also guides organisations to mistakenly believe that they can externalise and control knowledge resources at the managerial end of the KEn Diagram (see p. 26); this is evidenced in the ABD example (see p. 33) where their CoP requires the documentation of what is known, when it will be argued later that it is not possible to externalise tacit elements of knowledge (see p. 89). The RBV approach also moves against the findings of authors such as Call (2005) (see p. 52) and the contribution of intangible assets to the market value of the organisation.

Spender (1996) goes further, suggesting the RBV to be a reflection of the positivist or quantitative view of management studies in general that, when considering the drivers of the Knowledge Economy, and the findings of authors such as Call (2005) (see p. 48) is not appropriate. The fundamental problem is that the RBV attempts to manage intangible knowledge resources in the same way as tangible resources (Kraaijenbrink and Spender, 2010).

> "The RBV is strictly reductionist. It stands against holistic or emergent theories that liken firms to organisms with complex feedback-controlled mechanisms focused on boundary maintenance" (Kraaijenbrink and Spender, 2010, p. 359)

This, according to the findings presented in this thesis, is not realistic. This leads to the KBV as an alternative to the RBV, within which knowledge is the primary value creation tool for organisations (Grant, 1996; Alavi *et al.,* 2001). The KBV gives authority to the intangible value associated with concepts such as CoP (see p. 33). It views people, and their ability to problem-solve, innovate and develop adaptive capacity as core to organisational value creation. This aligns with my earlier stated views, where people are seen as activators of knowledge within organisations. It also gains currency through the reports on the influence of 'intangible assets' upon organisation value (see p. 56).

There is strong debate around the theoretical coherence of the KBV, with authors calling for further research before it is accepted (e.g. Felin and Hesterley, 2007). However, in terms of the OKM domain it has operational validity, while also responding to the drivers of the Knowledge economy. This said, Spender (1996) cautioned:

> "The Resource-Based and Knowledge-Based views are targeted attempts to deconstruct the black box of the economist's production function into some more elemental components and interactions, and until we can identify these we cannot be confident about what is useful to observe over time" (p. 46)

Here Spender introduces the need for OKM models, or diagnostic tools for the coordination of knowledge resources, to identify the constructs that organise within these systems (see p. 75 for further discussion on this). My findings in this research directly respond to this need.

The RBV gives currency to the view of knowledge as a tangible asset (the technical end of the KEn Diagram, see p. 26), while the KBV embraces the wider domain, giving currency to social processes (the managerial end of the KEn Diagram) and knowledge as a discrete, intangible asset. Beyond this, if organisations are to move from the Resource-Based View of the organisation towards a Knowledge-Based View then an exploration of the links between intangible and tangible value is needed. In this way it may be possible to link the management of knowledge resources to the market value of the organisation, though I note that for not-for-profit organisations this would be a difficult value measure for success. It is possible though, at least in theory; for example, the Balanced Scorecard was designed for commercial organisations, but is widely used in not-for-profit and non-government organisations.

3.5 Links between tangible and intangible value

The value of knowledge resources across the KEn Diagram (see p. 26) becomes more difficult to assess as the view moves from object (technical, for example, patents) to process (managerial, for example, CoP (see p. 33)), as it is specific to time, context and the perception of what it is that constitutes a knowledge asset (Leonard, 1999).

Chen and Huang (2007) explored links between intangible and tangible value, suggesting a chain relationship between organisational market value, social capital, socialisation, process and culture. This correlates with the views of Diakoulakis *et al.* (2004), who highlighted links between Intellectual Capital and the market value of organisations through a generic Intellectual Capital model (adopted in this research for its comprehensiveness and interpreted in Figure 4, p. 56). Leonard (1999) warned that the assessment of knowledge resources often takes into account their existence, but overlooks the complexity and intangibility associated with their management, the influence of which could impact future viability and value; this is recognised by Diakoulakis *et al.* (2004) through 'process capital' (Figure 4). Regardless, human intellect and character is still difficult to measure, hindering organisations from ascertaining the true value of their workers (Donkin, 2002). Goodyear and Zenios (2007) cautioned that not all knowledge resources create positive value; for if knowledge is ill-founded it can have a negative effect, such as bankruptcy or litigation for improper practice. This introduces the need for feedback processes in OKM systems, as a form of reflection or quality assurance, which is noted in my findings (see p. 156).

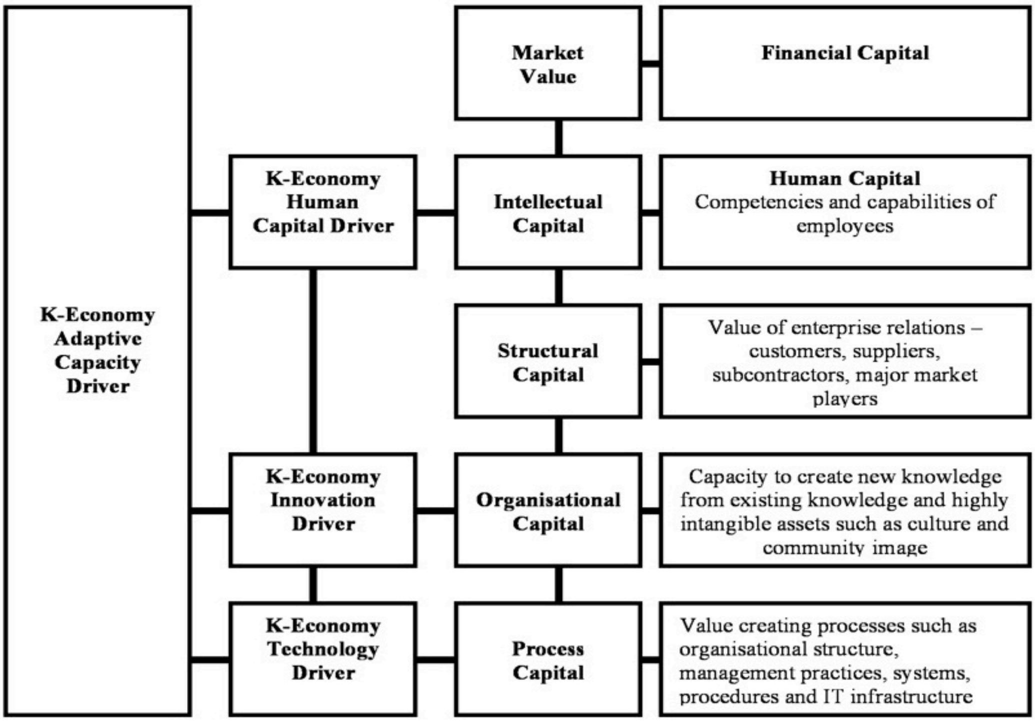


Figure 4: Alignment between Knowledge Economy drivers and market value of the organisation (Griffiths, 2011 informed by Diakoulakis *et al.*, 2004)

Figure 4 synthesises the discussion and illustrates how the Knowledge Economy influences intangible OKM processes and how they can contribute to the market value of an organisation. This model could have limited application within government or third sector organisations. However, policy-makers and managers in these contexts still require an awareness of the value associated with intangible processes. Therefore, it is posited that this model will have merit regardless of economic or industry sector.

3.6 The enduring need for knowledge as a resource

To overcome the uncertainty set out in Chapter 1, around OKM as a management tool, there is a need to explore the history of knowledge as an organisational commodity. In this way it might be possible to demonstrate that OKM systems are a response to an enduring need, thereby reassuring organisations that OKM is not a fad and worth the investment of time and money.

3.6.1 The historical perspective[2]

> "The shallowness of KM's understandings of the traditions that it came from, and its lack of recognition of continuing near relatives in the challenges of working with knowledge [are contributing to malaise in KM]. To forget our past is also to forget what made us who we are today" (Lambe, 2011, p. 196)

The following descriptive literature review emerged from the same position as that held by Lambe (2011), above, where existing literature did not adequately convey the origins of societal or organisational interest in knowledge as a resource. To facilitate the review it was necessary to explore literature prior to 1980, the decade widely credited with the advent of OKM (see p. 21). A literature search was conducted in February and March 2009 utilising JSTOR, Emerald and Business Source Premier databases, using the keyword 'knowledge' in an article title search. The interest was in literature discussing knowledge, as opposed to information, as an organisational resource, and where it was seen as providing a contribution to the value, tangible or intangible, of services or products produced by the organisation. Table 3.3 (p. 58) provides an overview of findings; it is noted that these are limited to publications available in electronic format, which does restrict the scope of the findings.

Literature was screened to exclude the following: Popular article titles from around the turn of the twentieth century that included the phrase: "A contribution to the knowledge on…"; Harvard Law Review articles involving points of law; and psychology articles investigating the cognitive foundations of knowledge.

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[2] Aspects of this section were published in Griffiths and Koukpaki (2010). Subsequent to this Lambe (2011) has published similar, but more limited, findings, which has allowed for comparison of the data through triangulation of analysts (triangulation methods areis discussed in the Chapter 5).

Author	Year	Aspect
Marshall	***1890***	Knowledge as a part of capital and an engine of production
The Lancet	***1908***	The need for knowledge sharing in medicine
Nutting	***1918***	Knowledge as a national resource
Fisher	***1933***	Tertiary stage of development – emphasis on knowledge-based goods and services
Williams	***1931***	Knowledge collection and creation through problem-solving in education
Barnard	***1938***	Need for organisations to create and disseminate knowledge
The Science Newsletter	***1940***	Knowledge as a resource for competitive advantage
Lusty	***1942***	Industrial Efficiency Engineers
Bush ASLIB	***1945*** ***1952***	The knowledge explosion
Drucker	***1959***	Productive work involves work based on the mind
Machlup	***1962***	The production and distribution of knowledge
Carter	***1967***	Government involvement in the development and conservation of knowledge
Maxwell	***1968***	Information storage and retrieval
Havelock *et al.*	***1969***	Science Of Knowledge Utilisation
Farradance	***1970***	Importance of knowledge creation through education
Duncan	***1972***	Knowledge flow in organisations
Bell	***1973***	Knowledge usurping capital in organisations
Henry Gates *et al.*	***1974*** ***1975***	KM appears as a term in papers on Public Administration
Freeman	***1977***	KM in Marine and Environmental sciences
Hillman	***1977***	KM in Computer Sciences
Mokyr	***2005***	Evidence of knowledge as a resource through technological advances during the First and Second Industrial Revolution – linked via our research to surge in new universities

Table 3.2: Summary of exploratory research into the history of literature on knowledge as an organisational resource

3.6.2 Historical literature review findings

Mokyr (2002) links knowledge to advancements in technology, suggesting surges in technology development to be representative of a developing Knowledge economy. Mokyr believes this to be evidenced in the technological achievements of the First and Second Industrial Revolution: “The Industrial Revolution…constitutes a stage in which the weight of the knowledge-induced component of economic growth increased markedly” (p.30). Authors from the period of the First Industrial revolution support this, where Marshall (1890) stated that knowledge contributed to capital value and was a significant engine for output.

In the publications accessed, one of the first mentions of knowledge as an organisational resource was in 1908, when The Lancet published “The diffusion of medical knowledge”, extolling the virtues of knowledge sharing within the field of medicine and health. Moving forward, in 1918 (Nutting) knowledge was discussed as a resource in North America.

> “The greatest problem for any nation is that of developing its resources to the utmost. The solution of this problem involves a thorough knowledge of all resources – natural, intellectual, manual and financial – and thorough knowledge of all means of making the most of them” (p. 406)

Fisher (1933) then observed industry to be moving toward an emphasis on knowledge-based goods and services over traditional manufacturing and production. During the same period Barnard (1938) argued the need for organisations to create and disseminate knowledge. Knowledge was also being discussed as a resource in the education sector, with authors alerting practitioners to the value of knowledge collection and creation through problem-solving in higher education (Williams, 1931).

Periods of war brought knowledge to the fore of societal competitive advantage (The Science Newsletter, 1940):

> “Primarily we need proved weapons, men, planes and ships to make America safe from attack….Back of these defence lines lies knowledge, organised and implemented by the searchings of human minds and hands” (p. 47)

This period also introduced ‘Industrial Efficiency Engineers’, who appear to be an early incarnation of the modern Knowledge Manager (Lusty, 1942). These were specialists who could critically manage knowledge to bring about:

> “…An organisation, so arranged that the results of all its efforts are recorded and analysed. The lessons to be learned and the experience to be gained are thus made as much as a company’s asset as more tangible things, and can be used in the direction of future undertakings” (p. 201)

Later, Drucker (1959) stated, “Productive work in today’s society and economy is work that applies vision, knowledge and concepts – Work that is based on the mind rather than the hand” (p. 120). Havelock *et al.* (1968) then described a ‘knowledge explosion' in industry, stimulated by the post war recovery of Britain (Bush, 1945; ASLIB, 1952). This brought another step towards the modern knowledge manager, through the, "science of knowledge utilisation", which focused on the need to coordinate knowledge that was deemed useful to man (Havelock *et al.* 1968).

Machlup (1962) discussed the economic contribution of knowledge resources in, 'The production and distribution of knowledge in the US'. Carter (1968) championed this as, "something with which the Federal Government must be vitally concerned…[as] it needs to guide the overall development and conservation of such an asset [knowledge]" (p. 13). Maxwell (1968) put forward the importance of technology for Information Storage and Retrieval, in perhaps the first example of technology acting as a management tool for the coordination of knowledge resources. Duncan (1972) took this further through a discussion on business process flows in organisations: "The knowledge flow system in management and organisation includes all resource and user subsystems involved in development and application of meaningful management knowledge" (p. 274).

As far as I have been able to ascertain, the term Knowledge Management first appeared in 1974, through discourse on Public Administration (Henry), "By Knowledge Management, I mean public policy for the production, dissemination, and use of information as it applies to public policy formulation" (p. 189). Around this time authors began to suggest that knowledge was usurping capital in the battle for power within organisations (Bell, 1973). In 1977 (Freeman) KM appeared in discussions on marine and environmental science and it was again being discussed in the field of computer science in 1977 (Hillman).

These findings demonstrate that the economic value of knowledge as a resource has been recognised and consideration given to its coordination for well over 250 years. It also demonstrates that the management function has adapted to the shifting needs of the environment, for example the suggested emergence of KM from Industrial Efficiency Engineers. It is therefore fair to assert that discussions around the management of organisational knowledge resources being a 'fad' or immature are incorrect, though perhaps it is the very term ‘Knowledge Management’ that is the problem.

3.7 KM: A poor term?

Accepting knowledge as an economic resource leads to discussion of its management. Drucker (2007) described this as, “the directed, focused, united effort, of free human beings…” (p. 11). This brings thought to OKM as the coordinating mechanism, a concept that has often been declared as flawed in its conception (Snowden, 2010).

There is no agreement on the origins of today’s notion of OKM. Many credit Drucker (1988), citing his article ‘The coming of the new organisation’ (Spender and Marr, 2005); some credit Karl-Erik Sveiby (Wilson, 2002); others credit Fritz Machlup (Mingers, 2008); and some Robert Buckman (Angus, 2003). Henry (1974) does not appear in these discussions, though he did use the term before any of these authors (see p. 58). This is concerning as it indicates a potential lack of depth of enquiry within OKM literature, which could deprive organisations of the opportunity to understand the history of the concept and the transferable lessons learned during earlier stages of OKM system development.

Of course, Knowledge Management is itself still contentious, with many suggesting that it is not possible to manage knowledge as a commodifiable resource, a view supported by such as Drucker and Sveiby; the latter quoted as saying, “I don’t believe knowledge can be managed” (cited in Wilson, 2002, p. 2) and Drucker (Cited in Wilson, 2002, p. 2), “[scoffing] at the notion of KM. ‘You can’t manage knowledge,’ he says”. Some attempt to diffuse this argument by positing that, “you cannot manage knowledge like you cannot manage love, patriotism or your children, but you can set up an environment where knowledge evolves” (Prusak, cited in Schutt, 2003, p. 45). This thesis aligns with this latter position, as it moves OKM away from the sensitivity around managing cognitive knowledge flows within the person towards business process flows, which can be managed.

Fundamentally the divergence of opinion is based on whether the organisation is setting out to manage knowledge within people or to manage knowledge resources by regulating the organisational environment? If the organisational strategy subscribes to the view of knowledge as an object then organisations could be excused for arguing that they are actually managing knowledge – though this thesis has already presented an argument that this responds to only one aspect of the KEn Diagram (see p. 26) and misses the value of managerial knowledge and its contribution to market value.

Focusing on the externalisation of knowledge through the creation of objects or social processes is nevertheless still problematic:

> "'Representations within the brain'…and the knowledge "this is how you do that" is twice removed from the audience: First by the ability of the knower to map what he does into his own brain, and then by his ability to cast it in a language common with the audience" (Mokyr, 2002, p. 11)

While a valid consideration for aspects of OKM systems, such as lessons learned (see the NASA case example, p. 29), this returns the discussion to the notion of managing the environment, as opposed to the knowledge itself, which is certainly more appropriate as the knowledge resource view moves between the tacit (managerial knowledge resources) and the explicit (technical knowledge resources) within the KEn Diagram (see p. 26).

The internal organisation knowledge environment has been positioned as comprising the complicated and the complex (Diagram 1, p. 26), requiring the coordination of individual cognitive experiences, which are influenced by personally situated reflections, perceptions and interpretations balanced against a sense of time and place, in which experiential practice exists as the cornerstone for the process (Nonaka and Toyama, 2007). While previous discussion (see p. 40) cannot provide agreement for the author's assertion as to the position of wider literature in the consideration of knowledge definition, Rahe (2009) emphasised the difficulty of coordinating these individual cognitive experiences:

> "In the literature, knowledge is defined as the result of a process which combines ideas, rules, procedures and information…The outcome of this

> process is based on reasoning and understanding and therefore made by the mind, whereby the process itself reflects information through experience, learning and introspection" (p. 105)

Therefore, what is being put forward is that the management of organisational knowledge resources requires an understanding of the constructs that organise within the scope of an OKM system, as suggested earlier by Spender (1996) (see p. 54). Only then is it possible to regulate the internal environment of the organisation to develop knowledge resources for competitive advantage. It is through this lens of OKM existing as a mechanism to regulate the organisation's internal environment that it becomes possible to overcome the argument as to whether 'Knowledge Management' can actually manage knowledge in an organisation.

In conclusion, theorists have stated their objection to 'Knowledge Management' as a term and yet widely apply it in their research (Prusak, cited in Schutt, 2003). This includes Svieby, who stated, "KM is a poor term, but we are stuck with it, I suppose" (cited in Wilson, 2002, p. 2). The chronology of OKM literature (see p. 57) suggests 'we are stuck with it', at least until a critical mass of dissatisfaction brings about a shift towards a more suitable title, as with the move away from the concept of Industrial Efficiency Engineers (see p. 59). This directs researchers to accept Knowledge Management or, in the case of this research, Organisational Knowledge Management, as the term for the coordination of knowledge resources, with the understanding that it is focused on the management of the organisation's internal environment as set out in the KEn Diagram (see p. 26).

3.8 Theoretical foundations of OKM

> "KM has ended up very much like the English language, borrowing vocabularies, concepts, models and approaches from other disciplines. Unlike the English language it has not built a distinctive identity and literature of its own. There is in KM very little sense of overall coherence, integration or common agenda. The consequence is a chronic sense of malaise, uncertainty and confusion in the field" (Lambe, 2011, p. 191)

OKM involves a complex web of theoretical ideas, which inhibit the development of a unified strategy for the field (Lambe, 2011). Research into 658 OKM publications between 1995 and 2006 demonstrated that the field has expanded from social science to encompass six key disciplines: Business and Management; Medicine and Health; Computer Sciences; Decision Science; Engineering; and Social Sciences (Mekhilef and Flock, 2006). These are broad disciplines, with a weakness being the assignment of particular sectors or jobs to the categories; for example, where would an agricultural business be placed in this categorisation? This acknowledged, Mekhilef & Flock (2006) do provide a useful lens through which to better understand the origins and challenges facing the field today. The scope and scale of their enquiry, and subsequent categorisation of KM disciplines is rare in OKM literature and provides a useful framework for further research. Therefore, limitations accepted, this thesis will use their categorisation of KM disciplines as a working platform for enquiry.

Kakabadse *et al.* (2003) suggested KM to be influenced by eight worldviews: cognitive (understanding knowledge workers), philosophy (definition of knowledge), community of practice, network, social science (understanding motivation, culture and environment), management science (efficiency and effectiveness of operations against situated need), information science (building knowledge-related capabilities), knowledge engineering (acquisition and storage), artificial intelligence (automating routine knowledge-intensive work) and economics (prioritisation of need).

Kakabadse *et al.* (2003) further introduce five broad schools for KM, providing insight into the convergence and divergence of the object and process views of knowledge: Cognitive, Philosophy, Network, Community of Practice and Quantum.

> **The *Philosophy* school** examines doubt as an instinct that enables questions, which leads to knowledge generation; it also reinforces the idea, introduced earlier, that knowledge cannot exist outside the body human, as it is tacit in nature and forms the building blocks of all knowledge development processes: "All knowledge is either tacit or rooted in tacit knowledge" (Polanyi, cited in Kakabadse *et al.* 2003 p. 81).

The *Cognitive* school of thought opposes this tenet, believing that it is the existing explicit knowledge that provides the building blocks for the development of tacit knowledge (an example of this can be found in Action Learning (Revans, 1980 (see p. 86)), where existing propositional knowledge is challenged through enquiry, to bring about learning and new knowledge).

The *Philosophy* school centres on the individual and the interaction with the group or organisation, which is in common with the *cognitive* school. However, unlike the *cognitive* school, which promotes technology to regenerate and codify knowledge, it does not embrace technology; instead focusing on a search for what is termed “higher knowledge”. The *Cognitive* and *Philosophy* models examine self-similar ideas, such as objectives, type and source of knowledge. However they diverge in that the *Philosophy* school of thought looks at how knowledge links with other human instincts, such as certainty, belief, causation and doubt.

***Community of Practice* and *Network* schools** of thought build on the *philosophy* school by amplifying the need for social interaction, with structural and cultural development being seen as essential to successfully acquire and co-ordinate knowledge.

The *Quantum* school is the antithesis of the *Philosophy* school, entrenching itself in technology. Applying quantum physics theories and IT solutions it develops scenario algorithms to determine the decision-making outcome. It examines the interface between human and digital resources and shares elements with the *Philosophy* school, in that it works to become an instrument of wisdom in the organisation’s social architecture.

This demonstrates how theorists such as Lambe (2011) could formulate the opinion that the field lacks sense or overall coherence. However, with OKM being charged with the management of internal organisational knowledge resources, and those resources taking the form of objects (databases) and processes (people-based social activity, such as CoP (see p. 33)), and varying degrees of the tacit and the explicit between those domains, then practitioners and academics have to be comfortable with a level of ‘fuzziness’ when discussing the field.

While this provides a contribution to the knowledge and understanding of the theoretical influences upon OKM systems, it is the definition of OKM itself that is of interest. If there is a lack of coherence (Lambe, 2011) then it is to be expected that this will impact a definition in relation to OKM’s purpose in an organisation, which, in turn, would impact the way in which the scope of the system’s activity is interpreted.

3.9 Towards a definition of OKM

An agreed *evidence-based* (see footnote 1, p. 22) definition of purpose for OKM as a management tool does not exist; it also seems that, to date, research has not been conducted to addresses this challenge. What is offered in literature is often situated in a specific time or place, which is unsatisfactory as this can create barriers to the transfer of lessons from systems development across sectors.

The findings in this thesis claim that it is not possible to begin to discuss OKM as a general management tool unless common functions that fall within the scope of that tool can be surfaced and agreed upon; evidence of commonality is needed in order to provide the platform for a discussion around a transferable definition of purpose. The position presented in my findings in this research is that there is adequate evidence of this common ground (Chapter 6, see p. 229). This can also be observed in wider discussion in OKM literature around tacit and explicit or object and process based knowledge resources; it is also evident in the case examples discussed at the outset of this Chapter (see p. 28-35). These are the indicators of commonality that researchers need to explore further and to which this research responds.

This is also demonstrated in the sample of definitions below, all of which discuss the ‘development’ or ‘creation’ of knowledge; though the overall definitions exist in stark contrast to the evidence-based definition of purpose for OKM systems presented in this research (see p. 192):

> "…The discipline of creating a thriving work and learning environment that fosters the continuous *creation*, aggregation, use and re-use of both organisational and personal knowledge in the pursuit of new business value" (Cross, 1998, p. 11)
>
> "…The way that organisations function, communicate, analyse situations, come up with novel solutions to problems and *develop* new ways of doing business. It can also involve issues of culture, custom, values and skills as well as relationships with suppliers and customers" (Iftikhar *et al.*, 2003, p. 57)
>
> "…A framework that builds on past experiences and creates new mechanisms for exchanging and *developing* Knowledge" (Kakabadse *et al.,* 2003, p. 78)
>
> "…The exploitation and *development* of the knowledge assets of an organisation with a view to furthering the organisation's objectives. The knowledge to be managed includes both explicit, documented knowledge, and tacit, subjective knowledge" (Metaxiotis *et al.,* 2005, p. 9)

Ultimately the concern is not so much around the variety of definitions, but that researchers appear content to provide definitions that lack an adequate evidence base (a position that lies at the heart of this thesis and one that is further explored later in this Chapter, see p. 97-101). This means that researchers could be missing vital functions that fall within the scope of OKM systems because their body of knowledge, from which they take their definition, lacks sufficient breadth and depth. It could also indicate that authors are not aware of organisational knowledge environment parameters or the constructs that fall within the scope of systems designed to regulate it, as posited by Spender (1996) (p. 54).

What is being put forward is the need to consider whether people are actually speaking of similar things, but using different way to express them, which therefore gives the *appearance* of heterogeneity, or whether there are as many constructs that organise within OKM systems as there are definitions, with the implication being that OKM systems are not generalisable. This is a fundamental question for researchers and one that this thesis responds to (see Chapter 6, p. 209). This is also needed before it is possible to progress a general definition of OKM purpose for system models or diagnostic tools. What also emerges is the need for discussion on systems from the OKM perspective, in order to understand how their scope could influence a definition of purpose. This leads to an exploration of systems thinking.

3.10 OKM as a system

OKM, as a management tool for the coordination of organisational knowledge resources, exists as a system involving constructs that are in a constant state of re-organisation (Alavi and Leidner, 1999; Tiwana, 2000; Cruywagen *et al.,* 2008). A system has various, but similar definitions, for example, "an entity which maintains its existence through the mutual interaction of its parts" (Chun *et al.,* 2008, p. 1). However, the following is selected as it conveys the need to 'organise thoughts about the world', which this research is setting out to do.

> "The concept 'system' is used not to refer to things in the world but to a particular way of organizing our thoughts about the world….second, we consider the notion of 'system' as an organizing concept." (Jackson and Flood, 1991, p 2)

It could be argued that the research contained in this thesis is be embedded within what is termed General Systems Theory, specifically in its consideration of OKM consisting of constructs that interact as part of the system's whole, seeking principles that exist as common, or general, constructs across organisational environments; a view Jackson (2009) credits to Bertalanffy. However, it is also seeking to understand social systems as they relate to managerial or tacit knowledge resources within the KEn Diagram (see p. 26), which takes it into the realms of Soft Systems Thinking. The following briefly describes the systems view in relation to this research.

Bertalanffy (1972) reported on his own work as part of a summary of General Systems Theory from the 1930s onwards, which is initially appealing in terms of the content of this thesis.

> "There exist models, principles and laws that apply to general systems or their subclasses irrespective of their particular kind, the nature of the component elements, and the relations or 'forces' between them" (p. 411)

Bertalanffy was a biologist and this influence is evident in his work on General Systems Theory; for example, autopoiesis and the concept of the organisation as an organism.

> "[Autopoietic systems] are systems that are defined as unities as networks of production of components that (1) recursively, through their interactions, generate and realize the network that produces them; and (2) constitute in the space in which they exist, the boundary" (Maturana, 1981, p. 47)

Autopoiesis is rooted in the theory of systems in cellular life (Luhman, 1995). It has also been used in social sciences to discuss systems in organisations. Here 'life' is extracted from the definition, becoming "a general form of system building…[which retains] general principles of autopoietic organisation which materialise as life, but also in other modes of circularity and self-reproduction" (Luhman, 1986, p. 172). This is a general theory for autopoiesis, one that is not exclusive to living systems (Luhman, 1986), observed as 'Social Autopoiesis' (Luisi, 2003).

Social autopoietic systems are made up of elements or constructs that organise to enable the organisation's output. The organisation itself is not self-contained; it interacts with its environment and in this way is considered to be 'open' (Luhman, 1986). Some organisations are more open than others, but, whether the interface between the organisation and its environment is partially open or fully open, it is argued that the door is nonetheless open. This leads researchers interested in the coordination of organisational knowledge resources to realise that, while the main focus will be on internal business processes, there has to be an acknowledgement of an 'openness' that allows for those processes to interface with the external environment. This is a key factor for consideration when designing models that represent OKM systems and one noted in my findings in this research (see p. 156).

OKM systems are observed in this thesis as encompassing complicated and complex domains (Figure 1, p. 26) with both encompassing human agency (see p. 51). This brought about as an evolution in thinking, where theorists moved away from General Systems Thinking, in terms of 'hard', static, cause and effect or deterministic, systems. This evolved thought towards non-linear, 'soft' driven systems that involved people and social elements, such as system models for society; a shift progressed by C.West Churchman, Russell. L. Ackoff and Peter Checkland (Jackson, 2009). These theorists brought about a shift in thinking from reductionist (complicated) views of the world to soft or social (complex) views, where multiple views of the same system can exist, particularly when considering the involvement of people (see p. 51) or social groups.

> "Attention turns to ensuring sufficient accommodation is achieved between different and sometimes conflicting world views in order that coalitions can be fashioned in support of change" (p. S28)

It is the embrace of multiple worldviews that is of interest to me, in that it allows for views from both the registers of hard (technology or complicated) and soft (people or complex) theory and practice, and multiple views from each, such as differing cultures or sectors, to co-exist within the same space in a mode of duality. This finds currency through Jackson (2009), where, citing the work of Boulding (1956), he outlines the nine levels in the hierarchy of biological complexity (see Table 3.3, p. 71). My findings in this research do not regard the position that social systems allow for the construction of multiple worldviews as being problematic. The findings emanating from my research move to embrace this diversity of views, while also demonstrating that there is commonality in these worldviews that have not been adequately explored or mapped in previous literature (see Chapters 6 and 7). This commonality allows for an easing of the flow of transfer of system design and/or development across sectors and geographic locations and potentially addresses the dissatisfaction being expressed by practitioners.

What Table 3.3 helps to do is tease out hierarchical levels for OKM systems, similar to the biological one, where hard or static systems, for example, databases, can coexist, as part of a hierarchy that moves towards more complex social structures. More recent authors, such as Snowden and Boone (2007) would argue this should not be a hierarchy, but a flow that encompasses simple, complicated, complex and chaotic domains. This argument is beyond the scope of this thesis, but is useful in establishing that systems thinking does allow for hard and soft systems to coexist in the same space, which gives currency to the systems based approach that I use in this research (see p. 125).

1. At level 1 are structures and frameworks which exhibit static behaviour and are studied by verbal or pictorial description in any discipline; an example being crystal structures
2. At level 2 are clockworks which exhibit predetermined motion and are studied by classical natural science; an example being the solar system
3. At level 3 are control mechanisms which exhibit closed-loop control and are studied by cybernetics; an example being a thermostat
4. At level 4 are open systems which exhibit structural self-maintenance and are studied by theories of metabolism; an example being a biological cell
5. At level 5 are lower organisms which have functional parts, exhibit blue-printed growth and reproduction, and are studied by botany; an example being a plant
6. At level 6 are animals which have a brain to guide behaviour, are capable of learning, and are studied by zoology; an example being an elephant
7. At level 7 are people who possess self-consciousness, know that they know, employ symbolic language, and are studied by biology and psychology; an example being any human being
8. At level 8 are socio-cultural systems which are typified by the existence of roles, communications and the transmission of values, and are studied by history, sociology, anthropology and behavioural science; an example being a nation
9. At level 9 are transcendental systems, the home of "inescapable unknowables", and which no scientific discipline can capture; an example being the idea of God

Table 3.3: A summary of Boulding's (1956) Hierarchy of Complexity (cited in Jackson, 2009, p. S28)

Introducing 'complexity' leads towards Complex Adaptive Systems theory, which is itself embedded within autopoiesis (Dooley, 1997). Here the belief is that "Systems can be understood by looking for patterns within their complexity that describe the potential evolutions of the system…control and order are emergent rather than hierarchical" (p. 76). This idea of emerging patterns that lend themselves to producing a better understanding of the system links well with the problems surfaced in this literature review, where the constructs that organise within the scope of OKM systems are currently fuzzy.

Conversely, complicated systems are seen as existing within closed environments, where outcomes can be deconstructed through regression to enable the prediction, management or replication of the process (Radford, 2008). In the complicated view the relationship between variables is known and can be predictably manipulated and controlled to produce an explanation or intended outcome.

> "In complicated systems interaction between elements or variables is generally linear and in manipulating particular variables we can observe the effects of the system and calculate on arriving at an expected result" (Radford, 2008, p. 265)

This leads towards technical or explicit knowledge resources within the KEn Diagram (see p. 26), but does not fit well with the 'open' nature of OKM systems or the knowledge resources at the managerial end of the KEn Diagram (p. 26).

Constructs in the complex domain do not interact in a hierarchical manner; instead they organise around the demands of the environment and are often discrete. Environmental disturbances expose the constructs and allow for their relationships to be surfaced and mapped, but only by exploring the system as a whole, as opposed to its component parts (Dooley, 1997). This is appealing to me and indicates the depth of enquiry that would need to be conducted in order to observe commonalities in patterns that range across OKM systems that will encompass multiple worldviews. This is a challenge, but one that I accept, as set out in Chapters 5 and 6, and reinforces the need for robustness when considering an evidence-based approach to OKM (see footnote 1, p. 22).

Organisations may be regarded as Complex Adaptive Systems, in that they are semi-autonomous systems, which are governed by interconnected components that have to be seen as a whole, and not treated in isolation. This is due to their complex nature, where cause and effect cannot always be determined as processes experience states of order and disorder (Spender, 1996). Spender suggests that four questions must be asked of such organisational systems, "Scope, Approach, Optic, and Modality" (p. 56): 'Scope' defines the boundary of the process; 'Approach' outlines the interaction of system variables; 'Optic' defines the underpinning epistemology that informs the system; 'Modality', "refers to the shaping of the approach, what constitutes progress towards the objective embedded in the scope" (p. 56). I have an interest in establishing the 'scope' of OKM as a management system for the coordination of organisational knowledge resources; 'optic' will be explored in the methodology (see Chapter 4); 'approach' is being explored as part of this literature review and the research enquiry (see Chapter 6); and 'modality' is set out in the methods section (see Chapter 5).

The following aims to clarify my position in terms of OKM systems. Complex processes, such as those within the scope of OKM systems (see Figure 1, p. 26) involve open, or partially open, systems and enrol a variety of constructs that organise in a distinctly non-linear manner. The constructs are important to the process, but the outcomes of their interaction cannot be predicted or managed towards a predetermined outcome, they can only be optimised towards an intended goal (Radford, 2008). Complexity means that, "unforeseen elements within the system emerge from interactions between other elements or variables and cannot therefore be taken into account until such interactions have occurred" (Radford, 2008, p. 265). For example, one may argue that the mind is a black box, where the construction and deconstruction of the decision-making process is not transparent to the decision-maker, being, for example, subject to availability bias and the affect heuristic (Kahneman, 2011); it leads to a further fair assumption that it cannot be externalised from the knower through a sequence of linear variables (Loftus and Loftus, 1976). This means that a management process cannot apply a positivistic, reductionist approach to the management of people-based knowledge resources, such as those found in CoP (see ADB example, p. 31-33 and RBV discussion, p. 48-51). Environmental disturbances, or events, cause constructs to organise, such as an organisation's immediate need to innovate. These disturbances allow researchers to identify the constructs and the way in which they organise in a particular time and place. This then allows the researcher to look for self-similarity, or commonality, in the way in which constructs organise across a variety of organisational systems using a meta-analysis or synthesis method. In this way it might be possible to bring about a general definition or purpose statement for OKM systems.

Criticism of systems thinking in the OKM domain emerges from evidence that organisations have focused on the isolated functions, such as developing a database as a knowledge repository, which, when looking at the KEn Diagram (see p. 26), responds to only one aspect of the system, while ignoring the interrelationships that contribute to the whole, such as managerial-centric knowledge capture (Chun *et al.* 2008). Importantly, this can cause complex systems to break down (Pasteur *et al.,* 2006), which is unacceptable when considering the position I am presenting in this research.

This break down in complex systems, as was the case with the NASA LLIS (p. 29), could be predicted if the organisation takes into account the Law of Requisite Variety (Ashby, 1956). Briefly, Ashby (1956) proposed the need to look at the whole, including the wider environment, to understand the cues that require a response from any system designed to regulate it. This understanding of the whole sets out the conditions required for the regulating system to be successful, similar to Spender's (1996) discussion on defining a system's 'scope'. If this understanding does not exist then the regulating system will fail. "If a system is to be stable the number of states of its control mechanism must be greater than or equal to the number of states in the system being controlled" (Ashby 1956, p. 207).

This indicates that the dissatisfaction being exhibited in the KM field is perhaps being brought about by systems that do not have the requisite variety, or identified preconditions (constructs for coordination), within their scope and therefore they fail. For example, the Law of Requisite Variety could be applied to suggest that if an OKM system does not account for human agency (p. 51), people being the activators of knowledge, then the model could fail when operationalised. This gains currency through Griffiths and Moon (2011) (see p. 34) where practitioners, when taking of OKM systems, frequently report dissatisfaction and human resource policy and procedures are often not considered as part of OKM systems; it is also evident in the report into the failure of NASA's LLIS (see p. 29).

The systems view has been criticised for being a 'Western' view of OKM (Sharif, 2005). Sharif believes 'Eastern' approaches to be founded upon communities of human interaction and this apparently does not conform to a Western systems view, which is seen as being focused on explicit, object-driven, processes instead of people-based social processes. However, the human interaction view is in fact supported by many ‘Western’ authors, such as Pasteur *et al.,* (2006), who observe knowledge resources as being developed through situated human interaction, which negates the East/West bias posited by Sharif. In the case of my research, systems thinking is being applied to consider both the object and human interaction view (see Figure 1, p. 26) and therefore these concerns are not relevant.

Systems thinking has also been criticised for overcomplicating what will happen spontaneously (Dawn *et al.,* 2002), the argument being that learning in organisations will take place without intervention. However, this thesis is focused on an approach to the development of OKM systems that address the coordination of organisational knowledge resources for competitive advantage and there is a need to understand the natural process in order to expedite the organisation of the constructs, especially given the demands of the modern Knowledge economy (see p. 50).

Finally, the terminology used when discussing OKM systems is important. Specifically, it is popular to use the term ‘variables’ over ‘constructs’ in literature, which is not always appropriate. "Constructs may be defined as terms which, though not observable either directly or indirectly, may be applied or defined as the basis of the observables, something qualitative in nature” (Kaplan, cited in Bacharach, 1989, p. 497). Bacharach (1989) defined a variable as something quantitative, "an observable entity, which is capable of assuming two or more values. So, for example, "performance" is a construct for which "sales" or "return on investment" is the variable” (p. 498). Given the non-linearity of OKM systems, as they respond to the complex domain within the KEn Diagram (see p. 26), it is more appropriate to discuss their components in terms of constructs as opposed to variables, which are specific to the ordered domain, a differentiation that is often not noted in OKM literature.

3.11 OKM system constructs

Discussion of OKM systems is subject to a lack of agreement on language, which continues to create difficulties in communicating the concept (Paulin & Suneson, 2012). Accepting this, academics and practitioners have worked to identify the functions and constructs of OKM systems, often referred to as Critical Success Factors (CSFs), for over twenty-five years; for example the work of Qureshi *et al.* (2006), Supyuenyong and Islam (2006) and Conlley and Zheng, (2009). However findings have often varied according to the situated world-view of the author, which is frequently left unclear; this serves to increase the granularity of the research. Also, the research presented in this thesis puts forward a position where the term CSF does not seem appropriate, for if OKM systems move between complicated and complex domains then the intensity of any given CSF will vary according to how factors organise around specific environmental disturbances. The term 'critical' is therefore variable according to time and place and has limited use when discussing transferable findings outside of a specific domain.

In mapping OKM system constructs there are broad points of divergence and convergence. There are concerns that much of the research presented in this Chapter lacks the breadth and depth of enquiry to develop credible and trustworthy evidence for commonality in practice, as will be discussed later (p. 99), which could act as a barrier to its transference. These limitations are evident when contrasted with the methods used to develop the findings in my research, described in Chapter 5.

However the body of literature presented here provides an interesting point of departure for the later discussion as to what falls within the scope of OKM systems. For example, Qureshi *et al.* (2006) conducted research between 1997 and 1999 to suggest five OKM process functions: create; collect; organise; deliver; and use knowledge. Their synthesis of the literature is limited, incorporating only 6 studies dominated by Northern hemisphere literature. However, criticism aside, they do signpost a basic definition for OKM systems, being five functions that are common in other areas of literature: *Creation, collection, organisation, delivery and use.*

Qureshi *et al's* (2006) work is similar to that carried out by Supyuenyong and Islam (2006), which originated in Thailand and encompassed a more extensive, but still limited, synthesis of 12 studies with a global perspective. Their review proposed four 'sub-processes' or functions for OKM: knowledge creation and acquisition;

organisation and retention; dissemination; and utilisation. They extended Qureshi *et al.*'s work through the addition of 'retention', which could also be defined as 'storage'. This exposes a lack of agreement in literature from the same time period and potentially confirms weaknesses in research, where outputs are lacking completeness, perhaps caused by insufficient breadth and depth in the original research. The research in this thesis also noted that it is not common for these types of studies to synthesise research on a large scale, which should help to lower the level of granularity of findings when it comes to identifying commonalities in systems that could improve the transfer of practice. The research methods presented in Chapter 5 were selected to address this.

Moving discussion forward, Gupta (2000) utilised a singular narrative approach to suggest five key steps for OKM systems: generation, sharing, adaption, application; and modification. Gupta's work is limited due to the absence of 'storing and gathering', again highlighting the lack of agreement within the wider body of literature. Gupta defined 'modification' as the generation of new knowledge, but redundancy occurs in his explanation, where he failed to differentiate between '*knowledge modification'* and *'knowledge generation'*. This lack of coherence and awareness of other research, demonstrates low levels of *know what* in OKM literature, which critically impacts the transmission and development of *know how*. If the, *what* is not clearly identified then it cannot be possible to understand the *how*, when it comes to designing effective systems or their diagnostics.

These examples demonstrate convergence and divergence in OKM literature, when discussing system constructs. I argue that this is due, in part, to the limited breadth and depth of research being conducted (see p. 99) and prompts the need for a deeper enquiry into the core constructs that organise within the scope of OKM systems to determine whether there is commonality across sectors or geographic locations. A lack of breadth and depth in research is unacceptable as it limits findings and creates the potential for fads, which can then be amplified through personalised languages that protect and monetise a researcher's or consultant's knowledge and understanding of the field (Fulop and Rifkin, 1999).

> "The language and jargon they [consultants] extol can be used to establish expertise, to impress, to influence, to exclude, to baffle, to establish ('expert') status or to cover up ignorance or fear" (p. 35)

The following examples are introduced to exemplify the variety of themes used to discuss constructs that organise within the scope of OKM systems and demonstrates the challenge facing organisations as they attempt to decipher the constructs within the scope of their own OKM systems. It represents the work of academics and practitioners, and encompasses published peer-reviewed articles, PowerPoint presentations, white papers and a research blog, the findings of which stand in sharp contrast to my findings in this research (see Chapter 6). It is not the intention to explore a specific author's meaning in their labelling of a theme (for example, 'culture'), which is often not possible as it is not clear in the literature itself, merely to report on the constructs that are identified by others as 'critical' to the design and development of OKM systems. This working approach seems reasonable, as all authors are discussing the management of knowledge in an organisational setting. The findings of all the authors are first described and then followed by a critical discussion (see p. 80).

Jennex and Zakharova (2005) synthesised 15 CSF studies, totalling 78 case studies and 100 organisational surveys, originating mainly from North America in the late 1990s (www.management.com.ua):

- Integrated technical infrastructure
- A knowledge strategy that identifies users experience
- A common enterprise wide knowledge structure
- Motivation and commitment of users including incentives and training
- Organisational culture
- Senior management support, including resources
- Measures to assess the impacts of the KM System
- Clear goals and purpose of the KM System
- Learning organisation
- Search retrieval and visualisation function of KM System, support knowledge use
- Work processes including knowledge capture and use
- Security an protection of knowledge

Hariharun (2005) listed 15 factors, based on personal experience, that evolved from only 4 factors identified in Hariharun (2002); of interest, 'Process', which appeared in Hariharun (2002) was omitted without explanation in Hariharun (2005):

- High expectations
- Top management support
- KM focus on critical business processes
- Start small and grow
- Focus on top business priorities
- Measure impact
- Knowledge sharing
- Sharing culture
- Time to promote collaboration
- Technology as an enabler
- Access to all structured and unstructured internal and external knowledge
- Replicate and innovate
- People
- Align performance appraisal with KM objectives
- Invest in KM specialists

The International Institute for Sustainable Development suggested 8 factors (Creech, 2005, www.iisd.org):

- A stated rationale for knowledge initiatives
- KM efforts connected to both mission and operations
- Setting objectives at the right level
- Understanding the basic components of KM
- Working with combinations of strategies
- Define roles and responsibilities
- Progress based on experimentation
- Planning for sustainability of knowledge mobilisation processes

Chowdhury and Ahmed (2005), surveyed 4 oil companies as part of a Malaysian KM study and identified the following factors (www.kmtalk.net):

- Leadership: Top Management – Role – Policy
- Technology: Collaboration technology – expert directory – databases
- Organisation: Organisational structure – Unit/team coordination – recognition for sharing
- Organisational learning: CoP – Formal/informal network – Education/Training

Hasanali (2002, p. 5) provided a narrative that suggested 5 factors:

- Leadership
- Culture
- Structure, roles and responsibilities

- Information technology infrastructure
- Measurement

Curve Consulting, presenting to the legal field, suggested in excess of 20 variables, with the following seeming to be the main issues (Rusanow, 2001, www.curveconsulting.com):

- Understand your market
- Understand your business objectives
- Define purpose
- Develop a KM strategy that aligns with your business objectives
- Articulate purpose of KM
- Define scope of KM
- Identify cultural issues impacting KM
- Create a KM organisation
- Develop a technology platform to facilitate KM

Azmi and Zairi (2005) provided a synthesis of 15 authors published between 1996 and 2001, predominantly from the Northern Hemisphere, to suggest 9 critical success factors (p. 7):

- Training
- Sharing
- Culture
- Transferring
- Top-Management Support
- Technology Infrastructure
- Creating
- Knowledge Strategy
- Knowledge Infrastructure

Azmi and Zairi's (2005) position is interesting, in that it suggests that *storing, gathering* and *application* are not critical to an OKM system, which are often represented in other literature (see p. 76). This is not unusual, as is evident in the comparison of Qureshi *et al.* (2005), Supyuenyong and Islam (2006) (see p. 76) and Jennex and Zakharova (2005). It is difficult to identify *applying, sharing, storing and gathering*, or *developing knowledge*, within the work of Jennex and Zakharova (2005), all of which are supported in my research as preconditions for successful OKM systems (see Chapter 6), as they are also in the work of Qureshi *et al.* (2005) and Supyuenyong and Islam (2006). This highlights the inconsistency that exists in the highly contextual single worldview of some practitioners and academics, and which is compounded where the underpinning assumptions of these authors are not made clear. These issues are acknowledged and addressed in this research through the methodology and methods used (see Chapters 4 and 5).

In another demonstration, Chowdhury and Ahmed (2005) called for CSFs to include 'collaboration technology', 'Community of Practice' and 'reward for sharing', but they do not believe 'gathering', 'creation' and 'sharing' to be factors for success. It could be argued that such factors are taken for granted, with authors not finding the need to identify them. However, this is unwise, as, given the demand on OKM systems as they negotiate elements of the complicated and the complex across the KEn Diagram (Figure 1, p. 26), it will not always be clear which will be the 'intense' or limiting constructs as they emerge and organise around changing disturbances in the environment.

Another point with Azmi and Zairi's (2005) research is that 'Training' is identified as a CSF and yet it is not clear against which construct that training should be conducted or even what training means. Training was only identified in 6 of the 15 (40%) academic articles reviewed by Azmi and Zairi and yet they considered it to be a CSF, suggesting that what researchers considered 'critical' within OKM systems can sometimes be lacking in credibility. In another example, a KM practitioner and doctoral student at Deloitte debated 46 unspecified, not being named in the discussion, factors from literature and a further 83 unspecified factors from survey research, giving a total of 129 CSFs (www.curtisconley.com). This thesis argues that the 'criticality' of these constructs could be debated purely on the number of CSFs that have been identified.

In the case of Hariharun (2002, 2005) there is not even agreement between articles or explanation for the change in opinion, which again brings into question the trustworthiness and credibility of the research. Rusanow (2001) illustrates how literature can contribute to redundancy and confusion, in stating one CSF to be 'create a KM organisation', when I would argue this to be an ambiguous, without supporting information for what a 'KM organisation' is or how one is created.

This sample, acknowledging the potential for researcher bias, demonstrates a lack of clarity, diversity of opinion in the literature and a gap that needs to be addressed; a gap which organisations need to have awareness of when designing OKM systems.

This is emphasised by Heisig (2009), who, in research encompassing 119 models and frameworks, failed to identify a consensus of OKM system CSFs. He noted that OKM models failed to identify a holistic method for the management of knowledge, echoing Spender's position thirteen years earlier (see p. 54), demonstrating that the issue still needs to be addressed by researchers.

> "In the literature broad consent prevails over the fact that the one-sided emphasis on one of the factors does not correspond to what is generally considered to constitute a holistic KM effort. The task of KM is to manage these factors as a whole in such a manner that the knowledge-referred activities and processes can be fulfilled as optimally as possible" (Heisig, 2009, p. 12)

Holsapple and Joshi (1999) stated, "There is not a common standard way of characterising knowledge manipulation activities….there is not a common standard way of characterising influences on the conduct of KM" (p. 7), demonstrating how long this has been an issue. Mekhilef and Flock (2006) confirm this; reporting on their meta-analysis of 658 academic papers, they failed to find a single common theory that bridged their six key KM disciplines, cited earlier (see p. 64). This problem is summarised by Metaxiotis *et al.* (2005), "the main and accepted finding is that a codified, universally accepted framework has not been established for KM" (p. 11). The idea of a 'universally accepted' framework might be ambitious, but the need for researchers to attempt to find commonalities in OKM systems is a persistent one, and one that I address (see Chapter 6).

3.12 OKM and Adult Learning Theory

Authors such as Jennex and Olfman (2005) have suggested a link between OKM, Learning Organisations (LO) and Organisational Learning (OL). Debate on the concepts aside, it is the link between learning and knowledge that holds interest for me, in the context of this research.

> "…it is remarkable how seldom learning theory is even referred to in the KM literature" (Spender, 2008, p. 165)

"It is clear that managing behaviour, learning and knowledge cannot be separated from one another" (Edwards and Rees, 2006, p. 167). This is a position supported in this thesis, where it is argued that learning contributes to the knowledge creation process, intangible value and, ultimately, market value in the complex domain of managerial or tacit knowledge resources (see p. 56).

Adult learning in organisations involves a blend of three considerations: the needs of the organisation, the needs of the individual and the processes that bind the two together (Knowles *et al.,* 2005). The approach frames the purpose of learning within the boundary of the organisation; it informs the individual learner's need and the organisation's response to the management of the learning environment. This includes the learner's need to know (what, why, how); self-concept (autonomous or self-directing); prior experience (resource, mental models); readiness to learn (life-related or developmental task); orientation to learning (problem-centred or contextual); and motivation to learn (intrinsic value or personal payoff) (Knowles *et al.* 2005, p. 5).

While an in-depth review of adult learning theory is beyond the scope of this thesis, there is benefit in understanding the way in which learning processes could influence OKM system design and development through the alignment of the above stated needs of the individual and the organisation. Swanson, cited in Knowles *et al.* (2005) demonstrated the way in which learning processes achieve this in organisations through the 'Matrix of enabling questions' (Table 3.4, p. 84).

Performance Variables	Performance Levels		
	Organisational Level	Process Level	Individual Level
Mission/Goal	Does the organisation's mission/goal fit the reality of the economic, political and cultural forces?	Do the process goals enable the organisation to meet organisational and individual missions/goals	Are the professional and personal mission/goals of individual congruent with the organisation's?
System Design	Does the organisational system provide structure and policies supporting the desired performance?	Are processes designed in such a way to work as a system	Do individuals face obstacles that impede their performance?
Capacity	Does the organisation have the leadership, capital, and infrastructure to achieve its mission/goals	Does the process have the capacity to perform (quantity, quality and timeliness)?	Does the individual have the mental, physical, and emotional capacity to perform?
Motivation	Do the policies, culture, and reward systems support the desired performance?	Does the process provide the information and human factors required to maintain it?	Does the individual want to perform no matter what?
Expertise	Does the organisation establish and maintain selection and training [learning and development] policies and resources?	Does the process of developing expertise meet the changing demands of changing processes?	Does the individual have the knowledge, skills and experience to perform?

Table 3.4: Performance diagnosis matrix of enabling questions (Swanson, cited in Knowles *et al,* 2005, p. 168)

Given the link between people, knowledge and learning, this framework is of interest to me as it has the potential to inform the architecture for OKM system diagnostics. A further summary of links between knowledge and learning (Chiva and Alegre, 2005) can be found in Appendix 11.Further to this, there is a need to differentiate learning and training in such a way that the researcher can understand the importance of their differences when discussed as CSFs, as happens in OKM literature (see p. 79-80).

3.12.1 Differentiating Training, Learning and Knowledge

In discussing OKM CSFs authors have identified training or learning as a critical construct (e.g. Azmi and Zairi, 2003; Chowdhury and Ahmed, 2005; Jennex and Zakharova, 2005) (see p. 78-80).

In Azmi and Zairi's (2003) research (see p. 80), 4 of the 6 authors who identified Training as a CSF did not then identify *developing knowledge* as critical function for OKM systems, a position set out earlier as commonly agreed in OKM literature and supported in my findings in this research (see Chapter 6). I argue in this research that if a construct is not identified then it increases the likelihood that it will be omitted from the scope of the OKM system. Perhaps these authors are substituting learning or training for the need to 'create' or 'develop' knowledge within OKM systems. If so, there is still a problem, even with the 4 authors who link training with knowledge creation or development, as will now be explained.

Training is generally accepted to be delivered via a reductionist approach, a mechanism by which components of a process are broken down and explained; placing training within the realms of explicit knowledge transfer (Knowles *et al.,* 2005) or the technical knowledge resource domain within the KEn Diagram (see p. 26). Therefore, if 'training' is given preference over 'learning' as the critical element or descriptor of an OKM system, it could be seen as aligning with the resource-based view of the organisation (see p. 52) and the treatment of knowledge as an object, which does not meet with the knowledge resource needs of the organisation as it moves towards the complex domain. The Danish Research Unit for Industrial Dynamics reinforce this, "KM, especially in sectors with rapid technology change, needs to focus more on the process of learning than on locating and allocating a given set of knowledge assets" (Ludvall, 2007, p. 207).

This contrasts with the concept of learning, which "is any relatively permanent change in behaviour that occurs as a result of experience" (Chowdhury, 2006, p. 1); alternative definitions also exist, "learning is the process of experiencing and analysing, or the process of communicating, the knowledge previously generated by others" (Spender, 1996, p. 48). In this way learning is identified with knowledge-centric processes and knowledge is observed as important to the learning process.

> "The recognition of one's own need to learn, the search for new knowledge, the test of that new knowledge in practical action, and the consolidation of

> the whole exercise within the memory are all essential to complete learning" (Antonacopoulou, 2006, p. 9)

This last contribution is useful as it aligns with the definition of 'knowing', introduced earlier (p. 42). What is significant is the belief that knowledge is something developed through the experience of the person, which, when developing OKM systems requires the organisation to become comfortable with the concept of managing social constructs, as opposed to the technical or explicit view of knowledge objects (Diagram 1, see p. 26); this emerges in organisations through concepts such as CoP (see p. 33).

This section demonstrates that training, taken in isolation, would be problematic and that care should be taken when assessing the scope of OKM systems, as processes need to have the capability to respond to the whole environment, as opposed to being polarised to one particular extreme of the KEn Diagram (see p. 26). As with the discussion on variables and constructs (see p. 75), it also demonstrates that better care needs to be taken by researchers when using terminology to describe the internal organisational responses to the coordination of knowledge resources.

3.12.2 Operationalising learning processes within an OKM system

Support for learning, and the subsequent creation of organisational knowledge resources, needs to be operationalised if it is to fall within the scope of OKM systems. The limitations of this literature review do not allow for a full exploration of approaches, but the following are two examples for consideration.

The first is double loop learning (Argyris and Schon, 1978). Organisations are directed to action through an applied strategy derived from a set of governing variables (the drivers for the applied strategy). The applied strategy will meet with varying degrees of success or failure, requiring the organisation to revisit their applied approach – this is known as single loop learning.

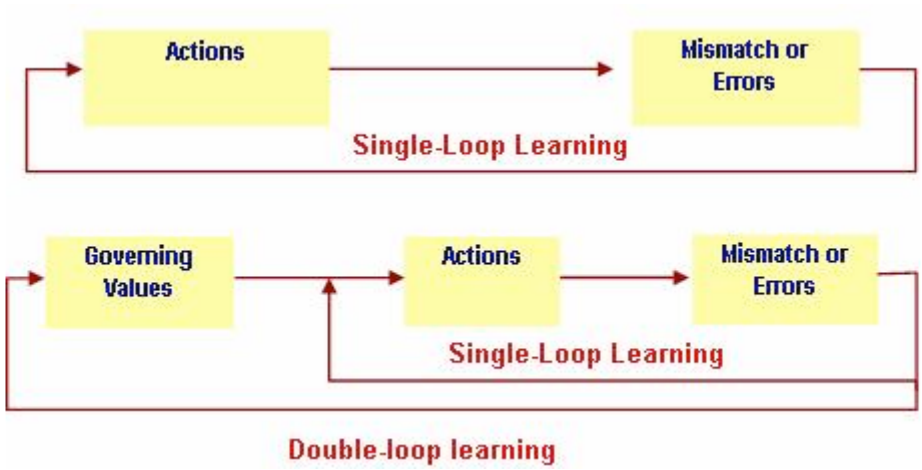

Figure 5: Single and Double Loop Learning adapted from Argyris and Schon (1978)

It is proposed that higher value is gained through double loop learning, a process that revisits the governing variables that drive the applied strategy. In this way the whole process is reflected upon and not just the action in isolation (Argyris and Schon, 1978). Knowledge, as an output of learning, is then generally captured, through, for example, a lessons learned process, which can be shared and stored in a knowledge repository for future access; where the lessons are tested the next time the scenario is being experienced by the organisation, developing knowing, which reignites the process of reflection again. Organisations could focus on capturing lessons learned through a process that only looks at the outcomes of the applied strategy, in which case they would miss the value linked to a reflection upon the original governing variables. This suggests that propositional knowledge provides the foundation for the development of further knowledge and can lead to questioning processes as means to drive learning and knowledge creation. Failure in this area is evident in the NASA LLIS case example (see p. 29), where the cause of the system breakdown could be attributed to a failure to engage in a double loop learning process.

Another example is Action Learning (Revans, 1980). This is a social process, where a problem is presented to a cross-section of stakeholders from the team/department/division/organisation, known as a Learning Set. A facilitator is employed to assist in ensuring a voice for all participants. The group explores an organisational problem; ‘unlearning’ any preconceived ideas they might have as to a predetermined solution, to develop a solution for testing; this is actioned with the group reflecting upon the results to assess degrees of success or failure. ‘Unlearning’ is put forward by Revans as core tenet for the Action Learning process, though it could be debated whether people ever ‘unlearn’ or whether they actually ‘revise’ or ‘reject’ their existing knowledge. This said, ‘unlearning’ is a widely adopted term in Action Learning literature and therefore is accepted in the context of this research.

This method was conceived by Revans (1980), who proposed a simple formula consisting of propositional, or foundational knowledge (P), questioning of this knowledge (Q), which produces learning; expressed as P+Q=L. This has become Q1+P+Q2=L, where Q1 represents the acquisition of appropriate knowledge, which is then redefined by the second questioning process (Q2) (Mumford, 1997). It was furthered again through P+Q+A+R=L, where (A) is action and (R) is reflection (Weinstein, 2002). This insight into the development of existing knowledge is useful to my research in identifying constructs that contribute to the knowledge creation process, which emerges in Chapter 6.

Revans (1980) advocated unlearning as a mechanism to bring about an agnostic approach to learning. This said, and reflecting on the premise that learning needs to meet the needs of the individual and the organisation (Knowles *et al.,* 2005), a question could asked as to what should be unlearned, as well as the value of the knowledge generated through Action Learning events. This is recognised as a potential problem for the research being conducted in this thesis and therefore the following conceptual formula has been adopted as a reflective process to assess the value of what is already known (Hori *et al.,* 2004):

Representational context [artefacts] + Conceptual context [existing in the mind] + Real world context [situated application] = value

These examples demonstrate sub systems that can bring about learning and the subsequent development of knowledge resources in organisations. They also surface potential constructs for consideration within the scope of an OKM system.

If people are the activators and creators of knowledge across the KEn Diagram (see p. 26), as well as being the resources driving organisational value, by producing costly-to-copy advantage (see discussion on the RBV, p. 52), then their learning or knowledge acquisition process must be considered within OKM systems. This confirms Spender's (2008) position that researchers should consider learning theory when discussing OKM systems (see p. 83). This responds to the coordination of knowledge resources across the KEn Diagram, but it becomes more pronounced as the environment moves towards the complex domain. Therefore this thesis accepts knowledge creation and its related social learning constructs as falling within the scope of OKM systems.

3.13 Existing OKM models

A search[3] on popular search engines such as Google Scholar or Bing, for OKM models, relating to the internal coordination of knowledge resources, returned hundreds of alternatives. Predominantly, there are three approaches to the modelling process, though hybrids also exist, and demonstrate the segmented approach to OKM system design.

Value Chain Models, which look at the separate elements to determine if they are effective. Broadly speaking, they develop strategy against internal and external organisational drivers, they inventory knowledge resources and bring focus to the knowledge needed; they then advocate the application and sharing of that knowledge.

Success models, driven by an understanding of the organisation, its needs, the capabilities of its staff and the way in which they use knowledge. These models

[3] This research is not interested in IT programme driven models and only looks into operational KM process models.

focus on OKM strategy development, as well as resource, technological, managerial and environmental influences.

Effectiveness models, which utilise a combination of capability and contingency theory to develop process and infrastructure capability. Heavily influenced by technology models, they usually look at knowledge acquisition, conversion, application and protection (Jennex and Olfman, 2004)

Effectiveness and Success models both attempt to engage with strategy and organisational need, and a blend of these models could bring together the needs of the individual, the organisation (as suggested by Knowles *et al.,* 2005 (Table 3.4, p. 84)) and the constructs that organise within the boundary of the whole, linking to the needs of a complex system (see p. 73). The complex domain requires academics and practitioner to move away from reductionist methods that focus on individual segments, which, depending on the segment, could see constructs omitted from the system model. Where a model focuses on a specific segment of the system it runs the risk of missing the interconnectivity of the whole. For this reason Value Chain models could be problematic in the context of my research, as they appear more suited toward a complicated domain.

The problem surfaced in this literature review is that there is a lack of a common model for OKM systems that has synthesised or analysed commonalities across the six OKM disciplines, or variations of these, put forward by Mekhilef and Flock (2006) (see p. 64). Checkland (2000) offers an explanation, suggesting that where there is a lack of generalised framework, a void, people can produce contextualised versions of the truth to fill the void that could then be difficult to transfer. This is because "interpretations of purpose will always be many and various, there would always be a number of models in play, never simply one model purporting to describe 'what is the case'" (p. s15). I argue that the foundations of a single model already exists for OKM systems through the general acceptance of two common knowledge resource attributes across organisational sectors and geographic locations, that of 'tacit' and 'explicit'; the associated notion of process and product (see p. 43;

and the commonality surfaced in aspects of the OKM literature discussing CSFs (see p. 76-82).

Work has already been conducted into the development of a transferable model for OKM system design, most notably in Europe and Australia: The British Standards Institution (2001), Standards Australia (2001), Wissensmanagement (www.wissenmanagement.com), and The European Committee for Standardisation (2004). However, none have been widely accepted. Time did not permit a meta-evaluation of OKM system evaluation methods and the findings that informed their model design. However, a potential reason for this lack of acceptance can be found in the analysis of a similar framework put forward by Holsapple and Joshi (2004), who attempted to address the need for a common OKM language to provide, "a common vocabulary and frame of reference that can enhance the communication and sharing of ideas among practitioners" (p. 609). In researching OKM literature, their findings do not appear to have had the desired impact on research or practice, which could be a result of the methods they used.

Holsapple and Joshi (2004) developed a framework by engaging a panel of 31 experienced theorists and practitioners in the field (including: Prusak, Sveiby, Skyrme and Wiig). The objective was to develop a 'unified language' for OKM, but the panel was biased towards 'Northern Hemisphere' world-views, with only one representative outside of a European-North America axis. This leads to the question of how a common language could be produced without representation from the wider global community, especially considering the Japanese influence of Nonaka *et al.* upon the field? Perhaps this is the reason why general approaches to OKM system design are not widely accepted. It should be noted that a general lack of global acceptance does not mean that the frameworks do not have a wide region of validly, such as in North America or Europe. However, even in these regions, they are rarely cited in research or practitioner literature and therefore their impact on the OKM field could still be brought into question. It is also telling that writers who identify the lack of common approach to OKM, acknowledge these models, but stop short of recommending one of them as the solution to bridge the gaps surfaced in this thesis;

notably, Heisig (2009). The reason for this is not known and leaves researchers with little insight into potential solutions to the problem.

Given his popularity in the field (see p. 43) any discussion on OKM must consider the work of Nonaka *et al.* (for example: 1991, 1995, 2000, 2002, 2007), and the SECI (Socialisation, Externalisation, Combination, Internalisation) model (Figure 6).

SECI models knowledge conversion, from tacit to explicit and *vice versa*, around a spiral incorporating: *Socialisation,* sharing tacit knowledge through social interaction; *Externalisation,* processing tacit knowledge into an explicit form; *Combination,* taking different forms of explicit knowledge, internal and external, and combining them to form more complex variants of the originals; *Internalisation,* the process that an individual employs to transmute explicit knowledge into personalised tacit knowledge. The model was progressed to include workplace *Ba* (cultural dynamics and spaces) and leadership to provide a unified model of knowledge creation (Nonaka *et al.,* 2000); however, the original is the most popular version and is therefore represented below.

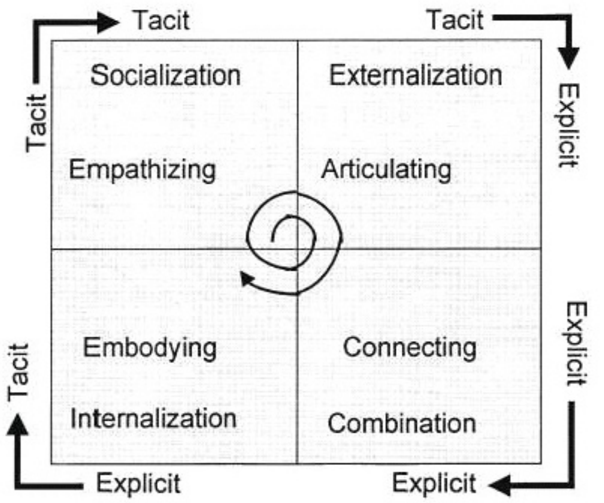

Figure 6: Nonaka's SECI Model (Nonaka, 1991)

The influence of this model is evident through the wide use of, *Socialisation*, *Externalisation*, *Combination* and *Internalisation,* in OKM literature. However, for all its influence the model has been extensively challenged, as alluded to earlier (see

p. 44). The model conveys ideas of *what* things can be done by the organisation, but it stops short of providing guidance on *how* things can be done or the constructs that organise within the functions of SECI. In this way the model becomes too abstract and, as such, could be argued to have limited use. Further still, Nonaka missed the need for the *application* or *use* of knowledge, which is the activation process that transitions knowledge into knowing (Gold *et al.,* 2001). In doing so he appears to have overlooked the operational needs of the organisations the model is designed to serve. In my view this renders SECI, as an OKM systems model, incomplete and therefore limits its currency within an organisation. The model is conceptual, but is represented in much of the OKM literature as an operational model for OKM. However Nonaka did not subject it to extensive applied testing and therefore its operational value within organisations needs to be questioned (Gold *et al.*, 2001; Wilson, 2002). Given the organisational dissatisfaction with OKM as a strategic management tool, I argue that organisations need evidenced driven applied solutions over conceptual models.

Sustained criticism of SECI exists across academic and practitioner literature, where Nonaka's central tenet of converting tacit knowledge to explicit and *vice versa*, is not considered possible (Cook and Brown, 1999; Snowden, 2010 (see, p. 44)). Here, Nonaka has been accused of misrepresenting the work of Polanyi, the person first credited with discussing tacit and explicit knowledge (see p. 44), in that Polanyi believed that tacit knowledge could only exist within the mind of the person and therefore could not be transformed into explicit knowledge (Wilson, 2002). This is a particular issue for organisations; for example, this conversion is relied upon by ADB within their model for a successful CoP (p. 33), which could bring into question whether their model can actually work.

Nonaka's (1991) model is also founded in Japanese culture, which could inhibit its portability across cultural boundaries.

> "Much as manufacturers around the world have learned from Japanese manufacturing techniques, any company that wants to compete on knowledge must also learn from Japanese techniques of knowledge creation" (p. 97).

Bhalla and Lampell (2007) are not comfortable with the assumption of the cultural transference of practice, pointing towards 'Western' failings in utilising other 'Eastern' concepts, such as Quality Circles. This is an issue for Nonaka and his assertion that, to compete, the world will need to follow Japanese ideology.

These challenges within established OKM literature direct the researcher to attempt to develop 'real world' solutions for 'real world' problems that are focused on developing a completeness, or commonality, of constructs, from across sectors and geographic locations, that fall within the scope of OKM systems in order to better inform the field. In fairness, Nonaka (1991; 2000) successfully conveys the duality of knowledge resources, as opposed to a dualism. In his view knowledge as a product and knowledge as a process co-exist in the same space; this aligns with the internal knowledge resource environment as illustrated in the KEn Diagram (p. 26). However, this argument is not about one model, there is an abundance of competing models, frameworks and theories for OKM systems. It therefore becomes necessary to establish what constitutes a good model when discussing systems for the coordination of knowledge resources.

3.14 What constitutes a good OKM model?

Good models need to answer practical issues such as utility, variables, relationships and constructs. To be effective they need to transmit answers to issues of *how, what, why, where* and *when*. Criticism has been levelled at models for being too narrative in their approach; describing the *what* of the problem, but stopping short of detailing *how* to solve the problem (Bacharach, 1989).

> "The primary goal of theory is to answer the question of how, when, and why, unlike the goal of description, which is to answer the question of what" (p. 498)

Hawking *et al*. (2010) stated that a good model needs to fulfil four criteria, 'elegance'; "few arbitrary or adjustable elements"; "agree with and explain all existing observations"; and predictions that can be tested to falsify or disprove the model (p. 41). He also argued that new models are required when the environment requires too many modifications to an existing model in order to succeed; leaving the model as a decorative concept as opposed to one that can be operationalised. This is interesting, as this criticism could be levelled at Nonaka's (1991) SECI model (Figure 6, p. 92) and yet many organisations and researchers continue to utilise the framework as an operational template for OKM systems.

Models should also be *comprehensive, complete, correct, conflict free, lacking in redundancy, useful* and be transmitted in a way that demonstrates *clarity* and *conciseness* (Shanks *et al.,* 2003). Rasli (2004) developed guidance, founded on the work of Bacharach (1989), to evaluate OKM frameworks, which also expands upon the work of Shanks *et al.* Rasli simplified the language of Bacharach and Shanks *et al.* to assess models and frameworks based on 'Comprehensiveness', 'Correctness', 'Usefulness', 'Clarity' and 'Conciseness'.

The question is whether existing OKM models designed for the coordination of knowledge resources meet these criteria and how does the practitioner know if they do in the first place, given that general constructs with the system's scope are not agreed? The answer is in the methods employed by the researcher. Successful practice depends on a white box, where clarity and transparency are the levers for the transfer of theory into practice. This leads to how organisations operationalise models, moving from theoretical to operational registers to deliver applied value (see Figure 4, p. 56).

Looking at the basic needs of an operational model, there is an input and, a transforming process, and an output (for example, see Lewis and Slack's, 2003 'Transformational Model', Figure 7, p. 96); here information is transformed from an input to a service output through people operating as the transforming resource. Lewis and Slack's (2003) model (Figure 7) is based on Bertalanffy's (1968) work on open systems, where the transformational process provides the means for the system to meet the needs of the environment (Sisaye, 2001). This model is acceptable from a high level of magnification, but what occurs at the lower level of magnification;

what are the management processes that facilitate the transformation of the resource into appropriate products or services?

I have already established the need to understand the constructs that fall within the scope of OKM systems (see p. 68-75). In my view, based on the literature, many existing models do not allow for this and, as such, is a weakness in the OKM field (see p. 54 (Spender, 1996)). For if the preconditions for management are not comprehensive and seen to be correct then how can a model be successfully applied to the point where the user observes it as being valuable?

To this end, Iftikhar *et al.* (2003) argued a need for an OKM evaluation tool as a diagnostic for business processes to "clarify options, reduce uncertainties, and provide information about programs, policies and processes within the contextual boundaries of time, place, values and politics" (p. 55-6). Dicken (2011) agreed, stating that organisations need to invest time and money in tools that will make a difference; taking action with social and technological stakeholders to improve the denominators that drive innovation, being individuals, groups and organisations, both internal and external to the process.

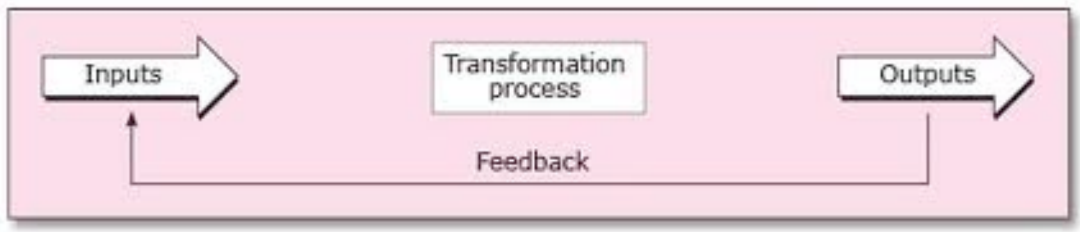

Figure 7: The Transformation Model (Lewis and Slack, 2003)

The problem is that even the outputs from the OKM processes can seem ambiguous, with some postulating that there are three possibilities: to make knowledge visible; to develop a knowledge intensive culture; to build a knowledge infrastructure (Ray, 2005). Based on earlier discussion, this is argued to be incorrect, where the drivers for OKM as a means to coordinate knowledge resources suggest that the outcomes, based on the transformational model (Figure 7), are more aligned with the use, development, acquisition and storage, and sharing of knowledge resources (see p. 76-82) against the needs of the Knowledge economy (see p. 50), particularly dynamic capability, agility and adaptive capacity.

Zhu (2010) believes that OKM system models gain currency if enough people find profit in their method. It is when the model breaks down that the original heading is forgone in search of a new, more profitable, one. However, Zhu (2010) identified a problem, "…We never insist that our propositions copy reality, or remain wholly consistent with one another. If they produce results, we keep them" (p. 180). This is interesting in that it progresses understanding as to why so many models exist in the field, while also emphasising the problem for OKM models, where there is a lack of consistency between models and the field they are designed to serve (see p. 76-82).

> "One of the most important tasks of KM is not to steer in detail the process of knowledge creation, but to create 'framework conditions' that stimulate agents within and outside the organisation…" (Lundvall, 2007, p. 208)

Based on the literature, I contend that existing general models (see p. 91) have not gained currency because not enough people see profit in their method. Too many models seem incomplete, which can lead to breakdowns. And, as with Nonaka's SECI model (Figure 5 p.92) it can be argued that often they fail to copy reality and, in the case of the CSFs exhibited earlier (see p. 76-82), there is a lack of consistency. This is a problem for OKM systems design and development and one to which my research responds (see Chapters 5 and 6).

This is supported where theorists and practitioners have been arguing for an evidence-based white box process to allow users to understand and assess the preconditions that organise within the scope of OKM systems (Lambe, 2011). Leonard (1999) argued for a filter function to ascertain what is important to the process, to bring understanding and to improve the individual's ability to use the process. Sarah and Haslett (2003) posited that a clearly defined OKM construct could drive the purposeful action required to deliver higher knowledge.

Pulling the discussion back to Systems Thinking (see p. 68-75), Leonard (1999) suggested that the viability of a system needs to be proven through the application of a Viable System Model to map management capacities and promote viability; basing this opinion on the work of Management Cybernetician, Stafford Beers.

> "Maintained by engaging in different activities, keeping them from interfering with each other, managing them together, focusing on the future and doing so in the context of an identity within which the interests of the whole over time could be considered" (Leonard, 1999, p. 2)

What is again being suggested is the need for the identification, separation and alignment of constructs (what it is that is to be managed) within the boundary of a whole (the organisation); something my research achieves, as demonstrated in Chapter 5 (see p. 150-157). Moving back to the KEn Diagram (see p. 26), the constructs that an organisation should manage as knowledge resources travel between the complicated and complex domains are distorted in OKM literature by the lack of research into commonality and the subsequent noise of the individual voice (see p. 76-82). The challenge for the researcher is to filter the noise to ascertain whether these individual voices are actually saying similar things. This challenge is met in Chapter 5, possibly for the first time in OKM research.

What is being argued is that if the criteria for a good model were to be synthesised and applied as a test for models within the wider body of OKM literature, many would fail. The testing of models against a set of criteria is appropriate and necessary, in order to provide robust evidence based solutions for OKM systems designed for the management of internal knowledge resources. This directs the researcher to address previous issues of commonality within the constructs that fall within the scope of OKM systems for the coordination of knowledge resources and, from there, develop a set of criteria that allows for the evaluation of existing models, with 'completeness' or 'comprehensiveness' being a significant indicator of the potential of the viability of a model in an operational setting.

3.15 Observations on the wider body of OKM literature

Signals have emerged in this review where aspects of the literature itself could be a contributor to the dissatisfaction in the field (for example see the discussion on CSFs, p. 76-82).

A scoping study conducted for this thesis randomly sampled 66 OKM articles from practitioners and academics; the methods are discussed later (see p. 135). It found that 59% of OKM literature was based on single narrative literature reviews, a finding supported through earlier research by Jones (2001). This means that the literature was produced using a view that can transmit the personal bias of the author, where supporting evidence is carefully selected to support the author's worldview (Tranfield *et al.,* 2003).

This is possibly a deeper issue than is first recognised, as transferring the single world view to operational requirements across organisations could cause distortions, especially as the research lens moves between the registers of theory and practice (Callon, 1986).

Tranfield *et al.* (2003) is supported by Kunda (1992), who stated that literature reviews with singular descriptive accounts at their core, especially when used to explore a hypothesis, can create dissonance that pollutes findings; in the context of this thesis the same could be said for the model creation process and the challenges of transferring the theory or concept into practice.

> "[Researchers] selectively access those memories, beliefs, and inferential rules capable of justifying their desired conclusions and creatively combine accessed knowledge to construct new beliefs that lend support to their desired conclusion" (Remenyi and Money, 2006, p. 337).

The literature used in the single narrative is often shallow and narrow, contributing to what Kahneman (2011) refers to as availability bias, where the reader is not able to critically reflect upon the findings due to the lack of counter claim within the work. In many cases quantitative, qualitative or blended research is then produced; in almost all cases they reinforce the author's worldview (Tranfield *et al.,* 2003). What is being suggested is that an author represents the OKM field with a set of biases, they then harvest support for their worldview and produce research to reinforce that view. A potentially good OKM example is Conlley and Zheng (2009), who produced a list of CSFs through a biased literature review that lacked any type of supporting data beyond the literature review itself.

This is observed as a common occurrence in disciplines such as Business and Management, but not so in disciplines such as Medicine and Health, where value is placed upon evidence-based systematic literature reviews (Tranfield *et al.,* 2003).

> "[The single narrative produces] a low degree of reputational control over significance standards… [which] means that the significance of problems and preferred ways of formulating them are unstable, subject to disputes, and are assessed by diffused and diverse standards" (Tranfield *et al.,* 2003, p. 211)

This is a challenge for OKM researchers and should inform the selection of research methods when working to deliver credible and trustworthy findings for the field. Compounding this is the flow between academics and practitioners, which is often suggested to be blocked, caused by academics that write in an incomprehensible language that diffuses their message and affects the ability of practitioners to apply findings in the work place (Greenwood and Levin, 2005). This issue of flow between academics and practitioners is not a recent one, being discussed in relation to the development of organisational knowledge resources as far back as 1968 (Havelock *et al.*) (see p. 58).

One way for the researcher to overcome this in the OKM systems domain is to take a lesson form the field of medicine and health and the use of systematic, evidence-based literature reviews. These literature reviews voice the needs of the academic and practitioner by including a variety of sources such as: books, articles, blogs, company website statements, industry articles, academic articles and conference proceedings. This approach differs from the traditional narrative review in the manner in which it rigorously approaches the literature resources, moving beyond simple breadth and scale to encompass a transparent scientific approach (Tranfield *et* *al.,* 2003).

> "[A systematic evidence based review] aims to minimise bias through exhaustive literature searches of published and unpublished studies" (p. 209).

Research produced using this method increases the reliability and robustness of findings; surpassing that of the singular narrative review process presented in many examples within the wider body of KM literature (Tranfield *et al.,* 2003). Given the lack of coherence in the discussion of OKM system models (see p. 76-82), it is apparent that consideration needs to be given to this type of evidence-based approach. Therefore, my research utilises a systematic literature review as a founding method for the exploration of commonality in OKM systems (see Chapter 5, p. 131).

This said, Wisker *et al.* (2003) believe that the researcher should take a 'meaningful' over an 'accumulation' approach to ensure that links and understanding are drawn from the work presented. I argue that a combination of the two approaches, accumulative and meaningful, would provide for a rich evidence base that can only benefit the transfer of OKM theory to practice and as such is adopted in its methods (see Chapter 5).

Greenwood and Levin (2005) offer an insight into the failings of OKM literature in fulfilling the primary knowledge need of 'knowing how'. They posit that for knowledge generated by research to be enabled, it needs to be understood for it to be applied in context:

> "The actor needs to make sense of the context to enable appropriate actions. "Knowing how" thus implies knowing how in a given context in which appropriate actions emerge from contextual knowing" (p. 51-2)

Greenwood and Levin (2005) thus support the position of Tranfield *et al.* (2003) in that the practitioner view should be carefully cultivated in the research process, especially where the research is focused on solving a problem embedded in practice, as in this research, where the problem is centred on the identification of common constructs within the scope of OKM systems. Reflecting on the discussion around Nonaka's SECI model (Figure 5, p. 92), it could be argued that the understanding of practitioner need, in an applied sense, is deficient and has hindered the viability of the concept in an organisational setting. This is achieved in this thesis by cultivating the practitioner voice through both a systematic literature review and a survey (see Chapter 5).

Ultimately, it is argued that systematic reviews increase the value of research and improve the flow between theory and practice:

> "For academics, the reviewing process increases methodological rigour. For practitioner/managers, systematic review helps develop a reliable knowledge base by accumulating knowledge from a range of studies" (Tranfield *et al.,* 2003, p. 220)

In the case of the opening scoping study (p. 99), only one (1) of the articles in the sample pool applied this approach, which could be considered as a contributor to the lack of completeness associated with the identification of common constructs within OKM system models; what Zhu (2010) referred to as a consistency between models (see p. 97), which could be brought about by 'accumulating knowledge from a range of studies'.

Of note, the OKM literature does not appear to be dominated by cultural lines of demarcation, though some would argue this (see p.74). Instead the popular definitions of *tacit* and *explicit* knowledge create the border, with the impression being a boundary exists between tacit and explicit forms of knowledge resource, with resources being either one or the other; a proposition that is not possible when considering the literature that informs the KEn Diagram (see p. 26), where there will be varying degrees of the tacit and the explicit as knowledge resources travel between the complicated and complex domains. This dualism informs much of the OKM research literature, contributing to a lack of agreed research strategy (for example, see Ragsdell, 2009).

Finally, the vast majority of literature sampled for this research fails to bring appropriate authority to external environmental drivers, related to the openness of OKM systems (see p. 69); their impact on internal processes for the coordination of knowledge resources; and the underpinning importance of the definition of knowledge resources and the implications of these influences upon research methods or operational processes. It is strongly argued that if the researcher or organisation fails to acknowledge the wider economic environment, or what is termed in this research to be context and its influence upon OKM systems, then a key influence upon system design is being missed. This not only signposts the need to treat existing OKM literature with care, but challenges the researcher to develop methods to overcome these gaps. Something achieved in Chapter 5 of this thesis.

3.16 Literature Review Conclusion

In summary, OKM is devoid of an evidence-based definition of function or purpose; there are dualisms and widespread uncertainty around models and systems designed for the coordination of knowledge resources. This said there are elements of emergent commonality, which signals to the researcher that a general or common systems framework for the coordination of knowledge resources might be possible; this is visible in elements of the discussion on CSFs, tacit and explicit knowledge and knowledge resources as products or processes.

At the core of the issue however, there is a lack of agreement and completeness in current literature as to the constructs that organise within the scope of OKM systems, which is argued to impact performance and satisfaction in the field. This in itself justifies the need for an evidence-based definition of purpose for these systems and an enquiry into the potential for a general system model that would allow for diagnostics to be conducted into management processes for the coordination of knowledge resources in organisations. There is a paucity of research in this area and it is not clear at this time whether any researcher has attempted the breadth and depth of enquiry needed to respond to these challenges. Researchers have developed rich data that identifies the problems, but have stopped short of addressing them.

The extensive range of literature reviewed confirms the need for this research as set out in the introduction (see Chapter 1) and supports Claim 1, 'The need to coordinate knowledge resources in an organisation is a persistent one' (p. 21). Though, as set out in the discussion on issues with existing OKM literature (see p. 99), it could be said that this is informed by researcher bias and this is an issue that needs to be considered in developing the methods for the enquiry as this research progresses.

Part II: Methodology and Methods

Chapter 4: Methodology

4.0 Introduction

This Chapter uses the definition of methodology and methods put forward by Olsen and Morgan (2005); *methodology* comprising combinations of methods and their application, including interpretation of output underpinned by the logic of the enquiry, and *methods* being mechanisms for the data collection itself.

4.1 Overview

I see myself as a pragmatist, informed largely by my twenty years experience as a practitioner. I therefore considered action first in terms of my research, not unusual with pragmatist researchers or systems thinkers, where the approach brings a focus on action in response to a problem, the best method being the one that contributes to a solution to the presenting problem. This approach can accept positivist and/or interpretivist approaches to organisation or management research, according to the ability of an approach to respond to the presenting problem (Mingers, 2008). This sits in contrast to a rationalist approach that would look at epistemology and ontology as the basis for method selection.

> "Management and decisions is not about deduction or proof, nor application of facts, it is a settling of opinion or belief: it is not true that belief is settled by either rigorously scientific method on the one hand or by erratic and emotional caprice on the other" (Beer, 1966, p. 16)

The pragmatist view is widely accepted in systems thinking, within which my research is grounded. For example, systems theorists such as Beer (1966) and Checkland (2000) have been influenced by C. West Churchman's pragmatist approach to systems thinking (Barton, 1999), Churchman's work regarded as being highly influential in the field (Ulrich, 1994) (see p. 70)

> "…A number of direct connections can be established between pragmatism and many of the major contributors to the field of systems thinking including Churchman, Ackoff, Emery and Beer…. while Checkland's soft systems

> methodology's relationship to Churchman…provides a further linkage." (Barton, 1999, p. 1)

I then considered the research from a position of systems duality, as set out in Chapter 2 (see p. 34-35); taking account of complicated (technical or hard) and complex (managerial or soft) views, from both practitioner and academic perspectives. My research also considered the need for academic rigour in data collection and analysis (see p. 36) and the practical aspects of OKM systems designed for the coordination of knowledge resources.

The problems discussed in Chapter 3 (see p. 99) led me to contemplate mixed methods through which breadth and depth could be achieved, whilst also capturing both the practitioner and the academic voice. I also wanted a strategy that not only accounted for the registers of theory and practice, but allowed for the identification of patterns within a system (see p. 68-75), the existence of which could then be demonstrated through the operationalisation of an illustrative system model via a management diagnostic tool.

This brought me to Checkland's (2000) Soft Systems Methodology (see p. 125) and Hypothetico-Deductive Reasoning (see p.121). This allowed me to explore methods for high quantity data collection; the need for rigour, where multiple data sets would be required and commensurability could become an issue; methods where frequency and meaning could be accommodated; a method where similarity between datasets could be explored; and a method where operational application could be captured in depth. This led to meta-analysis (see p. 131), a descriptive survey (see p. 141), fractal analysis (see p. 149), logic modelling (see p. 153) and a case study (see p. 163).

From here I began to explore the implications of my beliefs for my research design.

4.2 Understanding underpinning assumptions

> "Philosophy is dead. Philosophy has not kept up with modern developments in science…Scientists have become the bearers of the torch of discovery in the quest for it" (Hawking *et al.*, 2010, p. 8)

Initially I was attracted towards statements such as this, as they justified my pragmatic view and an initial lack of interest in engaging with philosophy, based on my practitioner-driven approach and focus on action. However, counterclaims from authors such as Checkland (2000), Patton (2002) and Knowlton and Phillips (2009) challenged my thinking, when they suggest that researchers should be prepared to state their assumptions before mapping their view of the world.

> "Neutrality is not an easily attainable stance, so all credible research strategies, include techniques for helping the investigator become aware of and deal with selective perception, personal biases and theoretical predispositions" (Patton, 2002, p. 51)

Easterby-Smith *et al.* (2002) have suggested that a degree of philosophical engagement could help specify the research strategy, including the type of evidence to be gathered, the way it is to be analysed and the manner in which it relates to the questions posed by the literature review. They argued that a declaration of assumptions allows for the evaluation of methodologies and their coherence with selected methods. In doing so this exposes limitations within the research strategy, while also allowing the researcher to explore methods that were beyond their initial horizon. In order to do this it was necessary to reflect upon my influence upon the research.

4.3 The researcher as pragmatist

Pragmatism is founded in logic, experience and scepticism of the senses as the sole connection to the world (Nubioloa, 1996). Charles Saunders Peirce (1878) is credited with the foundation of pragmatism, although Rorty (1980) believes that Pierce did not do anything for pragmatism except give it a name, believing Peirce's work to be overly ambiguous in his attempts to frame the pragmatist paradigm. This is debatable, depending on interpretation, as Peirce did put forward a maxim, framing the pragmatic approach as being focused on a researcher's clarity of ideas.

> "Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of those effects is the whole of our conception of the object" (www.peirce.org)

Peirce (1878) believed knowledge to be generated through a logical approach, or what is appropriate for the practical bearing. This view is also visible in the pragmatist view of systems thinking (Beer, 1966), cited in the previous section (see p. 106). The approach is informed by the reflexivity and reflectivity of the researcher. For example, researchers can utilise different methods of enquiry and yet arrive at the same conclusions, demonstrating, in the view of pragmatists, that there is no one 'right way' to develop truth; "the true [is] what is good in the way of belief" (William James, cited in Rorty, 1980, p. 721). This is a position that I find myself aligning with. I do believe that there are methods that are more appropriate than others, but my work experience guides me to recognise that there are multiple ways to arrive at the truth.

Rorty (1980), reviewing James (1909), believes that an epistemological focus in research to be of limited value, or of no concern, questioning, "why truths are good to believe or why…our present view of the world is roughly the one we should hold" (p. 722), the argument being that researchers focused on epistemology are attempting to develop currency for rationality and the connection between human thought and objects. In turn, the motivation for this rationality is to create a platform from which to critique positions contrary to their own and to generate new 'truths 'aligned to their view of the world. Pragmatists, on the other hand, reflect on the usefulness of truth by focusing on practice over theory, which is reflected in my research and its focus on informing action. Here again I find myself agreeing with the primacy of practice over theory when considering the usefulness of truth, with the caveat that the PhD process has brought me to realise the need for commensurability between the methods used to determine action and their epistemological and ontological implications.

> "James' dictum about truth says that the vocabulary of practice is uneliminable, that no distinction of kind separates the sciences from the crafts, from moral reflection, or from art" (p. 723)

Peirce also believed in reality being informed by the experiences of the person, which is subscribed to by William James (1909), who posited that truth could exist in relation to the experiences of the researcher. I align with this view as it speaks to my understanding of practical research from working within organisations. It also aligns with the shift in systems thinking, from Bertalanffy's General Systems view to Churchman's soft systems (see p. 68-75). The pragmatist view also permits for the application of experience in the reasoning and justification of reality, as this allows for the contextualisation of the enquiry. This aligns with the needs of my research, in developing a systems model that takes into account the practitioner's experience of managing knowledge resources:

> These thoughts, however, have been caused by sensations, and those sensations are constrained by something out of the mind. This thing out of the mind, which directly influences sensation, and through sensation thought, because it *is* out of the mind, is independent of how we think it, and is, in short, the real. (www.peirce.org)

Again, I relate to this as I have found throughout my career that people use experience as the basis for enquiry and reasoning in organisations. However, the very nature of what we choose to research could be seen as displaying discrete or unrecognised assumptions on the part of the researcher (Jackson, 2001).

Through my research question I am suggesting that there is the potential for commonality amongst OKM system for the coordination of knowledge resources, a commonality, or similarity that exists across sectors and geographic locations. At first it can seem as if I am subscribing to General Systems Thinking and a positivist approach to research. However, I am also working with soft, socially influenced, systems (for example, see p. 33 discussing the ADB CoP or human agency, see p.

51), leading towards holism, and anti-foundationalist solutions, or what Patton (2002) refers to as the "totality or unifying nature of particular settings" (p. 59). This in itself presents a warning, in that I might attempt to manufacture a situation where the enquiry is drawn away from foundationalist methods that could bring understanding to the system as whole. This is not the case in this research, demonstrated through my use of hypothetico-deductive reasoning (see p. 121).

The challenge for the pragmatist is that there can be a temptation to seek out methods to address a problem at hand, ignoring issues of commensurability between methods and their relationship to epistemology or ontology. The challenge being, if epistemology is of no concern, to overcome the problem of knowing how to ensure that the methods are appropriate to addressing the problem at hand (Holden and Lynch, 2004). Given the debate I set out around OKM systems, and the credibility and trustworthiness of some enquiries into common constructs for the coordination of knowledge resources, I was guided to explore the commensurability of my research paradigm, as set out earlier by Jackson (2001) and Easterby-Smith *et al.* (2002).

4.4 The research paradigm

My research is situated within soft systems within a social science-based approach, where research methodology literature centres on two extreme worldviews, Objectivism and Subjectivism, which then diversify, through varying degrees of alignment to one worldview or the other, to produce various schools of thought of which pragmatism is one (Holden and Lynch, 2004). Table 4.1 (p. 116) illustrates the argument detailed below from the alternate perspective of Weber (2004).

The extreme Objectivist position in social science leads to a realist ontology, where reality exists independent of the researcher; reality can be reduced to complicated processes that can be viewed and affected in isolation; cause and effect can be clearly identified through the modification of variables; this view involves a rational view of society where Man is controlled by the environment; values are free from the bias of the researcher and their influence upon what to study; research exists in a state of independence and is typified by large samples and quantitative analysis that looks to develop generalisable findings, typically being grounded in hypothesis testing and deductive reasoning (Durant-Law, 2005). This brings about a positivist epistemology, a worldview where human nature is seen as deterministic and there are clear links between cause and effect in human actions. Aspects of this paradigm are useful as they align with the complicated systems domain (see p. 68-75) and the concept of knowledge resources as objects; for example IT databases. However the internal organisational environment, as summarised in the KEn Diagram (see p. 26), is broader than this extreme in order to enquire into the tacit/managerial/process, or social view of knowledge resources in a complex domain, where pathways between cause and effect are blurred. This leads the researcher towards Subjectivist ontology.

The extreme Subjectivist position views reality as a projection of human imagination, where reality is influenced by the researcher; a view where reality cannot be reduced into component parts as the world is too complex and can only be understood through a holistic approach; cause and effect cannot be identified and the view of the world is discussed in terms of constructs; Man is the controlling element in the environment; research exists as a state of interaction and is typified by small samples with in-depth analysis that looks to develop transferable findings and is typically grounded in theory development and inductive reasoning (Durant-Law, 2005). This brings about an interpretivist epistemology, which at its extreme, works to obtain a phenomenological insight or revelation (Holden and Lynch, 2004). Here the paradigm aligns with the opposite end of the KEn Diagram (see p. 26) and the view of socially constructed or process based knowledge resources, such as Communities of Practice. However, again, it is not a perfect alignment, causing friction at the point of interface with the view of objects as knowledge resources, which requires a more Objectivist view of the world. "What the researcher is seeking is the 'sweet spot' where the overlap between ontological, epistemological…positions is maximized" (Durant-Law, 2005, p. 15).

As set out by Weber (2004) in Table 4.1 (p. 116), there is an intermediate position.

Here the ontological position accepts reality as being tangible, while also accepting that people inform its concreteness. The epistemological position becomes one focused on quality research, where certainty is given over to contextual explanations that are seen as being ‘probably generalisable’. Knowledge is not concrete, but can be gathered and tested and findings either retained or discarded. Human nature in this intermediate paradigm provides for the recognition of a structured society, but one that changes as people interact with it (Holden and Lynch, 2004). Given the view of organisational knowledge resources, as set out in the KEn Diagram (see p. 26), and the blend of hard and soft systems needed to coordinate them, this paradigm provides commensurability within the research design, giving a strong platform from which to explore the domain of enquiry.

4.5 Discovering knowledge in the domain of enquiry

4.5.1 Positivism

Rickman (1960) described Positivism as the founding philosophy for the natural sciences, a tool for the acquisition of knowledge grounded in empirical processes of physical sciences and observed behaviour. It employs controlled experiments under laboratory conditions to deliver precise statistically driven analysis.

Positivist methods are commonly challenged in the Social Sciences, as “something of the richness and complexity of human life seems to elude us and so often we bring up only the trivial and uninteresting in our nets” (Rickman, 1960, p. 307). Giddens (1974) observed Positivism to be concerned with a world that does not answer back, whereas Popper (1963) recognised that social scientists are immersed in interaction between themselves as the observers and the observed. Miller (2009) observed Positivism as seen as being grounded in the epistemological belief that objective reality exists as a state beyond the human mind, and ontological belief that reality exists in isolation from the researcher. It is also a paradigm for the construction of general laws and theories, which are reasoned through logic-based processes of deduction (Pritchard, 2009).

The literature review demonstrated the OKM system domain to incorporate complexity (Figure 1, p. 26). Patton (2002) suggests that the nature of complex phenomenon requires holistic enquiry that looks at the process as a whole: "The analyst searches for the totality or unifying nature of particular settings – the gestalt" (p. 59); this aligns with wider OKM literature (see p. 68-75). He contrasts this with the positivist view that looks to deconstruct the whole, examining individual parts in search of independent and dependent variables. This does not align with complex systems, where the dependency or independency of variables is not predictable in the linear fashion that is required for regression analysis, though it is argued that this could be achieved at the technical end of the KEn Diagram (see p. 26). However, the OKM domain does not tend to polarise to one end or the other, encompassing varying degrees of complexity, and the tacit/the explicit.

> "[Positivism] oversimplifies the complexities of real-world programs and participants experiences…misses major factors of importance that are not easily quantified and…fails to portray a sense of the program and its impact as a whole" (Patton, 2002, p. 59).

This supports the need to explore alternate approaches, without absolutely dismissing potential benefits that could be gained from positivist methods.

4.5.2 Interpretivism

Interpretivism accepts the experience of the senses, with some interpretivist views being seen as extreme, in that they believe all knowledge to be governed by situated reality (Weber, 2004). Weber (2004) observed the interpretivist worldview as being situated in the epistemological belief that knowledge is intentionally formed through the researcher's personal experience and the ontological belief that the researcher and the world cannot be separated. Research in this paradigm allows for the understanding of social phenomena, which polarises it against the quantitative nature of positivism (Pritchard, 2009).

Quality, particularly dependability, credibility and transferability has been cited as an issue for interpretivist research (Weber, 2004). This is attributed to, "The Social Scientist's inability to achieve disinterested objectivity" (Hay, cited in Clarke, 2009,

p. 28). However, this is argued to be no different to positivism, where researcher bias determines the research question and the method used; the argument being that there has to be an interest on the part of the researcher, with some form of pre-existing bias, thereby removing total objectivity from any enquiry (Spender, 1996).

> "Science is far from objectified or fully abstracted from the social context of its production. Not only is it closely intertwined with the automatic and collective knowledge of those who do the work of science, it is also incomprehensible when abstracted from the collective practices that give it sustained social meaning" (p. 55)

The argument presented in the literature review, in terms of knowledge resources being acquired, activated and constructed by the person, leads towards interpretivist methods. However, lines of demarcation between paradigms are often not so clearly cut (Miller, 2010). For example, Patton (2002) suggested that one potential method for overcoming researcher bias is through a blend of qualitative and quantitative methods, which aligns with the intermediate position between objectivist and subjectivist views of the world and the friction at the point of interface between technical and managerial knowledge resources in the OKM systems domain. However, this still does not remove the researcher fully as, for example, s/he chooses the research subject and methods. Therefore, in terms of this research, it is better to explore a mixed-method approach.

4.5.3 Mixed-method

> "Perhaps we all have a rather Victorian fetish for reductionist explanations about the world….We have somehow made behavioural phenomena feel connected to larger explanatory systems, the physical sciences, a world of certainty, graphs and unambiguous data. It feels like progress. In fact, as is often the case with spurious certainty, it's the very opposite" (Goldacre, 2008)

Guba and Lincoln (1994) argue that delineated paradigms are a thing of the past, with genres becoming distorted by the influence of the domain of enquiry and the view of the researcher. This finds oppositional forces to be consorting under a new state of order to compliment one and other's arguments. A position subscribed to by Zhu (2010), "despite all the differences, the closer we look, the more blurred the distinction between natural and social sciences" (p. 170) and one that I agree with.

Abbott (2001) posits that traditional paradigms are less fragmented than they appear, where researchers are generally talking about the same thing, but looking at similar outcomes through different lenses, believing their lens to be the one true way to look at the world. This aligns with the pragmatist view of the world; for example see James, cited by Rorty (see p. 109). This also reflects my experience of philosophical discussions during the PhD process. Abbott (2001) utilised fractal theory to demonstrate self-affinity, or commonality, in research paradigms, challenging theorists to deny that there is far more commonality than is first thought; a position supported by Weber (2004) (Table 4.1). The intricacies of this argument are beyond the scope of this thesis, however, Guba and Lincoln (1994) suggested that existing in a state of commonality is for the greater good of research.

> "…at the…philosophical, level, commensurability between positivist and post-positivist world views is not possible, but within each paradigm, mixed methodologies (strategies) make perfectly good sense" (p. 200)

Metatheoretical assumptions about	Positivism (Foundationalist)	Interpretivism (Anti-Foundationalist)	Commonality commentary (Weber, 2004)
Ontology	Person (researcher) and reality are separate	Person (researcher) and reality are inseparable (life-world)	Both are enhancing understanding of reality. Both have research bias and methods employed have strengths and weaknesses. Interpretivists recognise personal bias and assumptions – Positivists do not see as much benefit in this.
Epistemology	Objective reality exist beyond the human mind	Knowledge of the world is intentionally constituted through a person's lived experience	Objective reality cannot be fully determined. Research is a method to construct an understanding of reality and as such is challenged and discarded – little knowledge is sacrosanct
Research object	Research object has inherent qualities that exist independently of the researcher	Research object is interpreted in light of meaning structure of person's (researcher's) lived experience	Positivist reality is created through artefacts created by the researcher. Interpretivist researchers become the measurement instrument. Therefore in both cases the research process and the objects of research are coupled.
Method	Statistics, content analysis	Hermeneutics, phenomenology etc.	Weber cites 'Protocol' analysis as an example of blurred methods – where a positivist approach is frequently analysed from a positivist and interpretivist perspective.

Theory of truth	Correspondence theory of truth: One-to-one mapping between research statements and reality	Trust as intentional fulfilment: interpretations of research object match lived experience of object	Intentional fulfilment is conjoined to positivistic goals of theory building and testing
Validity	Certainty: data truly measures reality	Defensible knowledge claims	Fundamentally there is no way to measure reality. Positivists and Interpretivists focus on developing constructs that are accepted by the collective and are deemed useful. Validity issues arise through the strengths and weaknesses of the research lens
Reliability	Replicability: research results can be reproduced	Interpretive awareness: researchers recognise and address implications of their subjectivity	Both research paradigms are concerned with replicability – demonstrated by the rigour applied to interpretivist research methods

Table 4.1: Blurring the boundaries of research paradigms, adapted from Weber (2004)

This emancipates the researcher from the confines of a single paradigm, allowing for greater freedom in the justification and reasoning of enquiry. However, the mixed-method approach is an emerging field, with some stating that the researcher exposes themselves to challenges of rigour due to the potential conflict of world-views that can impact consistency of assumptions and transparency of knowledge claims or "incommensurability" (Feyerabend, 1993). Proponents of mixed-method research counter for the need to acknowledge the challenges to be found in the weaknesses of singularly focused qualitative or quantitative study (Gilbert, 2006).

This acknowledged, if the researcher is aware of this, and is prepared to expose their research to scrutiny, then there would not seem to be a fair challenge that prohibits this approach – evidenced by the literature in support of mixed methods; for example, Johnson and Onwuegbuzie, (2004) and Mason (2006)

> "The call becomes louder and louder for combining knowledge of 'the natural' and 'the social', apparently because experiences in the real world keep telling us that human life projects including [KM] ones, do not fit with the great divide very well" (Zhu, 2010, p. 174).

For example, quantitative methods allow for the statistical aggregation of the opinions of many people to a limited set of questions. By contrast qualitative data provides more detail from a smaller number of people about a small number of cases (Patton, 2002), though it might be argued, using computational methods such as text mining, that qualitative data could provide more detail on a large scale. Qualitative methods can provide a great deal of depth of information, but, due to the limited breadth, it impacts external validity, leading research to transferability over generalisability. Also, quantitative research focuses on the measuring instrument, whereas, in qualitative research, the focus is on the researcher as the measuring instrument. An example of a mixed method design is 'concurrent triangulation', where both qualitative and quantitative methods are applied in a single case to allow for meaning to be explored within quantitative data; areas of convergence or divergence in the data can then be explored (Gilbert, 2006).

In deploying a mixed-method strategy, it is necessary to clarify the language to be used in describing the research process (Table 4.2). Positivism utilises terms such as, 'external validity', whereas Interpretivists will refer to 'transferability'. Given the social aspect within the domain of enquiry, as well as its complexity, I decided to use interpretivist language in this research.

Positivist	***Interpretivist***
Internal Validity	*Credibility*
External Validity	*Transferability*
Reliability	*Dependability*
Objectivity	*Confirmability* (Guba and Lincoln, 1994)

Table 4.2: Positivist versus Interpretivist terminology

4.6 Reasoning

Guba and Lincoln (1994) stated that researchers should be prepared to discuss the method of reasoning within the research design, which, given the discussion on issues within OKM literature (Chapter 3, p. 99), I subscribe to. Levin-Rozalis (2004) put forward three traditional forms of reasoning: Abductive, Deductive and Inductive. Lawson (2005) disputed this, suggesting a fourth form, Hypothetico-Deductive logic. The following introduces the three traditional modes of reasoning before arguing the need for a blended position.

4.6.1 Deduction

Deduction is used to take a hypothesis and, through a valid logical connection, to attempt to link it to existing theoretical assumptions as a generalisable fact. The deductive process is taken from an existing theory, against which a hypothesis is tested in isolation from the rest of the world (Levin-Rozalis, 2004). Here the reasoning is interested in the findings in isolation against the hypothesis, any other information that is discovered is not seen as relevant. Ultimately deduction is seen as a process of reasoning to validate, "variables and suppositions stemming from an existing theory" (Levin-Rozalis, 2004, p. 3). Lee (1969) stated that deduction brings nothing more than is already possessed and is grounded in logic. Whereas induction takes research beyond what is already know; "if logic is deductive, then science is inductive" (p. 291). This approach is not appropriate for this research as there is not an established theory for testing.

4.6.2 Induction

Induction is used to discover recurring patterns that exist in the field as a way to reason the probability that these patterns will be repeated (Levin-Rozalis, 2004). Lawson (2005) supported this, stating that inductive reasoning is founded on the basis of learning from experience where the researcher draws upon regularities in experience and project them into other situations. Levin-Rozalis (2004) argued that it is necessary for the researcher to know the characteristics of the patterns prior to the beginning of the enquiry. At first this seems appropriate for this research, but there is a problem that the constructs and patterns within OKM systems lack agreement (see p.76-82); therefore there is a need for a step prior to inductive reasoning.

However, Patton (2002) argued that inductive research allows for the discovery of patterns and therefore there seems to be a divergence in views. Lawson (2005) overcomes this by stating, "associations, patterns, regularities are observed, and on this basis expectations or concepts regarding the way the world is organised is formed” (p. 717).

Lawson (2005) presented an argument against induction, with the concern that there is no ‘formal incentive’ for observing one pattern over another, which is essential in approaching research. The author cites Popper to posit, “Observation is always selective. It needs a chosen object, a definite task, an interest, a point of view, a problem” (p. 718). This is perhaps an irresolvable problem, as suggested by Spender (1996)(see p. 115), where any enquiry could be susceptible to researcher bias.

Induction is said to require an understanding of the characteristics inherent to the field of enquiry (Baxter, 2010). While I have an intuition driven idea for the existence of a pattern, derived from the literature review, it did not exist at the outset of this enquiry. This is a problem for me and led me to abduction as a starting point for my research.

4.6.3 Abduction

Abduction is founded on the condition that *a priori* hypotheses do not exist and that advance theorising has not occurred (Levin-Rozalis, 2004), which is the case in this thesis; the enquiry was stimulated by environmental signals of dissatisfaction, but an established theory for general OKM process constructs was not available for testing.

> “An order, or a rule, in this procedure must therefore first be discovered or invented, and this has to happen with the aid of intellectual effort. Something unintelligible is discovered in the data and, on the basis of the mental design of a *new* rule, the rule is discovered or invented and, simultaneously, it becomes clear what the case is” (Reichertz, 2010, www.qualitative-research.net).

Taking an abductive approach, the researcher must not attempt to theorise in advance of the facts. The researcher is required to maintain an open perspective and react to the stimulus of the facts as they are unveiled and not through presuppositions (Levin-Rozalis (2004).

The discussion in this section is leading the research design towards a blend of approaches to reasoning in order to answer the research questions (see p. 22).

4.6.4 Mixed reasoning

Staat (1993) suggested that bringing the core aspects of abduction, deduction and induction to bear on an enquiry could bring about a powerful lens through which to view the phenomena under enquiry, enabling an interconnectedness that exists between the forms of reasoning.

Staat (1993) argued for this interconnectedness through Peirce's '*Collected Papers'* (1868). It has also surfaced in OKM literature: "When we define science as the process of generating new knowledge by interacting these two types, i.e. science does not comprise either data or hypotheses alone, but arises from their interaction" (Spender, 1996, p. 49). Staat (1993) opined that the choice of reasoning is driven by the context of the domain, but that the "succession 'abduction, induction, deduction' is one of increasing certainty" (p. 227). This is a logical approach that overcomes criticism that can emerge from the use of a single form of reasoning.

> "The maxim that data should be gathered without guidance by antecedent hypotheses about the connections among the facts under study is self-defeating, and is certainly not followed in scientific enquiry. On the contrary, tentative hypotheses are needed to give direction to scientific investigation" (Hempel, 1966, p. 13).

This is supported by authors such as Levin-Rozalis (2004) and a mixed method approach negates the argument against induction, and the need for pattern identification to exist prior to the enquiry; an abductive process could inform a 'hypothesis on probation', which uses an inductive process to develop credibility before it is tested using a deductive approach.

4.6.5 Mixed method: Hypothetico-Deductive Reasoning

Lawson (2005) linked human reasoning in everyday contexts to suggest that it operates in the same way as scientific enquiry.

> "At its most basic level, scientific method is a simple, three-step process by which scientists investigate nature. Begin by carefully observing some aspect of nature. If something emerges that is not well understood, speculate about its

> explanation and then find some way to test those speculations" (Carey, 2004, cited in Lawson, 2005, p. 719)

Lawson's (2005) argument being that science, especially in the interpretivist paradigm, looks for patterns or unanswered questions towards developing a hypothesis on probation, which is then tested; the findings compared against predictions, allowing further tests to compare and contrast findings against alternatives until a clear hypothesis is identified and tested.

> "Inductivism was replaced more and more consciously by the so-called hypothetico-deductive method. According to this method the first step is to 'speculate,' as Darwin called it, that is to generate a hypothesis. The second step is to conduct experiments or gather observations permitting the testing of this hypothesis" (Mayr, 1982, cited in Lawson, 2005, p. 718).

Platt and Warwick (1995) support this, reasoning that science is best addressed through a hypothetico-deductive approach using the following steps: Observe a puzzle; develop a theory, construct a theory on probation; test the theory; compare findings to those that were predicted and recalibrate the theory on probation accordingly; generate a hypothesis through tests where findings are repeated on more than one occasion and where competing alternatives are tested and discarded. There is a suggestion that this is about hypothesis testing and therefore is positivist in nature. Lerner (2002) and Lawson (2005) overcome this, positing that a purely deductive approach could fail to satisfy the reasoning requirements of the researcher.

> "…Science best advances when fact are gathered with an eye towards eventual integration with theory….What we see then is that in actuality the method that perhaps characterizes the reasoning of the practicing scientist is neither purely deductive or purely inductive" (p. 12)

Lerner's (2002) approach has resulted in what is a more palatable reasoning process for practical researchers, as is my position, through what has been termed 'inductive-hypothetico-deductive' reasoning. This is confirmed by Patton (2002, p. 41): "Immersion in the specifics of the data to discover important patterns, themes and interrelationships; begins by exploring, then confirming; guided by analytical principle rather than rule; ends with creative synthesis". With this being the case the overarching research questions and the supporting sub questions allow for the following approach to reasoning to be employed in this thesis:

Abduction – The review of the field looking for what informs key issues and searching for key characteristics – *leading to* **Induction** – The revealing of patterns emerging from the key characteristics and developing a theory for their use – *leading to* **Deduction** – The testing of the theory in a situated environment

There is an issue here, in that the theory to be developed and tested could be seen as being researched for corroboration, where the focus is on the collection of favourable supporting evidence; as opposed to the research setting out to falsify the theory under enquiry (Popper, 1959). However, Smith (2000) argued that Popper intended for this to be used as an approach to overcome the bias of the researcher in the process; where it was suggested that confirming, or corroborating evidence, was fallible and it was only through a process whereby the theory under enquiry was tested for conditions where it would fail that true science could occur. I have noted this and have developed methods that work to minimise researcher bias (for example see the use of a Research Assistant in the meta analysis p. 138).

4.7 Conditions for theory testing

There is a further issue in finalising the research strategy: what are the determinants for the forming of a theory? Simply, it must make a prediction and that prediction must be falsifiable (Popper, 1963); this is established in this thesis on p. 123.

There has been debate surrounding management and organisational theory building. Much appears focused on what theory building actually is and whether many theories are actually theories at all (Bacharach, 1989; Edwards, 2010). Bacharach (1989) defines a theory as:

> "…A statement of relationships between units observed or approximated in the empirical world….[where] the primary goal of theory is to answer the questions of *how, when* and *why*, unlike the goal of description, which is to answer the question of *what*" (p. 498).

Bacharach (1989) further suggested observed units, measurable units, defined as measurable through the potential of a unit to hold two or more values, are considered to be variables and link to the development of an hypothesis; whereas units that cannot me measured, abstract concepts, such as culture, are considered to be constructs, which inform the building of propositions, not hypotheses.

Therefore, reflecting on the literature review (Chapter 3), I decided that my enquiry would lend itself more towards the discussion of constructs and propositions than variables and hypotheses (see p. 72). Bacharach (1989) also requires that a boundary incorporating values, time and space are included in the theory; an organisational or management theory needs to be able to convey an explanation, but it must also predict the outcome of its process, and to do this a theory must be able to move beyond description (what) to develop understanding through how and why.

Bacharach (1989) and Edwards (2010) suggested that a proposed theory must answer to two primary criteria, falsifiability and utility.

> "If researchers are to avoid wading through ever deeper piles of irrefutable statements disguised as theories, they must be able to discard such false theories. To be able to do this, they must try to construct theories that are coherent enough to be refuted" (Bacharach, 1989, p. 501)

In determining the credibility of a construct the onus is on the theorist to demonstrate convergent validity; multiple evidence sources, taken from different perspectives and collected by different means. This informs the need for triangulation in the research design (see p. 129). The theorist needs to adequately communicate the interrelated relationship between two or more constructs. Unlike with variables, there is no need to demonstrate dependency, only parsimony (Bacharach, 1989). Parsimony defined, using the principle of William of Ockham's Razor, as, "a principle that states that the simplest explanation that explains the greatest number of observations is preferred to more complex explanations" (Fastovsky and Weishampel, 1996, p. 437).

Bacharach (1989) furthered the requirement for propositional falsifiability through logical and empirical adequacy; being the adequacy of the relationships bound within the overall construct. In the first instance the relationship between constructs and the outcomes must not be seen as predetermined or guaranteed; secondly, there needs to be a clearly defined framework that demonstrates that the construct under scrutiny is required within the overall framework in order for the proposition to be true; in this way researcher can refute the claim by demonstrating that the stated outcome can exist without the existence of a particular construct within the framework, thereby opening the proposition to refutation. This has been considered in the methods selected for this research. Finally, these views have been brought together to inform the proposition introduced in the findings section (see p. 163)

4.8 Soft Systems Methodology

My choice of methodology was driven by the need for a multi-faceted mode of enquiry that bridged the registers of theory and practice, allowed for an iterative approach that converged with the chain of reasoning, as well as being accepting of a co-generative approach to research. Initially this appeared to be captured by Action Research (AR), with its iterative cycles of action, where one aspect of enquiry informs the next (Flood, 2001).

There was an extensive discussion with my PhD supervisors, regarding the use of Grounded Theory[4] as an appropriate methodology for the research. However, this did not fit with my view of the world and was dismissed; authors such as Cohen *et al.* (2007) have suggested there to be similarities between Grounded Theory and AR, but they also signposted significant differences; one departure being that Grounded Theory tends to leave the action to someone else, this does not align with my need to take action in addressing a challenge as I want to see the enquiry through to the operationalisation of a solution.

> "…The theoretical framework must be translated, or converted, to observable, confirmable components/elements. These components/elements can be in the form of, for example, confirmable propositions, hypotheses, empirical indicators, and/or so-called knowledge claims" (Lynham, 2002. P. 232)

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[4] Grounded theory is seen as the development or generation of theory by, "examining processes, making the study of action central, and creating abstract interpretive understanding of the data" (Charmaz, 2006, p.9) Charmaz, K. (2006) *Constructing Grounded Theory,* London: Sage

In exploring AR and systems thinking I arrived at Soft Systems Methodology (SSM). SSM is an AR process developed over the last 40 years by Checkland, Wilson, Jenkins and Rippen at the University of Lancaster, United Kingdom. It is a generic process that can be adapted to the situated needs of unstructured problems focused on Human Activity Systems (Platt and Warwick, 1995), which aligns with the OKM system domain (see p. 68-75).

> "[SSM] deals with "fuzzy" problem situations – situations where people are viewed not as passive objects, but as active subjects, where objectives are unclear or multiple objectives may exist" (Platt and Warwick, 19995, p. 19)

Platt and Warwick (1995) defined Human Activity Systems as, "a collection of activities, in which people are purposefully engaged, and the relationship between those activities" (p. 19). These systems are treated holistically and there is no attempt to apply a reductionist approach, where aspects of the system are treated in isolation, which fits with the overall view of the OKM system domain (see p. 68-75).

Platt and Warwick (1995), in their 25-year review of SSM, suggest that the most popular version of SSM is the Checkland (2000) Methodology, which comprises seven stages; though it is emphasised that this process is not rigid and is provided as a framework to be adapted according to situated need.

> **Stages one and two** are described as "the problem unstructured" and "the problem situation expressed" (p. 19); requiring the development of a 'rich picture' as a way of developing understanding of the presenting problem.
>
> **Stage three** is "the root definitions of relevant systems" (p. 19); requiring the uncovering of the systems' properties using the mnemonic CATWOE: Customer (beneficiaries of the system), Actor (system participants), Transformation, Weltanschauung (Worldview), Ownership, Environment). Stage three incorporates an important indicator for the enquiry into KM, being *Weltanschauung*, the German term for 'Worldview'.

> “Different individuals will perceive the same event in different ways according to their view of the world, based on their experiences, personality and situation. These different views result in inferences being made which are not explicit. However, these different views from different individuals must be appreciated and incorporated where possible” (Platt and Warwick, 1995, p. 20)

This reflects the issues emerging through the literature review, where the work of Mekhilef and Flock (2006) and Heisig (2009) (see p. 82) demonstrated there to be multiple worldviews in the OKM system domain. SSM guides the researcher to acknowledge these worldviews when attempting to resolve the presenting problem (Checkland, 2000). This further cements the suitability of SSM in answering the research question.

Stage four progresses to ‘deriving conceptual models’; this develops a model to represent the process activities and the relationship between those activities. Platt and Warwick (1995) stress that all aspects of CATWOE must be represented in the final model or the model is rendered incomplete.

Stages five and six, “comparing conceptual models with the real world” and “defining feasible, desirable changes” (p. 19). This brings a comparison between the conceptual model and the real world. The authors emphasise that processes that do not exist in the real world must not be removed from the conceptual model:

> “The conceptual model if constructed correctly, encompasses all the activities necessary for the emergent system. Removal of the activities from the conceptual model would result in those emergent properties being lost” (p. 20)

Instead, providing the findings of earlier stages have been approached with rigour, the missing real world activities can be seen as a gap that needs to be addressed in order to solve the problem at hand. This poses a problem for my research in that the development of a model in isolation will not allow for the complete analysis of what is a complex environment, signposting the need to develop a tool in parallel with the model that will stimulate trends of enquiry within the problem environment.

Stage seven is about 'taking action' where findings are applied and evaluated as part of an ongoing process. The caveat is that if this is not carried out the enquiry process can become a 'snap shot' of a problem embedded in the past. It is therefore necessary to ensure that the enquiry accounts for a reflective process that monitors and evaluates the changes to the environment brought about by the SSM process.

SSM appears to be relatively unchallenged as a real world problem-solving tool, but there has been some critique of the methodology, for example Schmidt and Carstensen (1990). This criticism is not based on the process, but on issues surrounding social systems, and the potential for multiple interpretations of Checkland's concepts, such as root definition. There is also disagreement with the terminology used by Checkland (2000); for example, Checkland asks the researcher to select the root definition of a relevant system. Schmidt and Carstensen (1990) state this to be a 'notional system' as the 'real world' system does not yet exist; though it could be debated that the system already exists and is awaiting discovery by the researcher. While this is interesting, and served to clarify any potential misinterpretation of meaning, it does not detract from the integrity of Checkland's approach. Further to this SSM aligns with hypothetico-deductive reasoning (Table 4.3).

Hypothetico-deductive Reasoning Step	SSM Stages	Research approach
Making an initial puzzling observation	**Stage 1:** The problem situation unstructured	**Literature review**
Using analogical reasoning to develop a theory	**Stage 2:** The problem situation expressed	**Meta-Analysis** **Survey** **Fractal analysis**
Develop a hypothesis on probation	**Stage 3:** Root definitions of relevant systems Stage 4: Deriving conceptual models	**Modelling and PIAT development**
Conduct the test	**Stage 5**: Comparing conceptual models with the 'real world'	**Case Study**
Compare predicted and	**Stage 6:** Defining feasible,	**Case Study analysis**

observed results	desirable changes	
Recycle the procedure until a hypothesis is generated, tested, and supported on one or more occasions and its competing alternatives have been tested and rejected	**Stage 7:** Taking action	**Discussion Chapter**

Table 4.3: Alignment of Checkland's (2000) SSM and Platt and Warwick's (1995) approach to Hypothetico-Deductive Reasoning

4.8.1 Triangulation

This Chapter has signposted the need for a range of methods to compare and contrast the views of the different data sets (for example, p. 124); this leads to corroboration or triangulation, which acts to strengthen the confirmability, dependability and transferability of the enquiry.

> "[Triangulation] offer[s] strategies for reducing systematic bias and distortions during data analysis. In each case the strategy involves checking findings against other sources and perspectives" (Patton, 2002, p.563)

I will employ several triangulation techniques, as described by Patton (2002), fulfilling he described as a "thoughtful, systematic triangulation" (p. 563) approach, which will be highlighted throughout the methods Chapter:

> ***Methods triangulation***, where qualitative and quantitative methods are used to provide a multi-dimensional snapshot of the phenomena; allowing for a comparative analysis of data sets and an illustration of convergence or divergence in the data.

> ***Triangulating data sources***, utilising multiple points of reference, gathered at different times, and from different sources; this can include comparing employee interview data with documentation, such as organisation policy and procedures.

Triangulating analysts, where multiple analysts are utilised to explore a single data set; allowing for the surfacing of convergence or divergence in findings.

Triangulation via participant review allows enquiry participants to provide reaction and feedback to enquiry findings.

> "Researchers can learn a great deal about the accuracy, completeness, fairness and perceived validity of their data analysis by having people described in the analysis react to what is described and concluded. To the extent that participants in the study are unable to relate to and confirm the description and analysis in a qualitative report, questions are raised about the credibility of the findings" (p. 560)

Expert audit triangulation, external subject matter or methodological experts audit or peer review research findings in order to increase credibility.

Audience review triangulation allows for the 'face-validity' of a report to be tested through the reactions of the intended audience and focuses on the connection between the research and how the audience relate it to their view of the world.

4.9 Chapter conclusion

This Chapter has set out my research strategy as a way to guide the reader through the decision-making process that has led to the selection of SSM in response to the research question. This leads to the selection of appropriate methods to populate the various stages of SSM.

Chapter 5: Methods

5.1 Meta-Analysis (systematic literature review and document analysis)

The meta-analysis corresponds to Stage 2 of Checkland's SSM, as set out in Table 4.3 (p. 128). My intention is to probe the application of OKM in organisations in order to identify common constructs that exist across OKM systems that are designed to coordinate knowledge resources. I recognised the need for a method that would provide breadth and depth for my enquiry (see p. 99) which Patton (2002) (see p. 114) signposted as a necessity for capturing the dynamics of a complex system, as is the case with OKM (see p. 68-75).

> "Meta-analysis refers to the analysis of analyses…[it] refer[s] to the statistical analysis of a large collection of results from individual studies for the purpose of integrating the findings. It connotes a rigorous alternative to the casual, narrative discussions of research studies which typify…attempts to make sense of the rapidly expanding research literature. (Glass, 1976)

The strength of the meta-analysis is dependent on the breadth and depth of the literature included, linked to the systematic literature review and the method for exploring heterogeneity in the data sample (Crombie and Davies, 2009). The approach allows the researcher to identify convergence or divergence within a sample from a single domain; it is interpretive and relies upon rigour in the underpinning methods (Paterson *et al.,* 2001).

This was implemented in this research by using a systematic review of literature, incorporating a thematic document analysis method (Fereday and Muir-Cochrane, 2006), which is then quantified as a means to communicate the frequency of occurrence, as opposed to meaning of functions and variables (Glass, 1976). I believed this approach would identify common constructs that exist in OKM systems across sectors and geographic locations. This approach was subjected to peer review, where a publication (Griffiths and Evans, 2011) was submitted to the Journal of European Industrial Training and feedback was received, requesting clarification as to why this method was selected, when "another form of data reduction (factor analysis) is perhaps more appropriate" (reviewer comment, communicated via email, August 2010).

Some methods, such as factor analysis, do not fit with my research strategy. For example, factor analysis is used as a regression tool to identify linear relationships, or cause and effect, between variables (Brown, 2006); this is more appropriate in considering knowledge processes at the technical end of the KEn Diagram (see p. 26). However the continuum incorporates varying degrees of complexity, where constructs begin to interact in a non-linear manner (see p. 68-75) and it is not possible to identify dependent/independent variable relationships. This limits the effectiveness of factor analysis in this enquiry domain.

5.1.1 Document Analysis

Document analysis was employed as part of a systematic framework through which to derive data from text-based artefacts, in electronic or printed form. There are five aspects to this approach, which are all relevant to my research: documents can provide context; they can suggest direction for research questions and observations; documents can be used to provide additional or complimentary data; they can provide an evidence chain for change or development processes; and they can be used to triangulate data collected from other sources (Bowen, 2009).

Document analysis is efficient, more a method of 'data selection' than 'data collection' that contributes to academic rigour as much of the data is now in the public domain, opening the research to replication; it is also stable, exact, cost-effective and enables a breadth of coverage, that is not available through other methods (Bowen, 2009). Dew (2006) corroborates this, but stressed the cultural and historic bias of the researcher, or selectivity bias, that could impact data selection; I have attempted to overcome this in my research through the breadth and depth of document selection and by employing a mixed sampling strategy (probability and non-probability). Dew (2006) also posited that documents are embedded within their own social, historical and cultural processes, which could provide interpretation challenges for the researcher. My research addressed this through the coding protocol, which creates groupings of terms that share meaning; I then confirmed this through expert-triangulation.

5.1.2 Data collection framework

Bowen (2009) cautions that where rigorous data collection frameworks are not put in place it can impact the credibility of the findings. Issues include: *Insufficient detail*, or completeness, linked with lack of *comprehensiveness*, where documents do not provide enough detail to answer the research question or do not cover the context of enquiry in sufficient detail; lack of *retrievability*, where documents cannot be accessed or are blocked; *biased selectivity*, where documents are biased towards the views of the researcher. My research acknowledged these challenges and, where appropriate, I developed a strategy to mitigate them; for example, documents were not used if they did not provide sufficient detail (see p. 136) and I attempted to overcome biased selectivity through a mixed probability and non-probability sampling strategy (see p. 135).

My research uses a document analysis approach that is described by Fereday and Muir-Cochrane (2006) as *thematic*, which is used as a means to explore patterns emerging from within the data pool through scrutiny of the text.

> "The reviewer takes a closer look at the selected data and performs coding and category construction, based on the data's characteristics, to uncover themes pertinent to the phenomenon" (Bowen, 2009, p. 32)

The researcher is required to overcome issues of bias and demonstrate an ability to react to subtle changes in order to capture the essence of the data and the emerging pattern it may represent; this was achieved in my research via a review process (see p. 137-8). I also noted that researchers are required to interrogate a broad sample of documents; while there is no set parameters for the number of documents that are needed for any given data pool, the focus should be on quality through breadth and comprehensiveness of the sample (Bowen, 2009).

5.1.3 Sampling parameters

I decided to utilise the six-discipline framework formulated by Mekhilef and Flock (2006) for the literature review (see p.64). I believed this would allow me to determine the potential for commonalities in OKM systems against a previously published and tested method. However, there was difficulty here, as the definitions applied by Mekhilef and Flock (2006) to each of the disciplines, were not available. I attempted to contact the authors via email, but no response was received, requiring me to apply my judgement in developing my own working definitions for the disciplines (presented in full in Appendix 1).

There were problems with this method, in terms of apportioning documents to the sample, in aligning business sectors with Mekhilef and Flocks (2006) categorisation, and later with people self-selecting their position within the framework as part of the survey (see p. 296), but this did not appear to impact the findings. Though the framework does not allow for wider considerations in terms of sectors, for example, agricultural-businesses (see p. 61), the tight parameters assist in framing the data collection for this study, whilst providing scope for future research to explore any deficiencies in the category selection process.

5.1.4 Sampling strategy

I used a quota sampling strategy (Patton, 2002), to ensure a breadth of coverage. Taking into account the views of Bowen (2009) (see p. 132), a minimum of 40 pieces of literature were targeted to populate each category of Mekhilef and Flock's (2006) OKM disciplines (see p. 64); using a mixture of probability and non-probability methods (see p. 135), within a time period between 1900 to 2008 (the latter being the year my research started), in an attempt to investigate whether findings were emergent or stable through time.

The study was populated, using 84 search terms (see Appendix 2), with literature accessed via academic and public search engines, including: Academic peer reviewed articles; professional journals, company blogs; bulletin board articles;

presentations; newspaper and magazine articles; books; white papers; reports; white papers; company presentations and job adverts. This meets the requirements of Crombie and Davies (2009) (see p. 131).

I took geographic location into consideration, to account for potential weaknesses in previous OKM research, but I decided that the review should not force findings through equal representation according to location, as this could be problematic when considering access to literature from regions such as China and the Middle East. However, I did ensure that my search criteria included geographic signifiers. I did this in an attempt to represent cultural variation that could emerge within OKM systems (Bhalla and Lampel, 2007); and as a lesson learned from Holsapple and Joshi (2004) (see p. 89-90), where I posited that a failure to engage with a global view potentially disrupted the application of their findings.

To minimise selectivity bias I employed elements of randomness within my literature selection process (Tranfield *et al.,* 2003); non-probability sampling is a positivist approach, whereas purposeful sampling is more directed towards the social sciences (Patton, 2002). For example, where search engines such as Google Scholar, Google and The Brint Institute Portal, provided multiple returns, a random number generator was employed (www.randomizer.org). I applied this approach to select 50% of the articles from any given search page, selecting 81 aspects of literature (32% of the study); this was only possible for 32% of the study as much of the academic literature in my sample was researched through academic bibliographic databases, encompassing a broad variety of disciplines, which required me to hand select the articles (Patton, 2002). Given the case for mixed-method (see p. 115) I did not see this as a concern.

5.1.5 Coding Protocol and Scoping Study

I conducted a scoping study in July 2008 to establish a coding protocol, using Fereday and Muir-Cochrane's (2006) six-stage coding framework: Develop a coding manual; test the reliability of the codes; summarise data and identify initial themes;

apply template of codes and additional codes; connect codes and identify themes; corroborate code themes.

> "A 'good code' is one that captures the qualitative richness of the phenomenon. Encoding the information organizes the data to identify and develop themes from them…. [A] theme [is] a 'pattern in the information that at minimum describes and organises the possible observations and at maximum interprets aspects of the phenomenon' (Fereday and Muir-Cochrane, 2006, p. 4)

My scoping study encompassed 60 pieces of academic literature (Table 5.1, see p. 137) from which, using thematic analysis, I developed 312 coding descriptors (Appendix 3). A preliminary grouping of terms within the coding protocol suggested 15 OKM CSFs (see Table 5.1). I submitted these findings for feedback to the Vice Principal for Knowledge Management at the University of Edinburgh (PhD supervisor), the Director of Quality for the University of Edinburgh (PhD co-supervisor) and a research lecturer at the University of Edinburgh, with a specialism in this method, with no challenges being made.

To address the possibility of selectivity bias (see p. 132), literature that I used in the scoping study, which could have been used to 'fit' meta-analysis outputs to the preliminary findings, was excluded from the main enquiry.

Addressing the concerns of Bowen (2009) (see p. 132), I screened both the scoping and main study documents to filter returns of insufficient length or detail; this was a particular issue when accessing blogs and bulletin boards. I also screened out literature if it did not directly address the management or utilisation of knowledge for operational purposes in an economic context. I found that search returns often straddled disciplines, which was the case in 6% of the total literature sampled. Where this occurred I used personal judgement to determine the primary focus of the article (see discussion on this in Chapter 7).

Identified Construct	**Source**
Creating Knowledge	Amidon and Davis (2004); Alavi et al. (2001); Nonaka et al. (2001); Sarah and Haslett (2003); Roth (2003); Watson and Hewitt (2006); Armstrong (2006); Gerber and Oaklief (2000); Chowdhury (2006); Kulkarne et al. (2006); Argyris (1982)

What Is Known	Roth (2003); Watson and Hewitt (2006); Armstrong (2006); Gerber and Oaklief (2000) Chowdhury (2006); Kulkarne et al. (2006); Argyris (1982); Davies et al. (2005); Goodyear and Zenios (2007); Leonard (1999); Lundvall (2006); Antonacopoulou (2006)
Extending What Is Known	Roth (2003); Watson and Hewett (2006); Armstrong (2006); Gerber and Oaklief (2000); Chowdhuty (2006); Kulkarne et al. (2006); Argyris (1982); Antonacopoulou (2006); Cook and Brown (1999); Lundvall (2006)
Reflection	Clegg (2000); Stewart (1998); Argyris (1982); Sarah and Haslett (2003); Roth (2003); Goodyear and Zenios (2007); Alavi et al. (2001); Hedlund (1994)
Context	Nonaka et al. (2001); Bhatt (2000); Fulop and Rifkin (1999); Jennex and Olfman (2004); Antonacopoulou (2006); Roth (2003); Alavi et al. (2001); Gerber and Oaklief (2000)
Motivation	Nonaka et al. (2001); Kakabadse et al. (2003); Bhalla and Lampel (2007); Rigby and Gillies (2000); Smith (2003); Jennex and Olfman (2004); Hall (2001); Kulkarne et al. (2006); Garavan et al. (2000); Antonacopoulou (2006); Edwards and Rees (2006)
Sharing	Clegg (2000); Kakabadse et al. (2003); Fukuzawa (2007); Nonaka (1991); Kulkarne et al. (2006); Sarah and Haslett (2003); Watson and Hewitt (2006); Smith (2003); Leonard (1999); Cloke and Goldsmith (2002); Garavelli (2002); Chen and Huang (2007); Iftikhar et al. (2003); Goodyear and Zenios (2007); Cook and brown (1999); Van der Ridder (2004)
Culture	Clegg (2000); Stewart (1998); Nonaka et al. (2001); Bhatt (2000); Kakabdse et al. (2003); Chen and Huang (2007); Sharkie (2003); Amidon and Davies (2004); Davenport 91995); Smith (2003); Gold et al. (2001); Kulkarne et al. (2006); Roth (2003); van Merrewijk (2004); Leonard (1999); Antonacopoulou (2006); Van de Hoof and de Ridder (2004); Chowdhury (2006)
Organisational Structure	Sharkie (2003); Boxall 91996); Boxall and Steenveld (1999); Chen and Huang (2007); Gold et al. (2001); Frank (2001)
Spaces	Bhalla and Lampel (2007); Sarah and Haslett (2003); Fulop and Rifkin (1999); Smith (2003); McKenzie (2008)
Capturing and Storing Knowledge	Bhalla and Lampel (2007); Fulop and Rifkin (1999); Jennex and Olfman (2004); Antonacopoulou (2006); Sarah and Haslett (2003); Alavi et al. (2001); Cook and Brown (1999); Clegg (2000); Lundvall (2006)
Artefacts	Bhalla and Lampel (2007); Fulop and Rifkin (1999); Jennex and Olfman (2004); Leonard (1999); Rutkauskiene (2006); Snowden (2004); Clegg (2000); Cook and Brown (1999)
Communicating	Fulop and Rifkin (1999); Jennex and Olfman (2004); Snowden (2004); Roth (2003); Nonaka (2000)
Catalysts	Kakabadse et al. (2003); Jennex and Olfman (2004); Roth (2003); Gold et al. (2001); Goodyear and Zenios (2007); Davies et al. (2005); Leonard (1999); Iftikhar (2003); Kulkarne et al. (2006)
Using Knowledge	Sarah and Haslett (2003); Gold et al. (2001); Antonacopoulou (2006); Roth (2003); Cook and Brown (1999); Goodyear and Zenios (2007)

Table 5.1 Original scoping study sample pool

My research continued the thematic analysis after the scoping study. During the meta-analysis I conducted a review after 50 articles had been coded and identified an anomaly, an emerging theme that had not initially been identified, ‘Knowledge Structure’, which justified my decision to persist with thematic analysis in the main study. I then extended the coding protocol to 386 descriptors (Appendix 3), and a 16th construct was established (see 185-188). I again submitted the protocol to the original coding panel for verification and I also shared this ‘final’ version with KM practitioners, through forums and publications detailed in the research outputs (Appendix 12), with no challenges being received, beyond those detailed and addressed in the discursive conclusion (Chapter 7).

Finally I needed to break down the findings of the study to determine whether results of the investigation were OKM system functions (providing broad purpose for the system) or constructs that organised within the system. To determine this I devised a test: if findings could be broken down via the literature to separate constructs, I considered them to be 'functions'. If not, I considered them to be 'constructs'. Thus, *Knowledge Creation* was identified as a function as, based on literature, it could be distilled to constructs such as '*What is known', 'Extending what is known', 'Motivation', 'Context'* and *'Reflection'* (see p. 190-191).

5.1.6 Mitigating bias in the meta-analysis

Being a sole researcher, I considered the potential for error in my data. Therefore I employed an independent Research Assistant (RA), a graduate with experience in coding and data analysis, to sample 28 aspects of my literature coding (10% of the study). This secondary review identified 3 coding descriptors that I used that could not be identified by the RA, and 1 descriptor that I had not included in the findings. This was generalised to an error rate of +0.30% and -0.911%, which, when presented to my PhD supervisors, was not considered to have a significant bearing upon the credibility of the findings.

5.2 Meta analysis of existing models

Having established functions and constructs that exist within OKM systems, I needed to contrast my meta analysis findings against existing models. I needed to do this as I did not believe it appropriate to suggest a new model if I could demonstrate that an existing model existed that responded to the constructs identified in my initial meta-analysis; this builds upon SSM Stage 2 enquiry (Table 4.3, p. 128). It was not possible for me to analyse all OKM system models available to organisations, and therefore I selected a broad sample to minimise researcher selectivity bias. I utilised a randomly selected sample of existing theoretical and conceptual OKM models and frameworks.

Models were selected against the three categories identified by Jennex and Olfman (2004)(see p. 90): Computer programming processes, related to data and information management, were not included as I considered them to be IT architecture processes that did not align with the context of the knowledge domain as described in the KEn Diagram (see p. 26). I replicated methods utilised in the initial meta-analysis (see p. 131), with the following departures.

The sampling strategy was dictated by the popularity of models according to search engine algorithm returns. I believed that this approach would best represent the models being utilised at the time of the enquiry; accepting that models located beyond the front page of the search engine return would, by the nature of the search engine algorithm, be more discrete. My assumption being that this approach, coupled with a probability sampling method, where the random number generator selected all models in the sample, would capture a wide range of models, past and present. I utilised Four search terms to generate returns: “KM model”, “Knowledge Management model”, “KM framework” and “Knowledge Management framework”. I did not use search terms for general organisational systems models as I wanted to access models specifically designed with OKM systems in mind.

I again used document analysis and the list of OKM models accessed for my research can be found in Appendix 9; one difference during this phase was that I was no longer attempting to identify initial patterns and therefore frameworks were compared against the original coding protocol to determine whether the conditions that surfaced in my original meta-analysis appeared in each text; giving a yes or no value to each construct (Bowen, 2009).

In order to continue to test and progress the findings of the initial meta-analysis, I continued to look to identify constructs in existing OKM models that could not be linked to the functions and constructs identified in my initial meta-analysis, with none being found.

5.2.1 Framework for Model Assessment

I analysed the first 10 OKM models and frameworks within the sample and discovered a challenge to the analysis. I found there to be problems with clarity and redundancy, where my analysis demonstrated that models failed to display all of the functions and constructs discussed in the supporting text, or, issues of redundancy where, for example, models highlighted self-similar constructs, such as *communication* and *conversation*. This was in conflict with the criteria for what constitutes a good model (see p. 93-97); for example, models should also be *comprehensive, complete, correct, conflict free, lacking in redundancy, useful* and be transmitted in a way that demonstrates *clarity* and *conciseness* (Shanks *et al.,* 2003).

I realised that criteria were needed in order to identify an effective construct in the event that a model or framework identified all 16 aspects of the original meta-analysis. I therefore decided to use the criteria put forward by Rasli (2004) (see p. 94): 'Comprehensiveness', 'Correctness', 'Usefulness', 'Clarity' and 'Conciseness', for the ease of understanding of the framework.

5.3 Survey and fractal analysis method

While the meta-analysis was designed to be rigorous in process, I was concerned about utilising a single research method when a complex phenomenon has been said to require a deep multi-faceted enquiry (Chapter 3). I also believed there to be a need to engage with practitioners more directly, in order to fully capture OKM in practice, and, from there, I wanted to be able to explore convergence and/or divergence in datasets. This led me to explore surveys and fractal analysis, the latter being a way to bring visibility to potential patterns that existed within the data. This latter approach appeared to be rare in OKM research, with no other examples of this being found within the literature utilised in my research. I felt that this responded to the needs of my research, based on the need to identify commonalities across OKM systems and the reasoning design put forward in Chapter 3 (see p. 121)

5.3.1 Descriptive Survey

For this aspect of SSM Stage 2 enquiry (Table 4.3, p. 128) I utilised a descriptive survey, using the Bristol Online Survey tool (www.survey.bris.ac.uk); comparing the findings from it against my meta-analysis data as part of a concurrent triangulation strategy.

Descriptive surveys seek to report on the current views of a population as to 'what' a phenomenon is, or looks like; as compared to inferential surveys that attempt to determine relationships between variables as part of a reductionist method to determine cause and effect (Burns and Bush, 2010). As discussed in Chapter 4, I have not employed methods designed to look at cause and effect relationships.

> "We knew that human behaviour was rarely if ever directly influenced or explained by an isolated variable; we knew that it was impossible to assume that any set of such variables was additive (with or without weighting); we knew that complex mathematics of the interaction among any set of variables was incomprehensible to us. In effect, although we knew they did not exist, we defined them into being" (Deutscher, 1970, p. 33)

This aligns with the discussion on theory building (see p.123) and the need to determine logical adequacy through coherence between the views of different data sets. It also allows for meaning to be explored within quantitative data and findings from both methods can then be interpreted, and areas of convergence or divergence explored (Gilbert, 2006). I decided to utilise an eight-step survey method developed by Cochran (1977) for my research, due to its clarity in relation to my research objectives:

- Determine the objectives of the survey
- Define the population
- Determine the data to be collected
- Determine the degree of precision required
- Determine the survey format
- Divide the population into sampling units
- Determine survey administration
- Summarise and analyse findings

5.3.1.1 Sampling strategy

My survey was Internet based, accessed by a Universal Resource Locator (Alvarez *et al*, 2003), and hosted by Bristol Online Survey; I chose this approach for its recognised potential for “low costs, rapid turnaround [and] access to a vast geographical pool of potential respondents” (p. 23). This was relevant due to time and cost restraints and the need to look at OKM system constructs across sectors and geographical locations.

It was not possible for me to know the number of people in the world with OKM experience, or engaged in OKM activity, and who have access to the Internet. This ruled out the potential for a probability based sampling strategy. Instead, due to the unknown nature of an Internet based sample pool, I used self-selection. There are three Internet survey variants: Entertainment, Self-Selection and Volunteer survey pools. Entertainment surveys are not scientific and therefore I dismissed it; Volunteer survey panels exist where people volunteer to take surveys and a sample is drawn from the ‘panel’ for particular surveys, which is not appropriate in this case; I chose self-selection as it is a process where respondents choose to participate in the survey according to their affinity with the subject matter (Alvarez *et al.,* 2003; Patton, 2002).

There is a need to ensure that the respondents are drawn from the population of interest, where an unknown sample could bias results (Wang and Doong, 2007). This could bring about ‘coverage error’, where the sample does not represent the population that I wish to hear from; further to this there could be issues where the target population does not have access to the Internet, access could be blocked during work hours, or they are not exposed to the survey announcement or survey tool (Alvarez *et al.,* 2003).

I attempted to mitigate these challenges by publishing the survey link through repeated postings across practitioner bulletin boards and social networking sites; for example, Facebook, LinkedIn and Gurteen Knowledge. My strategy to mitigate the risk of coverage error is discussed in the next section.

5.3.1.2 Improving survey rigour

There is the challenge that, “Non-probability Internet surveys are not based on rigorous sampling procedures, raising concerns about the validity of inferences drawn from them” (Alvarez *et al.,* 2003, p. 12). I therefore screened respondents through an opening question: “Are you familiar with the field of KM either in theory or practice?” (See Appendix 4 for the survey question set). I then expanded the line of questioning to determine the respondent’s level of experience, but I did not collect information regarding job title, as OKM-related job titles are subject to cultural/sector bias (Alstete and Halpern, 2008) and I did not believe that the data gathered would add benefit to the survey findings.

However, my data could still be seen as being based on trust, in that the respondent is actually telling the truth and therefore I used a secondary form of verification. Using the previously mentioned RA, 15% of respondents were selected by random number generator and contacted by email, and, where possible, by telephone to verify their responses; limitations of time did not allow for verification of all respondents. Contact was made with 14 respondents (9 by email and 5 by telephone), who were asked to describe their response to Q8 (Appendix 4), “Using no more than a couple of sentences, provide your definition of KM”. All respondents were able to engage in a conversation around the concept and no apparent challenges to the validity of the data were identified, which, while a limited sample, suggests that the data are credible.

The RA also asked a pre-qualifying question, under conditions of anonymity, relating to the respondent’s organisation and their role within that organisation in relation to KM activities, this information was withheld from me in order to avoid potential bias, where the respondent’s views of their organisation and their OKM systems could be revealed to a greater extent than other survey respondents not contacted by the RA.

5.3.1.3 Survey protocol

In accordance with ethical guidelines, set out by Baxter (2010) and Wang and Doong (2007), survey respondents received a full disclosure of the nature of the survey, its intended use and the guarantee of anonymity within the published findings (Appendix 5). In accordance with issues raised by Wang and Doong (2007), IP addresses were not used, where identity of the respondent might be revealed; instead voluntary consent was requested through the provision of an email address. Respondents were warned that a failure to provide an email address might render their responses invalid and their data might not be used in the analysis phase. Email addresses were screened for duplication and I sent an email, thanking respondents for their contribution, with all non-functioning addresses being removed from the sample.

5.3.1.4 Survey tool design

Questions (Appendix 4) were directly informed by the findings of the meta-analysis to minimise my bias upon the question set.

My survey utilised a mixed-method framework, presenting questions in a staged design; heeding advice from Wisker *et al.* (2003), who suggested that depth of understanding and research rigour, could be obtained through this approach.

Albaum (1997) suggested that quantitative surveys look to acquire data on disposition (positive or negative) or strength of feeling towards a particular statement. The quantitative aspects of the survey utilised a five-point Likert scale. I asked respondents to provide a response based on strength of feeling towards a given statement: For example, Questions 11a required responses to statements using a 5-point Likert scale (Strongly agree; agree; neither agree or disagree; disagree; strongly disagree): "Capturing and Storing knowledge is a key function of KM[5]". Albaum (1997) suggested that there is subjectivity in the intensity of a given response towards an extreme, point 1 or 5, and the subsequent marginal ratings of 2 or 4. In other words, the survey cannot explain why a respondent does not, for example,

[5] A definition of the term 'Key' was provided to survey respondents: "Key, in the context of this survey, is defined as being critical or core to the KM process"

strongly agree with a statement, instead only choosing to agree. Albaum (1997) also posited that the conviction of a respondent towards a given statement is complex and difficult to capture, which could be seen as a weakness in using a Likert scaling approach, the authors believing that it is not possible to determine how firmly a given attitude is actually held by the respondent.

I addressed these concerns by applying a "comment" option to the 19 Likert scaled questions, allowing respondents an opportunity to clarify their answer. Open-ended questions were also asked in order to gain a greater depth of understanding from respondents (Wisker *et al.* 2003).

I looked to analyse responses by location, experience of OKM, and discipline; employing the six disciplines utilised by Mekhilef and Flock (2006) (see p. 64), which harmonised with the meta-analysis. I also decided that data would be analysed by combining the responses at the ends of the Likert scale (for example, combining responses 1 and 2), as I was not focused on the intensity of feeling towards statements, but whether they agreed, disagreed or held no opinion. I did consider collapsing the scale to only three-points: agree, no opinion or disagree. However, Allen and Seaman (2007) suggested that it is better to allow a wider choice for response, as opposed to attempting to force the respondent into a negative or positive stance, the concern being that this lack of comfort could lead respondents to choose a 'comfortable' middle ground. Allen and Seaman also state that it is reasonable to collapse the data during the data analysis phase.

5.3.1.5 Survey pilot

To improve the measurement instrument and strengthen the credibility of the data collected, I piloted my survey to test issues of language, structure and coherence (Wang and Doong, 2007). Wang and Doong (2007) recommend surveys be piloted in their online format as well as a paper version, their rationale being that the two different mediums might provide differing results. I piloted my survey using five online and five paper-based respondents, and no differences were found.

My survey was live for a period of 90 days; links were posted on both open and subscription-only OKM sites around the world, such as the NASA KM Listserv; The Gurteen Listserv; Chartered Institute of Personnel and Development KM group on Facebook and practitioner Listserv tools based in India and Australia.

5.3.1.6 Cronbach's Alpha Test

Although my survey tool is descriptive, I utilised Likert scale questions to measure the strength of a respondent's agreement with findings from the initial meta-analysis. Therefore, to assure the reliability of the survey tool, I tested the nineteen quantitative driven questions within the survey for internal consistency by running Cronbach's Alpha using the SPSS software package.

> "Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability" (Santos, 1999, www.joe.org)

What Santos (1999) is suggesting is that the reliability of the survey, as a whole construct, needs to be tested, where the survey tool is tested for internal consistency in scaling. Cronbach's Alpha tests the underlying construct for stability in response, where the survey as a construct becomes the hypothetical variable under scrutiny. Santos stated, "it is very important to know whether the same set of items would elicit the same responses if the same questions are recast and re-administered to the same respondents" (www.joe.org).

SPSS returned a reliability finding of 0.884 on my nineteen Likert scaled questions. The integrity of Cronbach's Alpha was retained through all nineteen questions with Alpha varying between 0.871 and 0.889 according to the question deleted – a score of 0.7 or greater is regarded as an acceptable reliability coefficient (Santos, 1999), suggesting that my survey is reliable.

5.3.1.7 Respondent Feedback

I asked respondents a question in the survey, "Did you feel comfortable with the survey format?"; 88% of respondents stated they were comfortable. Comments included: “Good survey, we need knowledge sharing to solve the complex problems we are creating” and “this is a very comprehensive survey and I like the way the material was presented”. Five negative comments (5% of respondents) included: “I doubt such surveys contribute to our understanding of knowledge in organisations” and “Very presumptive. You have a preconceived notion of what KM is, but you haven't stated it”.

This last comment, while an outlier, can be addressed. I did not make my underlying assumptions explicit to the respondents, as I wanted to protect them from bias that could be elicited through the provision of a definition that might have influenced the respondent’s personal view of OKM activity. Also, it has been argued that all surveys have an underlying assumption that they are attempting to test, where researcher bias cannot be truly avoided as the researcher chooses which questions are to be asked in the first place (Patton, 2002).

5.3.1.8 Coding and Reliability

I hand-coded the qualitative responses, using the coding protocol established for the meta analysis – I did consider NVIVO, but I decided not to use it during the meta-analysis due to issues with the accuracy of imported documents in PDF format; therefore, for consistency, I used the same qualitative data analysis method throughout my research.

In order to enhance the reliability and confirmability of my research, I used the previously mentioned RA to contact 10% (nine) of the survey respondents by email to determine whether the survey questions had been understood and whether their comments were being interpreted correctly. Five responses were received, and these respondents were interviewed by telephone by the RA; conversations were recorded through hand written notes taken at the time of the interview. The following is an example of the process:

> **RA**: “What is your understanding of question 13d, ‘Technology is required to make KM work’”?

> **Respondent V2**: "I thought it meant that KM requires things like intranets or discussion boards for it to work effectively" (Respondent, GS0811)

Additional comments were not solicited at this time and no issues were recorded that brought into question the credibility of my survey data.

I also wanted to explore the susceptibility of the field to incomplete information; this was suggested Chapter 3, in the discussion on the 'completeness' of OKM system models (see p. 75-82) and the ability of the user to recognise the weaknesses in their design. My rationale was informed by my initial meta-analysis findings, where, on average, only 10 of the 16 functions or constructs identified were present in any single piece of literature. Therefore I omitted two constructs from survey questions concerning opinions on constructs and functions identified in the meta analysis of literature (see p. 183), '*Context*' and '*What Is Known'*, which I chose using a random number generator to negate researcher bias: '*Context*' had a meta-analysis average of 69% and a *Business and Management* average of 71%, '*What is Known'* had a meta-analysis average of 80% and a *Business and Management* average of 67%. I designed this omission to afford respondents the opportunity to reflect upon OKM processes and point towards gaps in the survey's thinking. This was achieved by asking two questions: "14. Do you believe anything has been missed from the list above?" and "14.a**.** If you answered 'yes', what do you believe is missing?"

5.3.2 Fractal analysis

I wanted to find a way to visualise converging or diverging patterns in my meta analysis and survey data. This led me to the concept of fractals and self-similarity in complexity and chaos.

It has been suggested that even within chaotic, non-linear adaptive systems, patterns can develop (Mandelbrot, 2002; Taleb, 2007; Hoverstadt, 2008). In other words, apparent disorderly and chaotic systems develop forms of structures at different levels of granularity (Thietart and Forgues 1995). This phenomenon was addressed by Mandelbrot (2002) who introduced fractals as a way to look at irregular geometric shapes that did not conform to the smooth nature of natural science mathematics.

Fractals are visualisations of holistic phenomena, where self-similar patterns can be identified between the whole, the individual and all the layers between (Mandelbrot, 2002). Some theorists have also referred to this link between the individual and the whole as, "scaling" (Taleb, 2007). Bearse (1999) noted:

> "That which is smaller or lower-level, is essentially similar to the macrocosm, that which is larger and/or higher level….[and] the dynamics of development are such that the macrocosm springs from and is grounded in the microcosm, not the other way around" (p. 1)

This aligned with my view of OKM, in that the dynamic patterns inherent within situated models could have affinities that could be replicated at increasing levels of abstraction away from the 'situation' to form a general model. Cross (2004) found fractals to be, "particularly helpful for exploring issues of diversity and hybridity and the spaces where official and unofficial discourse interact" (p. 1). This is relevant given the diversity of the organisational knowledge resource environment (Figure 1, p. 26).

Fractals do not simplify as one moves from the general to specific level (Mandelbrot, 2002; Dimitrov and Fell, 2007). They are said to have logic of replication through the scales rather than logic of simplification (Thietart and Forgues 1995). In fact, because the whole emerges from the individual components, the general level can appear fuzzier than the specificity of the individual levels (Abbott, 2001). This lends itself to addressing the issues being experienced by OKM, where a general model can be seen as non-specific to the situated environment of the organisation. However, self-similarity suggests that the governing variables remain the same, but the applied strategy will vary according to context. Taleb (2007) supports this, noting that Mandelbrot Fractals are self-affine, meaning that the layers have affinity, as opposed to the precise resemblance suggested by self-similarity. Affinity, as originally suggested by Mandelbrot (2002), suits the nature of fractals in the context of OKM. However, Taleb (2007) noted that 'self-similarity' has been merged to take on the meaning of affinity as Mandelbrot had difficulty communicating the nature of affinity over similarity and therefore 'self-similarity' is utilised in my research.

My use of fractals is not unique, being used by theorists such as Hoverstadt (2008), who observed organisations as complex adaptive environments that are fractal in nature, where operational units are self-similar but existing with different purposes. This use is not restricted to theory, the North American Aurosoorya organisation used fractal theory to demonstrate, "a level of organisational dynamics…that is unavailable with the use of conventional organisational seeing and thinking" (www.aurosoorya.com).

5.4 Model Building

In progressing to Stage 3 of SSM (Table 4.3, p. 128) I needed to consider an underpinning method for the construction of a model for testing. The following details the construction of my model, the Knowledge-Core, and supporting materials, which are then taken forward into a Case Study. My model is fore-grounded as a reference point for the knowledge and understanding that informed the design.

5.4.1 The K-Core Model

The Knowledge-Core (K-Core) (Figure 8a through 8c, p. 151-152) is a visual representation of the research findings, built upon Chapter 3 (p. 94) and taking into consideration the design challenges and requirements outlined in section 5.4.4 (p. 156).

> "Too often...models are built without the benefit of explicitly naming the assumptions and underlying theories of change. This omission can help explain why tremendous conflict, even chaos can erupt during program development, planning and implementation, or assessment" (Knowlton and Phillips, 2009, p. 36)

The K-Core model is driven by the findings, in that my meta-analysis of models demonstrated there to be a lack of completeness in current thinking. This 'lack of completeness' conflicts with the Law of Requisite Variety (see p. 74): "if a system is to be stable the number of states of its control mechanism must be greater than or equal to the number of states in the system being controlled" (Ashby 1956, p. 207); this affords strong currency to an argument in favour of the development of a new model. The model is presented in three parts: Figure 8a shows the K-Core as it would sit in an organisational environment, the input being the organisational need and the output being value, driven by the coordination of its functions and constructs (Figures 8b and 8c). Figure 8b shows the construction of the K-Core 'cone', it is four sided and incorporates the four OKM functions taken from my findings. Figure 9c illustrates a cross-section of the internal OKM system, incorporating the twelve constructs, framed by the four functions. The key provided with Figure 8c relates to abbreviations used in this Figure.

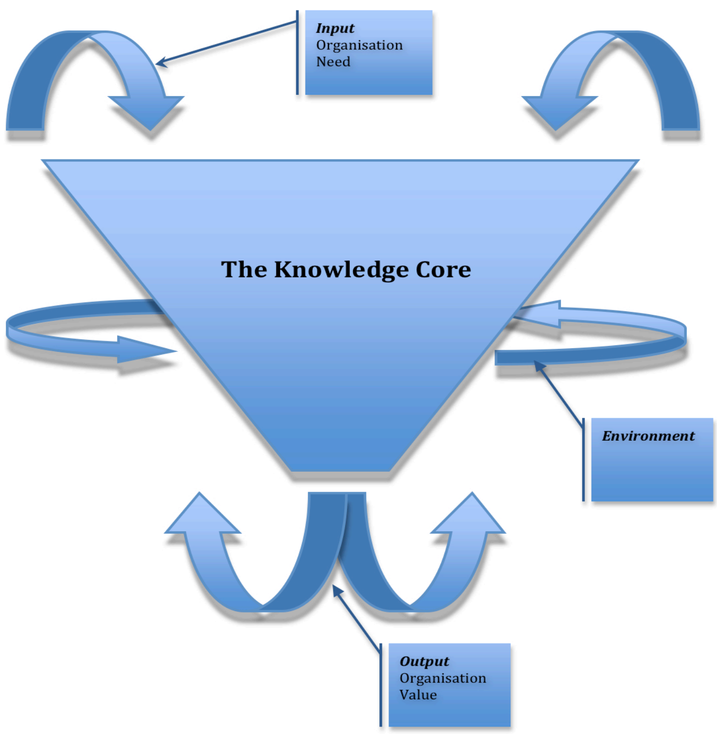

Figure 8a: The K-Core Model 'external' view (Griffiths *et al.* 2010)

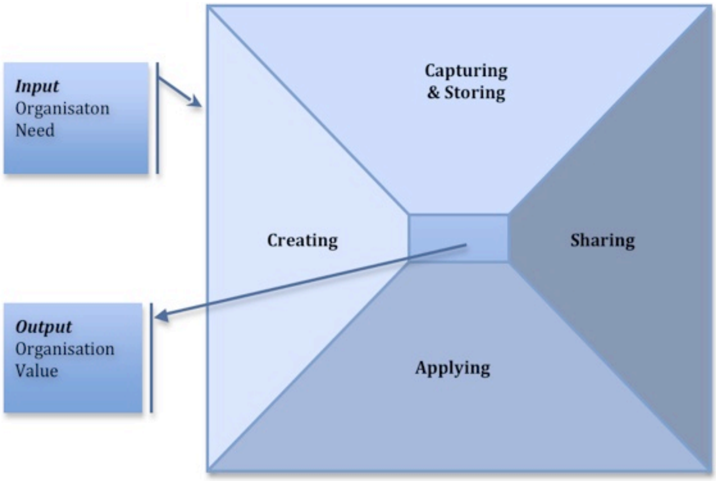

Figure 8b: The K-Core 'Core' close-up (Griffiths *et al.* 2010)

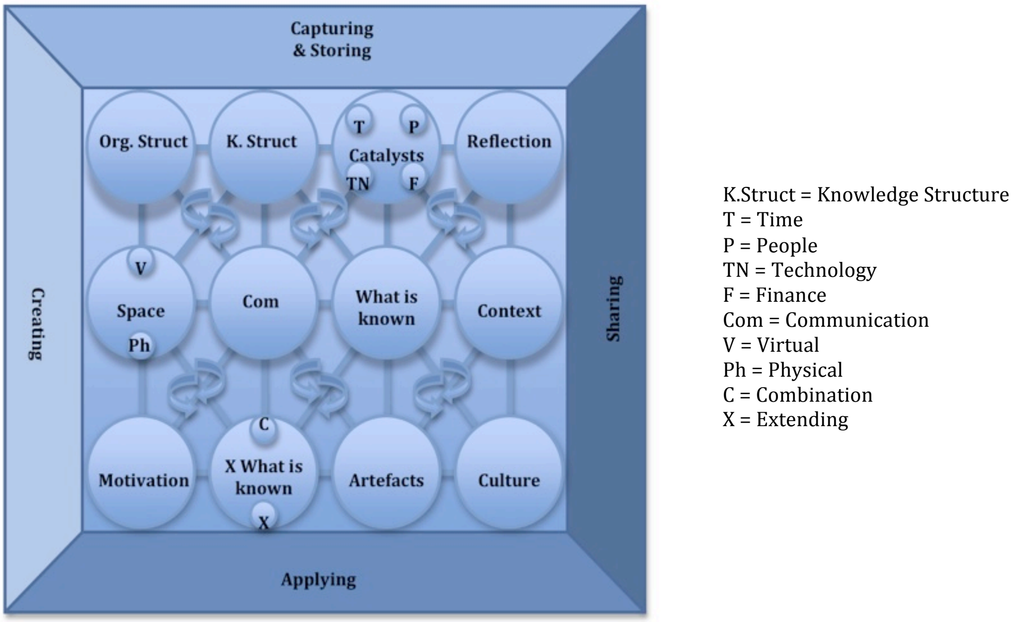

Figure 8c: The K-Core 'Core' cross-section (Griffiths *et al.* 2010)

5.4.2 Logic Modelling

SSM involves a "logic-based stream of analysis" (Checkland, 2000, p. s21). This guided me towards a Logic Modelling method, which offers a visual representation of the world in order to "offer a way to describe and share an understanding of relationships among elements necessary to operate a program or change effort" (Knowlton and Phillips, 2009, p. 5). Knowlton and Phillips offer two distinct spaces for Logic Modelling, '*Theory of change*' and '*Program*', the difference being that a Theory of Change Model provides a low level of resolution, giving a simple view of the world, whereas a Program Model gives a higher resolution, providing precise situated detail.

There is a problem of Logic Modelling definition when applied against the needs of my research. 'Theory of Change Models' are seen as delivering plausible 'big picture' overviews, which are designed to demonstrate the deliverables achievable through structured intervention (Knowlton and Phillips, 2009). However, my research criticises existing OKM models where they lack demonstrable 'know how' in their construction (see Chapters 3 and 6), meaning that a low level of resolution would not satisfy the current needs of organisations, as set out in Chapter 3.

Program Logic Models "help with more precise decisions about which activities in a given strategy are most effective" (Knowlton and Phillips, 2009, p. 14), but the authors state that these models are situated in their focus and are firmly grounded in validated knowledge of what is known. Knowlton and Phillips (2009) observe Theory of Change models as 'drafts' that are subject to change as the model evolves, which aligns with the Soft Systems Methodology process (Table 4.3, p. 128). The problem is that the Theory of Change modelling space does not provide for the details that impact planning, implementation and evaluation, all of which are necessary to assist in overcoming issues of OKM 'know-how' identified in Chapter 3. Therefore I decided to utilise a blended modelling space in my research, illustrating the scope of OKM systems through a Theory of Change Model, while using elements of higher resolution provided by Program Logic Models.

Knowlton and Phillips (2009) offer three key characteristics that need to be present in a Theory of Change Model: "Co-created with shared meaning; evidence based; appropriate scale" (p. 61). My approach has applied an approach to the meta-analysis that has encompassed the academic and practitioner voice (for example, see the meta analysis method, p. 131), which, combined with the scope and scale of the research would seem to satisfy Knowlton and Phillips' first two requirements; the third point has directly informed my design of the K-Core (Figure 8a through 8c, p. 151-152).

5.4.3 Additional influences on K-Core Design

Carter *et al.* (1986) describe key principles in the construction of system boundaries; only include those elements or relationships that cause an impact upon the process; include elements that are inherently controlled by the system or its user, but similarly it is important to remove those elements that cannot be controlled by the system or user.

This is what I have attempted to do in my research; for example, I have not included constructs embedded within the organisation's external environment or individual cognitive flows within the process, as they are beyond the 'control' of the system. This agrees with the principles of 'scope', 'approach', 'optic' and 'modality' put forward by Spender (1996) (see p. 72). Yolles (1996) suggested that this approach removes uncertainty, where system boundaries should avoid cutting across processes by either including or excluding them from the system whole. Carter *et al.* (1986) argued that a useful description is needed, in which the open or closed, or partial open/closed processes (see p. 68-75) are clear to the user. Senge (1997) posited that these convey, "what causes the patterns of behaviour" (p. 53), which in turn allows the user to understand how changes to these patterns can produce different behaviours within the system. Senge promoted this method over 'responsive processes' (those which examine patterns of behaviour), or 'reactive processes' (those which examine events).

I designed the K-Core model to demonstrate the 4 functions and 12 constructs with an element of environmental interaction, as dictated by OKM as an open system (see p. 68-75). This is where the model, as a representation of the organisation's Knowledge Management system, is illustrated as being positioned within an environment, with flows in and out of the system, being the K-Core system model itself. My approach utilised a blend of 'success' and 'effectiveness' models put forward by Jennex and Olfman (2004) (see p. 89); 'value chain' was disregarded, as the model does not set out to establish the 'value' of individual components within the process. I took this decision due to the fact that in a complex environment constructs reorganise according to environmental disturbances (see p. 68-75) and therefore the 'value' pathway is in a state of flux, which I considered difficult too model.

Systems Thinking determines a weighting towards the whole and not towards myths or perceived major factors, which could inhibit success through failure to identify a limiting factor having true influence over the process (Meadows, 1982). This fits with discussion in Chapter 3 (see p. 68-75) and therefore I did not design the model to take into account the frequency of findings discussed in the meta-analysis; as limiting factors would seem to be contextually embedded and subject to issues of complexity that cannot be represented within the blended Theory of Change Model. This has also informed the appropriate scale of the model, as suggested by Knowlton and Phillips (2009); again brought about by the nature of complex environments as described above.

5.4.4 Model design characteristics

The K-Core (Figures 8b and 8c, p. 151-152) exists to illustrate the constructs that organise within OKM systems for the coordination of knowledge resources (as set out in the KEn Diagram (p. 26)); the coordination of which could improve output, and it is through this output that value can be determined (see p. 56. The model is 'open' as it needs to respond to, and inform, internal and external environments (see p. 68-75), which requires representation within the flows of the model. This suggests the need for a model that utilises a loop as opposed to a linear chain.

I have structured the architecture to demonstrate the interrelated support of the four OKM functions from my research, which provide the parameters of the bounded whole (Figure 8b, p152). The twelve constructs are demonstrated to be interlinked, but dynamic, in that they are not stationary and will organise according to the need of the function and the demand of the situated environment (Figure 8c, p. 153).

I am proposing that in order for an organisation is to create value it must look at the whole (see Figure 4, p. 56 and text p. 68-75), being the bounded functions of 'Capturing and Storing', 'Sharing', 'Creating' and 'Applying' (Figure 8b, p. 152). From this position it should be possible to enquire into the efficiency and effectiveness of each function through the engagement of the twelve constructs (Figure 8c, p. 153).

> "Theory needs to provide concepts and frameworks that are both sufficiently recognisable to seem relevant to users and sufficiently generic to be translated in such a way as to support the user in action-focused reflection…The framing of theory needs to portray organisational processes in a mode that mirrors the way users are likely to experience them. It also, however, needs to provide insight beyond that which users would naturally have themselves" (Pettigrew, 1998, p. 8).

I have responded to Pettigrew's challenge by attempting to develop a model that "mirrors the way users are likely to experience" OKM systems. This was achieved using the logic modelling process, where I believe that the transition between a 'Theory of Change' and 'Programme' model allows for action through focused reflection. I have also attempted to illustrate the OKM system in a way that is recognisable in the organisational domain, but sufficiently generic to be adapted for use across sectors and geographic locations.

I also recognise that the K-Core model is open to interpretation and, reflecting on the work of Mokyr (2002) (see p. 58), I accept that this is 'twice removed', once from the vision in my mind to the K-Core illustration (Figures 8a through 8c, p. 151-152) and secondly from the receiver who will recode and interpret the model illustration based on their experience. However, I believe that the model sufficiently represents the way in which users will experience OKM. Also, while acknowledging the problem of interpretation, there is no way at this time to overcome it. I considered this extensively, as emerges in later discussion (Chapter 7).

5.4.5 Developing a diagnostic tool

I designed the K-Core (Figures 8a through 8c, p. 151-152) to provide an evidence-based falsifiable representation of 'know what', but for it to be an effective management tool the literature indicates that my model will need to transmit 'know how' (see Chapter 3). This would ensure that the K-Core aligns with the requirements of those such as Meadows (1982) who suggested that in order to heighten standards it is necessary to identify leverage points. However the 'know how' required to manipulate them would still appear to be ambiguous, which does not satisfy the current needs of organisations engaging with OKM systems. Handzic *et al.* (2008) agreed, finding that many model processes detail the 'what' but appear to fail in transmitting the 'how', rendering them incomplete. This need to identify 'know-how' to leverage value from the system is evident beyond OKM, with social scientists being criticised for not extrapolating from clearly signposted means of intervention to effect change at a practitioner level (Jackson, 2001). I therefore found it necessary to develop an assessment tool for organisations to evaluate their OKM systems and their effectiveness in managing internal knowledge resources.

This informed the need for a 'next step', the development of an OKM system diagnostic to support the K-Core model. This involved the development of a Participatory Integrated Assessment Tool (PIAT) for use as part of an organisational systems diagnostic process; this approach was chosen, in part, due to my familiarity with the application of PIATs in my time as a practitioner through, for example, the UK government endorsed initiative, Investors In People.

5.4.5.1 PIAT Design

> Integrated assessment has been defined as an interdisciplinary process of synthesising, interpreting and communicating knowledge from diverse scientific disciplines in order to provide relevant information for policy-makers on a specific decision problem (Toth, 2001, p. 5)

A PIAT centres on delivering knowledge "in such a way that the whole cause-effect chain of a problem can be evaluated from a synoptic perspective" (van der Slujis, 2002, p. 250). Van der Slujis asserts that this provides added value to practitioners as it takes the challenge under enquiry, models the process and develops supporting evidence of system strengths and failures from diverse perspectives in such a way as to provide clear information for decision makers. PIATs comprise models related to the input, output and process of the concept under review; this is necessary in order to evaluate a system's processes (Toth, 2001). This links the work of Knowles *et al.* (2005) (see p. 84), who stated that organisational knowledge processes need to take into account the needs of the organisation, the needs of the individual and the processes that bind the two together.

My PIAT is informed by the K-Core model (Figure 8a through 8c, p. 151-152). However, from my experience with Investors In People, a second model is also needed, namely a maturity model that can reflect the state of reality against indicators of effective practice required by the K-Core. The second requirement is the participatory method, or engagement with the audience, which can include scenario planning, modelling, interviews, policy analysis and focus groups; in all cases, people remain at the core of the enquiry activity (Toth, 2001), which links to the needs of OKM systems, which also have people at their core (e.g. see p. 51) .

> "The most important recommendation for applications of PIA [Participatory Integrated Assessment] techniques… is that organisers, in the design of and preparations for any application, should honestly reveal the potentially diverging interests, conflicting views and possible hidden agendas of expected participants. With the arrangements available in all PIA methods and with a skilful moderator, these problems can be managed if they are identified ahead of time and appropriate contingency measures have been taken" (Toth, 2001, p. 7)

I acknowledged Toth's (2001) warning and I have worked to improve credibility by utilising triangulation techniques highlighted in the methodology (see p. 129).

My PIAT takes the K-Core design and utilises it as a model to inform the development of a diagnostic process. The participatory process design triangulates document analysis, semi-structured interviews and surveys as a blended approach to identify gaps in existing practice. These gaps are then addressed as part of an Action Learning activity within the organisation (see p.86), the outcomes of which can then be used to inform strategic and operational plans for OKM system development.

5.4.5.2 PIAT Framework

My K-Core PIAT incorporates three parts (examples provided in Appendix 6). The first takes the K-Core's four functions and twelve constructs and develops a three-point maturity model of practice, which separates out strategic (direction) and operational (activity) processes against internal and external parameters, to examine over 500 evidence-based aspects of human and technology OKM processes[6].

I designed the maturity model using Office for Government Commerce (OGC) guidelines, which observes maturity models to be "a systematic framework for carrying out benchmarking and performance improvement" (www.ogc.gov.uk). This will enable the participatory model to benchmark the situated processes' state of development in producing the desired output. The OGC promote five-step maturity models, but note that there are many variations of this. I decided to attempt to simplify the analysis of OKM systems by using a three step traffic-light model: Green (Performance continuously improving), Amber (Awareness, but inconsistent practice) and Red (Limited awareness).

The second aspect is a feedback tool of Key Performance Indicators. I took the three step maturity model parameters and developed an analysis model, which was informed by the third aspect, a selection of over 500 evidence-based questions and document analysis requirements that directly link to the feedback tool and the maturity model; this is facilitated via a semi-structured interview process that requires a quota sample of employees, representing a cross-section of staffing responsibilities.

The enquiry into the effectiveness of each of the four K-Core functions is obtained through a quota-based approach; for example, a pool of 40 interviewees would see an allocation of 10 employees to the enquiry into each function. The twelve constructs are then aligned in a matrix against the four functions, with in-tool cross-referencing enquiring into coherence between each of the functions; this also reflects the

[6] While the framework has been restricted to protect the IP that informs the K-Core framework, examples of the process can be found in Appendix 6

complexity of the OKM domain as illustrated in the KEn Diagram (see p. 26). I used document analysis and in case cross-referencing to support this. I then contextualised the whole process using an organisational typology survey, based on the work of Mintzberg (1980); my use of Mintzberg's typology was prompted by authors such as Kraaijenbrink and Spender (2010), who stated that culture could be exhibited through artefacts, such as structures, policies and processes; with culture being one of the 12 constructs identified in the meta-analysis findings. I consider that Mintzberg's typology provided an existing model for the identification of organisational structure; this allows for the domain of enquiry to be contextualised, giving a greater depth of meaning to PIAT responses and providing multiple perspectives on employee perceptions of organisational structure and its impact on OKM systems.

My K-Core PIAT is generic, not being designed with a particular organisation size or structure in mind. This will require users to adjust questions asked against maturity indicators/descriptors accordingly.

5.4.5.3 Developing the PIAT Question Set

I designed a PIAT interview question set (sample provided in Appendix 6), which is informed by the need to identify practice around the identified K-Core functions and constructs in a given time and space. Limitations of the doctoral research process do not allow me to fully disclose all the parallel literature consulted in the development of the question set. However, to enable transparency, as well as mapping the complexity of the enquiry, I utilised a Concept Mapping[7] (Moon *et al.,* 2011), process that allowed me to illustrate the flow between key aspects of the enquiry through the use of C-Map software; it is hoped that this demonstrates my depth of understanding in the development of the interview question set (Appendix 7).
In designing my question set matrix, I took into account the work of 'enabling questions' put forward by Knowles *et al.* (2005) (see p. 84) (Table 5.2). This

[7] Concept mapping moves beyond mind mapping, which is more an illustrative map of thoughts, to allow the user to establish explicit links between concepts through an explanation of linkages (Moon *et al.* 2009)

allowed me to build a structure for the questions within the PIAT four function matrix.

Performance Variables	Performance Levels		
	Organisational Level	**Process Level**	**Individual Level**
Mission/Goal	Does the organisation's mission/goal fit the reality of the economic, political and cultural forces?	Do the process goals enable the organisation to meet organisational and individual missions/goals	Are the professional and personal mission/goals of individual congruent with the organisation's?
System design	Does the organisational system provide structure and policies supporting the desired performance?	Are processes designed in such a way to work as a system	Do individuals face obstacles that impede their performance?
Capacity	Does the organisation have the leadership, capital, and infrastructure to achieve its mission/goals	Does the process have the capacity to perform (quantity, quality and timeliness)?	Does the individual have the mental, physical, and emotional capacity to perform?
Motivation	Do the policies, culture, and reward systems support the desired performance?	Does the process provide the information and human factors required to maintain it?	Does the individual want to perform no matter what?
Expertise	Does the organisation establish and maintain selection and training [learning and development] policies and resources?	Does the process of developing expertise meet the changing demands of changing processes?	Does the individual have the knowledge, skills and experience to perform?

Table 5.2: Performance diagnosis matrix of enabling questions (Knowles *et al.*, 2005 p. 176)

The question set is designed as a guide, but I also recognised that, in using a semi-structured interview approach, I will require scope to investigate emerging issues as they relate to the PIAT feedback and maturity framework, which could take me beyond the initial questions contained in the question set.

5.4.6 Proposition for testing

The evidence presented in the findings from the meta analysis (see p. 183), survey (see p. 197) and fractal analysis (see p. 229), and the subsequent development of the K-Core model, leads to a proposition for testing:

> The K-Core model is an OKM systems model that can be used in organisations, regardless of sector or geographic location, to identify gaps in

systems for the coordination of knowledge resources through the application of a PIAT as a structured diagnostic method.

To test my proposition it is necessary to utilise a method that allows for enquiry into what is a "contemporary phenomenon within a real-life context" Yin (2009, p. 2). This led me towards the use of a case study as a way to respond to Stage 5 of SSM (Table 4.3) (see p. 126), "Comparing conceptual models with the 'real world'".

5.5 Case Study: Exploratory (pilot) and Explanatory

Element	Guideline	Authors
Way of thinking	Provide an argument for why a case study is appropriate.	Greenhalgh (1997), Darke et al, (1998).
	State philosophical stance and perspective. Take account of bias when performing data analysis.	Walsham (1995); Klein and Myers (1999).
Way of controlling	Define and use some form of quality control measures.	Greenhalgh, Miles and Huberman (1994), Yin (1984).
	Ensure that the results are credible.	Greenhalgh (1997), Moody and Buist (1999), Mays and Pope (1996).
	Determine how to draw conclusions and justify the results through the appropriate use of theory.	Walsham (1995), Carroll and Swatman (2000).
Way of working	Construct a clearly formulated question that describes an important IS issue or problem of interest.	Greenhalgh (1997), Yin (1984), Darke et al (1998).
	Create a first cut conceptual framework	Miles and Huberman (1994), Carroll and Swatman (2000)
	Devise first cut case study questions.	
	Make explicit the research approach.	Shanks *et al.* (1997)
	Perform a pilot case study	Yin (1984)
	Determine criteria for selecting the appropriate case and participants.	Greenhalgh (1997), Patton, (1990) Maxwell (1996).
	Refine the case study questions based on lessons learnt from the pilot study.	
	Revisit the research purpose/question and modify the conceptual framework as necessary.	Greenhalgh (1997), Klein and Myers (1999), Miles and Huberman (1994), Carroll and Swatman (2000).
Way of supporting	Choose appropriate methods for collecting data. Ensure that these are described in enough detail.	Greenhalgh (1997), Walsham (1995)
	Employ a systematic way to analyse the data. Ensure that these are described in enough detail	Greenhalgh (1997), Richards (1997), Miles and Huberman (1994).
Way of communicating	Create a plan for the final report.	Yin (1984), Walsham (1995).
	Determine how the case study findings might be transferable to other settings.	Greenhalgh (1997), Miles and Huberman (1994).
	Determine how to present the findings to the academic and practitioner communities.	Darke *et al.* (1998), Miles and Huberman (1994).

Table 5.3 Case study appraisal framework put forward by Atkins and Sampson (2000)

I chose a case study approach put forward by Atkins and Sampson (2000), which aligned with my understanding of the wider body of literature around the case study method. Their work (Table 5.3) develops a synthesis of literature in the field to provide an appraisal process for case study research.

5.5.1 Case Study – Rationale and Criticism

I elected to use a qualitative case study as a holistic tool for the capture of real-life phenomena that can also be used for theory testing (Tellis, 1997). I did this in response to Lynham's (2002) requirements for the operationalisation of a theoretical framework (see p. 123). This requires the case study to provide observable and confirmable components that support the claim that the K-Core model can function as a general diagnostic model for OKM systems for the coordination of knowledge resources by surfacing gaps in organisational processes and procedures that impact practice.

Case studies can be developed as either single or multiple studies; due to the limitations of time, I adopted a single case study. In either form the method is observed as utilising a triangulated strategy, where multiple sources of evidence are brought to bear on a focused issue to provide a depth of detail (Tellis, 1997). I have used methodological triangulation, applying mechanisms within the PIAT design, such as document analysis (see p. 173) and interviews (see p. 172) (Patton, 2002).

Single case studies have been criticised for their lack of ability to develop transferable findings across a field (Flyvbjerg, 2006). However, Yin (1984) argued that a single case study could deliver analytical generalisation, allowing the theory developed to be compared and contrasted against the empirical findings of the case study. Stake (1995) also argued for naturalistic generalisation, or 'pragmatic-validity'; founded in the idea that the data generated by the case study allow for resonance across, "a broad cross section of readers [by appealing to their own grounded experience], thereby facilitating a greater understanding of the phenomenon" (Tellis, 1997, p. 2). Patton (2002) agreed that generalisation is an issue, but suggests that generalisability could be achieved through the learning process experienced by the individual as they reflect upon the findings and the relationship to their own context. What is being suggested is that even though each case can be regarded as unique, subject to variation of data, culture, time, variables, relationships and place, the single case can be treated as a snapshot of the whole. Issues of time, cost and access limit the potential for multiple case studies in the context of this particular PhD research; this said Step 7 of the SSM process and the final stage for hypothetico-deductive process (Table 3.2) (see p. 126), allows for the development of further case studies as a progression of SSM.

Case studies can take three forms: explanatory, exploratory and descriptive (Yin, 2009). Exploratory case studies are utilised to develop theories for testing, but they can also be used to test processes that have been developed on a limited scale before being utilised in a larger scale study. Descriptive case studies are, as the name implies, used to describe a phenomenon, such as the monitoring and evaluation of a change process in an organisation. Explanatory case studies are seen as being useful when studying or testing processes or systems (Yin 1984). I decided to use two; first an *exploratory*, pilot study, to test the use of the proposed model and diagnostic toolkit in a limited setting and secondly an *explanatory* study to explain the process of the K-Core model's application and findings in a larger setting.

Case studies are open to criticism as to the replicability of the research (Stake, 1995). Zhu (2010) cited the 'Thesis of Double Hermeneutic' to demonstrate that the researcher cannot resolve this issue in the social sciences; in short, the social scientist will risk impacting the behaviour of the case under study due to the fact that they are part of the environment they are studying. For example I could ask an interview question that, upon reflection by the interviewee, could indirectly change organisational processes. This means that post enquiry, the system under enquiry will have changed and a subsequent researcher will not achieve the same findings due to my initial interaction with the organisation.

The K-Core model (Figures 8a through 8c, p. 151-152) has been developed to provide a well-founded falsifiable proposition for testing, which is essential if a single explanatory case study is to be utilised (Flyvbjerg, 2006). This reinforces the need for an explanatory case study that is deductive in nature, looking at the feasibility or non-feasibility of a theory or proposition, and works towards transferable findings (Flyvbjerg, 2006). Also, the business function in the case organisation, PSUK(A) (see p. 168) was chosen for its generic nature, which amplifies the opportunity for transferable findings from a single study (Flyvberg, 2006). Moving forward, Miles and Huberman (1989) suggest that any case study should define itself by bounding the territory of the enquiry (see p. 164).

Positivist Design Test	Realist Design Test	Case Study Technique	Qualitative Technique	Phase of Research	K-Core CS Action Taken
Construct Validity	Confirmability	• Use multiple sources of evidence • Establish claim of evidence • Have key informants review draft case study report	• Confirmability audit - examine the data, findings, interpretations and recommendations	Data collection and report writing	• 39 Key Informant Interviews with 24 High Level informants from Executive Management to New Hires • Document Analysis • Global Directors reviewed in-case analysis and draft report • Evidence chain evident in CS
Internal Validity	Credibility	• Do within-case analysis • Do explanation building • Assure internal coherence of findings and concepts are systematically related	• Triangulation - Sources, investigators and methods • Peer debriefing • Researcher's assumptions, worldview, theoretical orientation • Researcher self-monitoring	Research design, data collection, data analysis and report writing	• Final analysis cross references interviews, document analysis and strategy • Key recommendations are built through data analysis and clear lines of sight to theory • Managing Director and Global Directors debriefed - feedback to Corporate Executive Committee • Researcher's assumptions detailed as part of PhD process • Researcher monitored as part of the PhD supervision process and PhD Board Review • Model and underpinning theory subjected to peer review and published for wider comment • Informal peer review through research groups
External Validity	Transferability	• Define scope and boundaries of reasonable analytical generalisation for the research • Compare evidence with extant literature	• Predetermined questions • Thick description • Specific procedures for coding and analysis	Research design and data analysis	• Evidence based question set developed and reviewed as part of the PhD review process • Interview and Document Analysis provide rich descriptions contextualised by an organisational typology survey • Explicit coding protocol based on peer reviewed evidence-based research • Modeling process and underpinning theory presented at international conferences for peer review and feedback • Feedback protocol for K-Core model based on evidence-based peer reviewed meta-analysis • CS identified as a Critical Case Study and Project Services selected for its generic function - in accordance with CS literature • Live analysis utilised Global Director as a feedback loop to inform understanding and allow for reactive questioning for deeper analysis
Reliability	Dependability	• Give full account of theories and ideas • Assure congruence between research issues and features of study design • Develop and refine the case study protocol • Record observations and actions as concrete as possible • Use case study protocol • Record date mechanically and develop case study database • Assure meaningful parallelism of findings across multiple data sources • Use peer review/examination	• Dependability audit- examine and document the process of enquiry • Clarify researcher's theoretical position and biases	Research design, data collection and data analysis	• Modeling process and underpinning theory peer reviewed and presented at international conferences and within academic journal for wider feedback • Researcher's worldview made explicit through the PhD thesis process and through peer reviewed publications • Dependability audit and CS protocol review conducted through PhD supervision process and PhD Board review. Aspects subjected to peer review and conference publication • Data was recorded; interviews were mapped live and time coded by hand • Pilot study conducted in similar generic environment • Feedback coding independently verified with a zero error rate • Live feedback solicited to confirm understanding and allow for reactive questioning

Table 5.4 Case Study reliability and validity framework adapted from CRLRA (2000) and Riege (2003)

5.5.1.1 Strengthening Confirmability, Credibility, Transferability and Dependability

Patton (2002) posited, "The credibility of qualitative methods therefore, hinges to a great extent on the skill, competence and rigour of the person doing the fieldwork" (p. 14). This led me to synthesise case study frameworks (Table 5.4, p. 166) from the Centre for Research and Learning in Regional Australia (2000) and Riege (2003); these two frameworks were combined against the criteria for good models set out in Chapter 3 (see p. 94); specifically, elements of redundancy and completeness. These indicators then informed my case study design, as noted in the Table 5.4.

5.5.2 Bounding the case study territory: Two questions

In order to provide a bounded territory for the case study, I developed two sub-questions against the overarching research question:

1. How might a general OKM system tool for the coordination of knowledge resources be used in an organisation?
2. How might a general OKM system tool be used to identify gaps in organisation processes designed to coordinate knowledge resources?

5.5.3 Negotiating Success

Babbie (2009) stated that success is a state negotiated between the researcher and the organisation the core of which depends upon a robust research design that can produce the intended outcome. Babbie is also clear that, "ultimately the criteria for success and failure are often a matter of agreement" (p. 370)

I decided that the success of the Case Study was to be determined by its ability to answer the sub-questions listed above. However, I noted that there were two potential aspects to this discussion: the success of the tool against the research sub-questions and the relevance of the findings to the operations of the case organisation. Therefore there are two potential states for success, according to the researcher or organisation's view.

I decided that the Case Study would need to demonstrate that the K-Core (Figures 8a through 8c, p. 151-152) could meet the conceptual needs of the organisation prior to its implementation. The Case Study would then need to reveal that the K-Core tool could identify gaps in OKM systems in order to meet Lynham's (2002) requirements for operationalisation of a theoretical framework (see p. 125). Finally the value of the findings would be shown by the case organisation, with success determined by the key recommendations being reflected upon, accepted and a plan for action being produced.

My case study sub-questions were shared with the case organisation and agreed with the Managing Director and Global Project Services Director.

5.5.4 The Case Study setting

PSUK(A) is a multinational company; (A) signifying the European region for the company. It provides generic Project (P) Services (S), coordinating global and regional projects for industry-specific clients, and specialised, independent, industry services. At the time of the research they were positioned globally as number two in their field. The company operates in 6 global regions (Europe, North America, South America, Asia, Africa and India) and employs 25,000 people worldwide. Each region operates as a separate division with its own Managing Director. Within this structure there also exists a Principal Manager for Project Services and a Principal Manager for Project Services Learning and Development, both located in PSUK(A).

The enquiry was conducted in late 2009. PSUK(A) is the second largest office in Project Services with 91 staff, 10 administration and management, 54 Project Management and 27 Set-up. This operation acts as both a regional and global partner according to client needs. PSUK(A) consists of two functions, Project Management and Project Set-Up. Project Management Teams operate on an 8:1 ratio with Project Set-Up.

Project Services operate a team or 'pod' structure. Each pod consists of a Senior Manager (SM) with responsibilities for 6 to 10 Project Managers (PM). Each PM will have a Project Coordinator (PC) as a direct report – a rare exception will see a PM line manage 2 PCs. This structure is emulated in both the Project Management and Project Set-Up aspects of the business. Project Management teams do not have a dedicated Set-Up Team.

Project Services provides services for clients with a global presence. This means that stakeholders will interface with PSUK according to geographic location. For example, 'Client Alpha', based in North America, with satellite operations in Europe, will interface with both PSUK North American and Europe Project Services. To address consistency, the organisation promotes the position of a multinational organisation that acts as one, meaning that stakeholders should receive a harmonised service experience regardless of geographic location; to facilitate this, PSUK utilises Standard Operating Procedures (SOPs).

Project Services was in a transitional state at the time of my research, evolving from being a service coordinator to solutions provider. This move was evident in organisational strategy documents, driving operations towards service improvement, as a way to increase market share and revenue (Project Services Strategy Map, 2007/2009)[8].

5.5.5 Approaching the case study organisation

PSUK(A) was chosen for its Project Services function, which operates in a generic manner; this lends itself towards the improved likelihood of transferable findings when considering Stake's (1995) view of 'naturalistic generalisation' (see p. 164). It was also chosen due to convenience (the organisation was looking for consulting assistance) and practicality (in relation to the geographic location and the accessibility to employees being offered by the organisation). Furthermore, it was selected for the diversity of its knowledge resources from technical (complicated knowledge, existing in SOPs) to a heavy reliance on client knowledge and the understanding of PSUK(A) staff in the delivery of services (managerial or tacit knowledge). This was evidenced in the rationale for this enquiry within the organisation, because of the transition of Project Services from a 'service provider' to 'solutions provider'.

I approached the organisation in response to a conversation with an employee, where it emerged that PSUK(A) was attempting to improve KM processes. Initial contact was established via email with the Vice President for PSUK(A). This progressed to a meeting that included the Global Head of Project Services at the company offices in Europe. I presented the K-Core research and a common understanding for the term 'KM' was established, using an early version of the definition developed as part of my research findings (see p. 189).

[8] References for the document analysis are provided, but cannot be exhibited due to the nature of the non-disclosure agreement signed at the outset of this research

I informed PSUK(A) that, in order to deliver rich evidence-based findings, there would be need to interview 40-50% of staff within the chosen department. I informed PSUK(A) that interviews would last approximately 50 minutes and that data would be contextualised through a survey tool that would take approximately 10 minutes to complete. PSUK(A) was also informed of the need for access to documents in order to enrich the evidence process.

5.5.5.1 Framing the enquiry

PSUK(A) and I determined together the area within the organisation to be used for enquiry. An option was given by PSUK(A) for me to look at industry specific Technical Operations or Project Services. PSUK(A) were initially biased towards an enquiry focusing on the Technical Operations aspect of the business, as the Project Services team were viewed as being "…the better group, who really know what they are doing and are much better organised. In fact you'll be surprised at how well they do things" (communication by email, 2009). However, in selecting the area for enquiry, I was driven by the need to work towards 'Naturalistic Generalisation' (see p. 164), which required me to attempt to provide the maximum opportunity for resonance across the broadest section of readers. I determined that the selection of the Project Services function, would fulfil this criteria. I considered that the technical operations aspect of the organisation would be too industry-specific and focused towards the technical end of the KEn Diagram (p. 26), and this might make it less likely to find resonance with a broad section of readers, as recommended by Tellis (1997).

5.5.5.1.1 'How might a general KM Tool be used in an organisation'.

Executive Management representatives within PSUK(A) clarified the remit for the enquiry, in that it was to be holistic in nature – examining the capabilities of KM systems for the coordination of knowledge resources within PSUK(A) Project Services.

The holistic framework for the study and the understanding of what was meant by KM system capability was agreed between the organisation and me – this included a delivery of a Power Point presentation to key stakeholders in PSUK(A) describing the research underpinning the K-Core model:

- Knowledge capability was to include an enquiry of physical, virtual and human resources that bring value to Project services in its evolution from 'service coordinator' to 'solution provider'.

- The holistic aspect was defined as an enquiry that engages in an investigation in to human and technology-based support for knowledge-based activities as well as the interface between the two. Furthermore, the enquiry was to investigate the strategic direction provided by the organisation as well as aspects of support activities such as Learning and Development, Human Resource Management and Technology Support.

- Executive Management needed the enquiry to include existing business processes, the influence of the organisational structure and organisational culture upon practice.

My enquiry worked from the principle that the PSUK(A) Strategic Map (dated May, 2007) (Table 5.5, p. 172) directed Project Services operations; this was supported by the PSUK(A) Managing Director and Principal Manager of Project Services, who both stated that the Strategy Map underpinned all activity within the Project Services function. I identified specific strategic drivers for the enquiry, which were approved through feedback from the Principal Manager of Project services and the Global Learning and Development Director – the 'E', 'P' and 'C' descriptors in Table 5.5 have no bearing on this research, being internal descriptors used by PSUK(A) to separate out strategic work streams:

- ***E1 Communication – Enable understanding of our strategy and how to contribute to it*.**

- ***E2 Talent – Attract, develop and retain employees and develop an integrated career path within [PSUK(A)].***

- ***E3 Leaders – Identify and develop leadership to execute our strategy*.**

- ***E4 Culture – Develop a performance and knowledge culture focused on our customers.***

- ***E5 Organisation – Continue geographic expansion and upgrade of [PSUK(A)] facilities.***

- ***E6 Information – Upgrade IT platform to provide metrics to run the business***

- ***P1 Leverage the global footprint (processes, shared services, best practices).***
- ***P2 Improve pipeline and resource management.***
- ***P3 Improve customer communications and problem resolution.***
- ***P4 Set-up and manage projects effectively and efficiently.***
- ***P9 Develop innovative IT Solutions.***
- ***C1 Effectively and efficiently meet my requirements and exceed my expectations.***
- ***C3 Develop innovative solutions to help me manage my changing [product] services needs.***

Table 5.5 PSUK(A) Strategic statements

5.5.6 Style of management and impact upon reporting style

The industry sector within which the case organisation is located produces a style of management that is functionalist in terms of OKM systems, where functionalist is defined by Ragsdell (2009) as a paradigm in which rigour and validity are akin to that experienced by researchers in the natural sciences.

This surfaced in conversations with the Principal Manager for Project services in which s/he stated, "My background and [the field we work in] means that I want evidence to inform any decisions I take. I don't like to think that I know something, I want proof that I know something and I want the analysis to be clear" (communication by email, 2009). This aligned with the design of my K-Core diagnostic tool and I did not see this as an issue.

5.5.7 Time Scale

PSUK(A) was approached in July 2009, scoping meetings were held in August 2009 and permission for the research was granted in late August 2009. PSUK(A) requested that any research be conducted during Oct 2009 with analysis to be delivered by December 9th 2009, for a meeting of Project Services Global partners.

5.5.8 Pilot Study

Before progressing with the main study, I believed there to be a need to pilot my PIAT, an approach recommended by Yin (1984). The methods used are described later in this Chapter (see p. 175), in relation to the main case study, but the findings from the pilot case study impacted the development of the main case study strategy and therefore the outcomes are described first.

The pilot study was conducted at United Kingdom Business Solutions (UKBS), a Business Management Consultancy in Edinburgh. I chose the organisation for the potential of the findings, from the PIAT application, to be transferred to the main case organisation, as UKBS was involved in generic project style management. It was also convenient and I had access through a personal relationship with one of the Directors. This Director was not utilised as part of the study and I had no prior knowledge of the behaviours or processes employed by the staff that I interviewed. A detailed account of the case study is not provided as it was only used to explore the application of the PIAT in an operational setting, to learn lessons prior to the main explanatory case study.

The organisation consisted of six employees, two Directors and four Consultants. The business focus was on the development of marketing campaigns for UK based SMEs, predominantly in the IT sector. Each consultant was responsible for managing their own projects and report directly to the Business Development Director.

I interviewed five employees: the Director for Business development and all four Consultants. Interviews lasted between 41 and 63 minutes, with an average of 52 minutes. The aim of the pilot study was to test my PIAT question set, my interview process and my coding of responses against the K-Core feedback tool. I completed the PIAT coding on a Macintosh, utilising the OSX operating system; NVIVO was available through the University of Edinburgh, but, at the time of the research, NVIVO was not compatible with OSX and therefore a hand coding process was utilised using Microsoft Office Word and Excel to ensure a consistency of approach regardless of operating system; this was also replicated in the analysis of the main case organisation.

5.5.8.1 Impact of Pilot Study on Research Design and Field Procedures

It is said that the researcher should make explicit whether any adjustments were made to “theoretical concerns or objectives” (Yin, 2009, p. 38) as a result of the pilot study. This provides transparency on whether the design of the research, as driven by the research question, was amended to meet the needs of the case.

I offered top-level findings to the Business Development Director at UKBS, but a final report was not produced due to time constraints associated with the main Case Study organisation. Feedback from interviewees was satisfactory in all aspects of interview protocol. However, there was an issue of reciprocal understanding that emerged during the interview process. This involved my use of academic language and a lack of understanding of it on the part of the interviewees.

This feedback informed my pre-interview protocol for the main Case Study organisation, and also caused me to reframe interview questions for PSUK(A), using more ‘recognised’ business language. I then tested these redeveloped questions using two lecturers at the University of Edinburgh and six mature students with work experience attending the MSc in the Management of Training and Development during the 2009/10 academic year. The pilot also brought to my attention the need for a ‘feedback instrument’, within the host organisation, as recommended by Morse *et al*. (2002), in order to pick up on emergent issues and points of clarification during the interview process (see p. 180 and the use of the Principal Manager for Project Services Learning and Development as a feedback loop)

5.5.9 Data Collection: Interviews and Document Analysis

The coding method utilised in my literature meta-analysis (see p. 131) was applied to the interview data according to the outcomes defined by the PIAT (Appendix 6). All K-Core interviews were conducted over a 9-day period between October 5th and October 23rd 2009, with one exception occurring on September 21st 2009. Interviews were recorded, with permission, and questions were mapped and time-coded live, while in-depth analysis was conducted between October 5th and November 29th 2009;

interviews were recorded to allow for "…an accurate account of the conversations and [to] avoid losing data since not everything can be written down during interview" (Noor, 2008, p. 1604).

On average I conducted 4 interviews per day with a 60-minute break between each to allow for reflection, the collation of live-analysis notes and in-case cross-referencing. Interviews lasted between 12 and 55 minutes, with an average of 41 minutes. My PIAT process utilised 39 interviews, selected using a quota sampling strategy to ensure equal representation across job role and section. I selected staff by random number generator according to job title and the number of people holding that role within the area of enquiry, with a target of 50% representation of operational staff within each defined job role. Interviews were held in a closed meeting space at PSUK(A).

The interview timetable could be interpreted as intense and a potential issue for the researcher. However, Guba and Lincoln (1981) stated: "Loss in rigour [brought about by human factors, such as fatigue and shifts in knowledge] is more than offset by the flexibility, insight and ability to build on tacit knowledge that is the particular province of the human instrument" (p. 113)

The enquiry used the following informants:

- 2 Executive Managers
- 3 Senior Managers
- 5 Set-up Managers
- 1 Set-up Specialist
- 13 Project Managers/Associate Project Managers
- 11 Project Co-ordinators
- 4 Support staff/managers

I regarded all informants to be valid and reliable sources of information as they were all contracted, trained, fulltime employees of the organisation (Arbnor and Bjerk, 2009). I also noted that limitations of temporal sampling could limit staff available to the study (Patton, 2002), but in this case all staff requested were available with no cancellations or absences.

I used the following documents to triangulate feedback from the interviews and strengthen the credibility and confirmability of the findings. Due to limitations of this research, I will focus on presenting what I considered to be the key evidence, being interview findings in relation to the organisation's strategy. I have used interview data to describe the processes that were identified in the document analysis and, where appropriate, divergence between documented and actual process is noted.

- PSUK(A) PS Strategy Map (May 2007 and November 2009)
- HR Strategy Map (May 2007)
- PSUK(A) Learning and Development Organisation Chart
- Project Services Business Goals
- Project Management Training Plan
- Project Manager Job Description
- Project Coordinator Job Description
- Set- Up Training Plan
- Project Management Training Plan
- Induction Training Plans
- PSUK(A) – Global Training and Development Guidelines
- Email correspondence between Regional Managing Directors
- Email correspondence between Regional PMs
- Uploaded 'Case Studies' located within the company intranet
- Global Power Point strategy presentations delivered by the Principal Manager for Project Services

I also distributed the Organisational Typology survey (see p. 161) in electronic format to all staff involved in the interview process, and received a 73% response rate.

5.5.10 Ethical Considerations

Research ethics bear a relation to the findings of the research and the researcher should be prepared to be explicit about ethical considerations within the research strategy (Baxter, 2010). Burns and Burns (2008) define 'ethics' as "the application of moral principles and/or ethical standards that guide our behaviour in human relationship" (p. 29). In this case there is a need for me to look after the interests of those people in the case study organisation who, by revealing their opinions, could be subject to future bias if their personal thoughts were made known to senior management in the organisation.

I signed a non-disclosure agreement prior to the start of the enquiry. As such, the research organisation cannot be identified and all industry information must be decontextualised. I did not receive any direct payments or in-kind benefits in return for this study. All interviews were conducted by me and recorded directly to a portable hard drive. None of the interviews were conducted using PSUK(A) equipment, nor were interviews stored on PSUK(A) hard drives.

All interviews were allocated a coding known only to me. Interviewees were given my contact details and were briefed with an ethics protocol prior to the commencement of questions. All interviewees were guaranteed anonymity and were given the opportunity to receive a copy of the interview recording for their records. Interviews were to be kept until completion of my research on an encrypted hard drive at my home location, which was backed-up onto a hard drive at a secure location at the University of Edinburgh.

Other challenges that surfaced through the course of the enquiry are detailed within the method or the case itself; for example, where I was offered existing survey data that was rejected on the grounds that it could bias the study; also, the method underpinning the survey was not available and therefore its rigour could be brought into question.

5.5.11 Interview Protocol

I used semi-structured interviews due to the iterative nature of the interview process and it allowed for diversity in respondents within the bounded whole, permitting me to treat each respondent individually, according to their particular view of the world (Noor, 2008).

I first tested questions on a Project Manager, selected via random number generator; this employee was then excluded from the enquiry process. Learning from the pilot study, I asked this employee ten question to negotiate industry language against the OKM and Business terminology within the question set. This resulted in a change to interview protocol, where ‘managing knowledge resources’ replaced ‘Knowledge Management’. I affirmed this change to be necessary in feedback conversations with the Managing Director, Principal Manager for Project Services and Principal Manager for Project Services Learning and Development.

Interviews often require clarification in order to bring rigour to the findings (Gillham, 2004); therefore, I structured interviews to allow for interviewee feedback. This included answers to questions being repeated back to allow for clarification; statements of understanding on my part being conveyed to the interviewee, to allow correction; and an opportunity for the interviewee to feedback comments or analysis stimulated by the interview process. I also required interviewees to evidence assertions. For example, where an interviewee stated, “Senior Managers are rubbish at letting us know what is going on” (Interview DA22) I replied, “Give me an example of what you mean by this”. I also looked to establish links to the core business in order to establish the criticality of the presenting situation. For example, in response to a presenting issue, I might ask, “what impact did this action have upon the client?” or “There was a 350K Euro payback to one of your clients, what caused that?”

I mapped interviews in real time, using a generic mind mapping process in order to record key comments and time logs. I developed full transcripts of interviews within 14 days of the final interview, interviews were hand coded (see p. 175) and then cross-referenced against the K-Core feedback tool to extrapolate relevant responses. I used an organisation employee to give me feedback to clarify issues of terminology or systems and processes, their responses assisting in the coding process.

The transcription process should be clearly detailed as part of the research method in order to protect the integrity of the research findings (Halcomb and Davidson, 2006). I applied an ‘intelligent’ approach to transcription, where only the substantive content of the spoken word was captured, as opposed to ‘verbatim’ transcription, where an attempt is made to capture every nuance of the report, including pauses in the discourse and other verbal cues, such as ‘umms’ and ahs’ (Halcomb and

Davidson, 2006). The authors suggested that verbatim transcription is time consuming, costly and subject to human error; the suggestion being that there is a need for secondary analysis to ensure the integrity of the data. I conducted all transcription activity, except in the case of data verification, which was conducted by the RA. Issues of cost did not allow for the use of a transcription service and therefore I accept that human error could creep into the method as with many research methods. Not using a professional transcription service could be seen as a weakness, though I doubt this would improve the quality of the data as human error is more a problem of the method in general (Halcomb and Davidson, 2006).

5.5.12 Improving confirmability of responses

The researcher needs to improve reliability of the study by verifying that there is an understanding of the context and terminology in relation to the responses to interview questions; how does the interviewer know that their interpretation of a given response is actually correct? It is also said that a review process is required to ensure rigour in qualitative research and in doing so improving the credibility of the recommendations (Morse *et al.,* 2002).

I set out a design where the gathering and analysis of data was conducted as part of a seamless approach, where analysis began at the completion of the first interview. I used an employee, who was not part of the enquiry pool, to confirm and develop my interpretation of organisational terminology, systems and processes, which was then utilised to inform subsequent interviews. The Principal Manager for Project Services Learning and Development was also used as a feedback loop to improve my understanding of the environment and responses. I held Meetings with this Director on six occasions for an average of 26 minutes each; these meetings were used to determine the credibility of preliminary findings and no information was provided to suggest that respondents were misinforming me. Where further understanding could not be provided I contacted the interviewee was for clarification; this occurred on two occasions.

I also used a RA, with a BSc degree relating to PSUK(A)'s field and previously employed in a business management role within the same industry, to sample 25 anonymous responses from 10 informants for comparison against my PIAT feedback tool. I provided responses in non-coded transcript format with, on average, 3.25 minutes of interview time. The RA spent approximately 2 hours reviewing the information and agreed with the relationship between the interview response and my coding; at no time was the RA informed of my findings.

I held two debriefings, with the PSUK(A) Managing Director and Principal Manager for Project Services, within three hours of the final interview being conducted. These meetings lasted for approximately one hour and provided an overview of my preliminary analysis. The Managing Director expressed "surprise at the depth and scope of the findings" (personal communication by interview, 2009), while the Principal Manager found the initial summary to be "in line with what [they] thought and confirm[ed] many things [they] believed to be true" (personal communication by interview, 2009). The Principal Manager offered further feedback in that the analysis had "brought up some key issues that had not been considered [prior to the enquiry]".

5.5.12.2 Dependability Audit

I subjected my research design to a dependability audit (Table 5.4, p. 166) through two forums for peer review. Firstly, the suitability of SSM and the Critical Case Study method was reviewed as part of the University of Edinburgh PhD Progress Board. This allowed for peer review by a five-member panel consisting of an independent Chair, my two PhD supervisors and two Examiners, where it was agreed that SSM and the Critical Case Study were appropriate. Secondly, research design and interview protocols were audited in meetings with my two PhD supervisors in order to allow for peer debriefing and strengthen the credibility of the enquiry.

Chapter 6: Findings[9]

6.1 Meta Analysis of literature

My systematic literature review produced 287 examples of usable literature (Appendix 10). Table 6.1 presents top-level findings from the meta-analysis; lower level findings are presented in Appendix 8. Table 6.2 represents the tolerance of findings against the meta-analysis average.

	Business and Management	Medicine and Health	Social science	Engineering	Decision Science	Computer Science	Average
No of articles	n58	n45	n45	n50	n45	n44	n287
% Academic Journals	62	53	73	38	51	66	57
% Conference Proceedings	10	9	11	14	11	9	11
% Books	0	0	4	4	0	0	1
% Other	28	38	11	44	38	25	31
KM View							
% HR-Centric	69	20	44	28	31	2	32
% Socio-Techno-Centric	26	44	53	54	38	55	45
%Techno Centric	5	36	2	18	31	43	23
Construct							
% Catalysts	88	100	84	98	98	93	93
% Create K	57	42	64	48	67	52	55
% What is known	71	82	82	84	82	77	80
% Extending what is known	64	62	67	70	73	75	68
% Reflection	55	58	36	46	56	32	47
% Context	67	76	67	60	58	61	65
% Applying K	60	62	67	72	67	66	66
% Motivation	71	27	51	42	36	23	42
% Sharing	93	71	76	80	71	68	76
% Culture	71	38	67	50	49	30	51
% Org. Structure	50	31	49	38	38	30	39
% Spaces	19	16	20	13	13	25	18
% Storing K	64	76	71	45	84	93	72
% Communicating	81	82	91	82	76	89	83
%Artefacts	79	91	78	86	78	86	83
% K Structure	33	60	58	42	53	70	53
%Av. No. of constructs per source	62	62	62	62	62	62	62
% No. of sources discussing all constructs	3	0	4	6	2	5	3

Table 6.1 Table of Meta-Analysis Findings

HR-centric is used as a descriptor to represent managerial knowledge resources within OKM literature, Techno-centric is used to describe technical or object view

[9] All percentages are rounded to the nearest whole

and Socio-Techno-centric is used to describe a view that mediates the degrees of the explicit and the tacit that exists between the Techo-centric and HR-centric views.

	Range of findings (%): Average representation of all constructs = 62%						
	Business and Management	Medicine and Health	Social science	Engineering	Decision Science	Computer Science	Totals
% Catalysts	+22	+38	+22	+36	+36	+31	+31
% Create K	-5	-20	+2	-14	+5	-10	-7
% What is known	+9	+20	+20	+22	+20	+15	+18
% Extending what is known	+2	0	+5	+8	+11	+13	+6
% Reflection	-7	-4	-26	-16	-6	-30	-15
% Context	+5	+14	+5	-2	-4	-1	+3
% Applying K	-2	-2	+5	+10	+5	+4	+4
% Motivation	+9	-32	-11	-20	-26	-39	-20
% Sharing	+31	+9	+14	+18	+9	+6	+14
% Culture	+9	-24	+5	-12	-13	-32	-11
% Org. Structure	-12	-31	-13	-24	-24	-32	-23
% Spaces	-43	-46	-42	-49	-49	-37	-44
% Storing K	+2	+14	+9	-17	+22	+31	+10
% Communicating	+19	+20	+29	+20	+14	+24	+21
%Artefacts	+17	+29	+16	+24	+16	+24	+21
% K Structure	-29	-2	-4	-20	-9	+8	-12

Table 6.2 Tolerance of findings against meta analysis average for the whole

What this data demonstrates is that common functions and constructs exist across sectors.

The 16 functions and constructs are exhibited in all sectors (Table 6.1), with a situated frequency range of +38% to -49%, across the meta-analysis (Table 6.2). The four functions and twelve constructs within my findings are identified and defined in the next section.

6.1.1 Four KM Functions and Twelve Constructs

The working descriptions for my sixteen constructs were created from definitions used by authors in my meta analysis OKM literature sample. I arrived at these working definitions by using a parsimonious approach, where the "simplest explanation that explains the greatest number of observations is preferred to more complex observations" (Fastovsky and Weishampel, 1996, p. 437). I do not believe it to be possible to provide definitive descriptors for my 4 functions and 12 constructs that can be applied across all sectors or geographic locations, as this is one of the problems with socially constructed 'soft' systems, where elements of culture can act as a barrier to the development of a general system. This is evidenced in literature through the transition from General Systems Thinking to Soft Systems Thinking (see p. 64-71) and, I would argue, the lack of impact associated with the work of Holsapple and Joshi (2004) (see p, 91). Therefore these descriptors cannot be seen as being beyond contestation, and are instead presented as working definitions or descriptors that provide academics and practitioners an understanding of the underpinning assumptions within my research.

Create knowledge: The process of extending existing knowledge resources through combination of these resources or generation of new knowledge. However, knowledge generation requires other factors (see p. 190-191) and, while acknowledged in its own right within the coding, there is cross-over with the construct, *Extending what is known,* which is differentiated through the cognitive problem-solving process, as opposed to the organisational need to develop knowledge.

What is known: Refers to knowledge resources that already exist, encompassing technical and managerial knowledge, internal and external to the organisation, embedded within people and artefacts. It is differentiated from *artefacts* through its utilisation, such as through knowledge creation, as opposed to the act of designing an artefact through codification, utilising physical or virtual media or products, or by being embedded in services or processes.

Extending what is known: The process of extending *what is known,* where individual, group or organisation knowledge resources are insufficient to resolve the problem (see p. 88). *What is known* is extended by enquiry, through problem-solving and combination with other knowledge sources. There could be said to be an issue with *extending knowledge*, as the process itself must indicate the existence of current knowledge to allow for extension, which, using the rationale in this thesis, could make it a function. However, in my research it is intended to respond to specific issues of new knowledge adaption or formulation through problem-solving and is therefore listed as a construct, as in transitioning from knowledge to knowing. The literature suggests that existing knowledge is essential to engage in enquiry (for example, Revans (1980) P+Q=L, where P is existing knowledge and Q is the questioning process (see p. 88), which advances knowledge resources towards a new solution or resolution.

Catalysts: Refers to stimulants for OKM functions and constructs: Time – actual time allocated by the organisation for OKM activities; Finance – budgetary resources; People – human resources, either acquired or developed by the organisation and their contribution to knowledge resources; *Technology* – platforms designed to provide storage of, access to, transmission of, and extension of, *what is known*, and spaces for virtual interaction.

Communication: The ability of knowledge resources to communicate content in an organisation, verbally, visually and textually, in both live and codified forms.

Capturing and Storing: The act of acquiring and storing knowledge resources for later use. This could take the form of human, process or technology-based memory, and is relevant to internal and external sources. I decided to combine the act of acquisition (or capture) with the need to store knowledge, as the two functions are often spoken of in complimentary terms within OKM literature.

Context: Relates to the place and time within which the OKM activity is situated. It determines the content of knowledge resources, the application of *what is known*, the acquisition of knowledge resources, the sharing of knowledge resources and the manner in which knowledge resources are extended. *Context* can be determined by time and place, and in an organisational setting by discipline or sector, but can also be determined by organisational vision, mission, strategy and policy. Context can take into account an organisation's internal and external environments as they relate to the development of OKM systems.

Motivation: The stimulus to act at an individual, group or organisational level; this could be through environmental drivers, organisational leadership, process design, policy or reward and incentive structures to induce knowledge resource transactions between human resources, including their interface with technology, and the internal/external environment.

Sharing: The need for interaction and exchange between people to stimulate the use, acquisition, storage and generation of knowledge resources. These are person-to-person, individual-to-group and group-to-group transactions, internal or external, taking place in physical or virtual spaces, encompassing activities such as CoP, coaching and mentoring.

Culture: The values and ideology of the internal and external organisation environments, brought about by time, history and space that impact OKM process; for example, the interface between a US-owned, market-seeking, organisation and employee dynamics as it expands into China, and the friction that can occur as North American and Asian cultures interface for the first time within a single operational environment.

Organisational structure: The organisational architecture that represents the division of labour.

Spaces: The physical/virtual location of the organisation in relation to external knowledge resources that assist in enabling the exchange and extension of what is known. It also applies to the virtual and physical spaces within an organisation and the manner in which they activate/hinder OKM activities.

Using knowledge: Refers to the application of what the organisation or individual knows against operational and strategic needs.

Artefacts: Refers to representations of knowledge resources that exist inside and outside an organisation, for example: physical text; digital text; processes; patents;

products; services; blogs; databases; stories. *What is known* is differentiated from an artefact in that an artefact is seen as existing outside the individual.

Reflection: Relates to feedback processes, which are seen as being part of the process of developing knowledge resources (for example, see the development of the original Action Learning formula (P+Q=L) to encompass reflection (P+Q+A+R=L) (see p. 88). It is also extended to encompass review, being the formal or informal process of evaluation of the organisation process in part or as a whole; for example, Quality Assurance processes.

Knowledge Structure: Refers to the architecture of knowledge indexes, such as taxonomies or library functions, within an organisation. This construct indicates where knowledge is located; how it is located; and how it is indexed, both as a unique resource and its systematisation within a whole.

6.1.2 Wider Findings

OKM is a 'Socio-Techno-Centric' field, with 45% of literature supporting this view against HR-Centric (32%) view and Techno-Centric (23%). Business and Management will emerge as a point of focus later in this Chapter and is identified here as an outlier, where the HR-Centric view dominates 69% of the literature. This could be a concern, as the literature review suggests there to be varying degrees of tacit or explicitness in knowledge resources as the environment moves from the complicated to complex domain, suggesting that a blended approach is required and that a bias towards an extreme could be one of the causes of practitioner dissatisfaction highlighted in Chapter 2.

The findings demonstrate considerations in this area for each of the disciplines. For example, in the case of Social Science, there appears to be a tendency to focus on either the HR-Centric or Techno-Centric view and, therefore, it could be suggested that research needs to explore the middle ground to accurately reflect the needs of organisations as set out in the KEn Diagram (p. 26).

6.1.2.3 Issues of completeness and bias in describing the KM domain

Only 3% of literature refers to all 16 elements identified in this study, with an average of 62% or 10 factors mentioned in any single item of literature. This brings into question the credibility of much of the wider body of OKM literature, and seems to confirm the view of Edwards *et al.* (2003) (see p. 22), in that "relatively few articles are based on rigorous research, and most KM theory is not well informed by practice" (p. 49). Also, it brings into focus the concerns alluded to throughout Chapter 3, where it was suggested that models lacking completeness could have weaknesses in their architecture that become exposed when organisations attempt to operationalise them, perhaps resulting in dissatisfaction with the concept. This claim for failure due to weaknesses in the model architecture appears to be a reasonable assumption to make; if constructs are not identified within the architecture and the nature of the process relies on the completeness of the whole, as suggested in the literature review in discussing the nature of non-linear systems (Ashby, 1956), then non-identified constructs are likely to increase the potential for system failure (see p. 74).

According to the meta-analysis descriptors of Techno/HR/Socio-Techno-Centric, it appears that sectors with a strong 'Techno-Centric' (technical knowledge resources) view of the world could lack focus on 'HR' (managerial knowledge resources) aspects that impact OKM systems. This is demonstrated in literature in *Medicine and Health*, *Decision Science* and *Computer Science* when compared against the predominantly HR-Centric view of *Business and Management*. For example, 71% of *Business and Management* sources acknowledge the need for '*Motivation*', compared with 27% in *Medicine and Health*, 36% in *Decision Science* and 23% in *Computer Science*. Similar results can be observed with '*Culture*' and '*Organisation Structure'*. The tendency is reversed when observing a similar comparison with '*Knowledge Structure'*, perhaps a more technology driven construct, which achieves low recognition in *Business and Management* when compared to *Medicine and Health*, *Decision Science* and *Computer Science*. This confirms that a tendency towards OKM processes could result in pivotal or limiting management constructs being ignored.

These tendencies are amplified when reviewing the data according to type, Techno/HR/Socio-Techno-Centric. The Techno-Centric view produces 1 article that refers to all 16 functions and constructs (2% of literature). The Socio-Techno-Centric view produces 13, or 10% of literature. This disparity between the two views is further amplified when examining the number of articles that refer to at least 90% of the functions and constructs, a range of 13-15. The Techno-Centric view returned 0% of the literature from the meta analysis and the Socio-Techno centric view returned 18% of the literature used in the meta analysis. This again reinforces the concerns of authors such as Edwards (2003) who questions whether OKM practice is well enough informed by research (see p. 22).

6.1.2.1 Creating 'Know-What' in the KM domain

The analysis of the literature appears to confirm the gap in developing 'know what', as suggested in Chapter 2.

This is evidenced through areas, such as 'Developing Knowledge' or '*Creating Knowledge'* in the K-Core model (Figures 8a through 8c, p. 151-152), which McElroy (2000) observed as a process that is taken for granted. For example, authors identified in the literature review, such as Amidon and Davies (2004) and Nonaka (1991), amongst others, acknowledged the importance of knowledge generation to the KM process. However, there are constructs that need to be, and that can be, identified in order for 'know what' to progress to 'know how'. These include:

- *What is known* - Roth (2003), Kulkarne *et al.* (2006), Armstrong (2006) and Antonacopoulou (2006) identified the need for pre-existing knowledge in the development process. Existing knowledge or learning resources bring recognition of meaning to the process of enquiry into new learning or knowledge; "The role of knowledge in the learning process comprises drawing connections between what is already known and what may be discovered" (Kulkarne *et al.,* 2006, p. 19).

- *Extending what is known* - Enquiry is supported by many authors as being important to knowledge generation (Chowdhury, 2006; Kulkarne *et al.,* 2006; Argyris, 1982). Antonacopoulou (2006) suggests that enquiry is needed to evolve existing knowledge to apply in new contexts. Cook and Brown (1999) argued that to progress knowledge to knowing it is essential to engage in enquiry, which they define as challenging existing knowledge to advance an answer, solution or resolution

- *Reflection* - Authors propose reflection to be core to the knowledge generation process (Clegg, 2003; Stewart, 1997; Sarah and Haslett, 2003; Argyris, 1982) and is evident in practical methods such as Action Learning (Revans, 1980) (see p. 88). Sarah and Haslett (2003) observed reflection as a challenge for organisations in legitimising the knowledge and learning process: "For any learning or knowledge-creation to occur, there must be a space and time for evaluation and reflection" (p. 9). Hedlund (1994) stated that reflection is essential to the knowledge process as it describes the interaction that occurs between articulation and internalisation.

- *Context* – This is described by authors such as Edwards and Rees (2006) as the environment within which knowledge transactions take place: "every action is intrinsically connected with the context or situation in which it occurs" (p. 155).

- *Motivation* – Hall (2001), Smith (2003), Bhalla and Lampel (2007) supported Motivation as an influence upon knowledge generation. Hall (2001) observed motivation as being more important than the capture storage and socialisation of knowledge. Smith (2003) suggested that if organisations fail to engage individuals in a manner that stimulates their intrinsic motivation, they would labour to produce relationships contracted by compliance, which will not produce the knowledge needed for inimitable competitive advantage.

The meta-analysis literature sample demonstrates that enablers of '*know what'* are frequently missed. This is evidenced where '*Creating Knowledge*' is identified in only 55% of the literature with a discipline/sector variation of +5% and -20% (Table 6.2, p. 184). In sources where '*Creating Knowledge'* is identified, '*Reflection*' is only referred to in 47% of them and '*Motivation*' in 42%. This suggests a failure in the wider literature to develop aspects of '*know what*', which must mean that there are barriers to the development of '*know how'*. This finding also demonstrates that McElroy's (2000) observation, that the knowledge creation process is taken for granted still holds true over a decade later.

6.1.3 An evidence-based definition for the purpose of OKM systems

In distilling the findings from the literature sample, in accordance with the earlier example from 'Developing Knowledge' (see p. 190-191) the following are put forward as OKM system functions for the coordination of knowledge resources:

- Use knowledge
- Sharing of knowledge
- Capturing and Storing of knowledge
- Creation of knowledge

The following are proposed as constructs, or elements, that organise to create these functions:

- Catalysts (People, Technology, Finance, Time)
- What is known
- Extending what is known
- Reflection
- Context
- Motivation
- Culture
- Organisational Structure
- Space (physical and virtual)
- Communicating
- Artefacts
- Knowledge Structure

One of the challenges set out in Chapter 3 was the lack of evidence-based definition for the purpose of the OKM systems. Given the evidence generated by the meta-analysis findings, it is possible to offer an evidence-based definition for the purpose of OKM systems designed to coordinate internal knowledge resources, which is presented below. I took the decision to utilise 'technical' and 'managerial' knowledge resources, as put forward by Antonacopoulou (2006), as opposed to more popular 'tacit' and 'explicit' categorisation, as, in my opinion, it captures the organisation's system needs more clearly, as per the KEn Diagram (p. 26). In doing so it avoids the controversy surrounding the language of tacit and explicit knowledge (see p. 43) while also aligning with feedback gained during the case study pilot (see p. 173):

KM works to coordinate the acquisition and storage, application, sharing and development of knowledge resources, both technical and managerial, against the strategic and operational needs of the organisation

6.1.4 Data analysis considerations

Several potential constructs were identified and rejected during the coding process:

'*Content value*' was dismissed as I considered it to be determined by context and reflection, as demonstrated in the literature review by theorists such as Tranfield *et al.* (2003), Edwards and Rees (2006) and the value formula put forward by Hori *et al.* (2004) (see p. 88).

'*Process*' was not included as I considered it to be an artefact of, or pathway for, OKM systems, which marries with the view of Knowles *et al.* (2005), who noted processes to be a mechanism that aligns the needs of the individual with those of the organisation; what could be considered, in terms of the progression of this research, to be the model itself. This is further satisfied by DeLong (2004), who posited, "knowledge that is explicit is easily codified and can be shared independent of its human source, or it can be embedded in processes or systems" (p. 83).

6.2 Meta Analysis of models and frameworks

In this aspect of my enquiry I evaluated 71 theoretical or conceptual OKM system models and frameworks drawn from a period from 1996 to 2008 (Appendix 9). An attempt was made to access and contrast similar models derived from founding concepts, as described in the chronology of KM described in Chapter 2 (Table 3.2, p. 58), but little information appears to have been made available in electronic form. I also continued to test the literature for emerging constructs not accounted for in the initial meta-analysis; this provided a nil return.

6.2.1 Key findings

Of the OKM models and frameworks I reviewed only 1%, (1 of 71), discussed all 16 functions and constructs identified in the original findings. However, this one model failed Bacharach's (1989) secondary test of Comprehensiveness and Clarity; four of the constructs were discretely recognised in the supporting text of the article, but not represented in the visual representation of the model, which fails Rasli's (2004) test of '*Correctness*'. Therefore, based on these criteria, 0% of models reflected the functions and constructs identified in the initial meta-analysis, although this does not rule out the potential for some of these models to be adapted to meet the needs of my initial findings.

The most frequently represented Factors and Constructs from the meta analysis are compared against their representation in the meta analysis of models to ascertain whether there was variation between the data sets (Table 6.3)

	Model Meta-analysis	Primary Meta-analysis	Variation
Catalysts	86%	93%	-7%
Context	85%	65%	+20%
Communicate	82%	83%	-1%
Sharing	80%	76%	+4%

Table 6.3 Comparison of most popular models from meta-analysis findings

Similarly, the least frequently represented Factors and Constructs are represented in Table 6.4

	Model Meta-analysis	Primary Meta-analysis	Variation
Spaces	17%	18%	-1%
Organisation Structure	31%	39%	-8%
Motivation	45%	42%	+1%
Culture	55%	51%	+4%

Table 6.4 Comparison of least popular models from meta-analysis findings

Table 6.3 and 6.4 are presented to demonstrate the gaps in model construction, which impacts completeness in relation to the environment the models are designed to regulate. Of note, *context* is more widely recognised within the model meta analysis sample than the meta-analysis literature sample; other than this, the findings between the meta analysis of literature and the model meta analysis agree.

In total 721 occurrences of the constructs identified in my meta analysis of literature were identified in my meta analysis of models with an average of 10 constructs being present in any given model or framework; this supports the findings of the initial meta-analysis research. This average of 10 constructs remained constant regardless of whether the model sampled was generic or contextualised according to discipline/sector. Peer reviewed models provided an average of 11 constructs per model, or 67%, compared to 10 constructs, or 60%, of other models. This suggests that peer reviewed models and frameworks to be more complete; it also confirms limitations in the flow between academic and practitioner, as posited in the literature review (see p. 99-102).

My research did not attempt to identify an author's meaning when discussing a construct in either of the meta analysis samples, which could be seen as a shortcoming. For example, there could be issues of interpretation, such as where the '*Use*' or '*Developing Knowledge'* descriptor could take for granted the existence of

'*What is known'* as a construct; the possible rationale being that something has to be known for it to be used or developed in the first place.

However, accounting for the potential of this assumption, 15% of models still failed to acknowledge any of these constructs. Similarly, where '*Sharing*' could be misinterpreted as '*Communicating*', there is still a 6% shortfall in the identification of the construct within the sample pool. This also reinforces concerns with regard to the robustness of research in the OKM field and the transmission of '*know-what'* (see p. 99-102).

'*Creating Knowledge*' is represented in 72% of the models. However, 75% of this sub-sample failed to highlight the constructs associated with knowledge creation discussed earlier (see p. 190-191). This reinforces my meta-analysis findings, further supporting the suggestion in the Chapter 3 that literature in the field is deficient in the transmission of '*know how'*. Bacharach (1989) questioned the validity of any theoretical model or framework that fails to address '*know how*', suggesting models of this ilk to be narrative and lacking in value.

Exploring my findings further, of the 28% of models that failed to recognise '*Developing Knowledge*', 45% of that sub-sample also failed to acknowledge the existence of '*What is known*' or '*Extending what is known*'. This would seem to demonstrate a critical gap in the literature when considering '*Know what*', which is seen by Bacharach (1989) as being essential in the consideration of a valid theoretical model.

My research represents a Northern Hemisphere bias, which is a limitation of the meta-analysis, but representation from Asia, as an example, is inhibited by language, where research is published in Japanese or Chinese and therefore locating and analysing research is limited by the language capabilities of the researcher; this is also recognised in the discussion Chapter (Chapter 7). However, there is nothing to suggest that my findings would be impacted by geographical location.

My research did not collect enough information to ascertain the validity of the models according to the six sectors set out by Mekhilef and Flock (2006). This acknowledged, it could be said, with 63% of the sample being generic models, that this provides sufficient representation to suggest that my findings would be valid regardless of discipline/sector.

My initial meta-analysis suggests that there are common functions and constructs that unify the field, which supports the potential for creating a common OKM system framework for the coordination of knowledge resources. However, there is no evidence in the sample to support the prior existence of a framework that responds to all the constructs identified in this research (see p. 185-188); the one article in my sample that did identify all the constructs failed to illustrate them in the supporting model. This brings validity to my claim to have developed a new model to describe OKM systems.

6.3 Survey and fractal analysis

6.3.1 Survey: Overview of respondents

My survey received 107 responses from Africa, Asia, Australasia, Europe, North and South America. The verification process resulted in a data set with 91 usable returns, including respondents from Boeing, NASA, British American Tobacco, IBM, US Army, Australian government, recognised KM consultants and published authors in the field.

Respondents could be described as being mature or experienced in KM, with the majority (78%) having 3+ years of experience, under 12 months (7%), 1-2 years (14%), 3-4 years (12%), 5-6 years (12%), 7-8 years (11%), 9-10 years (10%), 10+ years (33%). [10]

Returns were biased towards the Business and Management sector: Business and Management (64%); Social science (12%); Computer science (10%); Engineering (9%); Medicine and Health (2%); Decision sciences (2%).

[10] All percentages in the survey analysis have been rounded to the nearest whole.

Respondents were predominantly from the Northern Hemisphere: North America (38%); Europe (24%); Asia (14%); Australasia (14%); Africa (4%); South America (4%).

Respondents were predominantly practitioners: Practitioners (69%); Academics (12%); Other (12%); Students (7%). Respondents, who categorised themselves as 'Other', were given the opportunity to clarify their perception of their position, which included: 1 respondent who classified themselves as a 'sales consultant', 1 as a 'trainer' and 10 as 'consultants' – this allowed respondents to disassociate themselves from Mekhilef and Flock's categories, if they so wished; this categorisation was not significant and was more a point of interest than a factor for analysis.

6.3.2 Satisfaction with current KM models

Respondents were asked about their satisfaction with the OKM models they were currently using to develop KM processes: 57% stated that they were satisfied with the model that they were using, while 43% expressed dissatisfaction. A deeper analysis would have been conducted to reflect upon the findings according to discipline, but the sample pool is dominated by Business and Management and other disciplines did not have a high enough representation to provide reliable findings. On reflection, this finding is subject to the same limitations as the findings of the Bain and Associates reports (Rigby and Gillies, 2000; Rigby and Bilodeau, 2007; 2009; Rigby, 2010) introduced in the Chapter 2. It is not possible to determine the understanding of the model's construction on the part of the respondent; the context of its application; the knowledge intensity of the process of the domain or domain-context it is being applied in; understanding of its application; the method of evaluation; experience of the respondent in delivering the model; or intensity of feeling towards the opinion of satisfaction/dissatisfaction. Therefore, though the relative satisfaction is interesting, my survey tool, in the consideration of this single aspect, did not provide the rigour in design for the finding to have any bearing on my research; nor was it a core aspect of my focus for this research.

6.3.3 Comparing Survey and Meta Analysis hard data

Due to bias within my survey sample pool respondents towards the discipline of Business and Management, I decided to not only compare the survey total against the meta-analysis total, but, to ensure fairness of data comparison, I compared the 58 survey respondents from Business and Management against the 58 aspects of literature from the same discipline populating the meta-analysis. I acknowledge the similar sample size as a significant coincidence. However, only 48% of the meta-analysis literature represents practitioner views, whereas 72% of the Business and Management survey respondents were practitioners; therefore my data cannot be considered to be a truly equal representation and variations could still occur due to the bias of the survey data towards practitioners.

Function	Survey total %	Meta-analysis %	Tolerance Survey Vs Meta-analysis	Business and Management Survey %	Business and Management Meta-analysis %	Tolerance Survey Vs Meta-analysis
Capturing and Storing	67	72	-5%	63	64	-1%
Sharing	91	76	+15%	87	93	-6%
Creating	62	55	+7%	57	57	0%
Using	66	76.5	-10.5%	66	70	-4%

Table 6.5 comparison of survey and literature meta analysis data against KM functions identified in the meta-analysis

What Table 6.5 suggests is that there is a significant alignment between the findings of my literature meta-analysis and that of my survey, which is amplified when focused towards *Business and Management*. One issue is the view of *Knowledge Sharing* as an OKM function there is a +15% variation, when considering the survey against the meta-analysis totals. This said, the tolerance narrows significantly when comparing *Business and Management* data in isolation (-6%). Also, the analysis demonstrates such a weight of support for the construct of *Knowledge Sharing* that it does not appear to be a significant point requiring further discussion.

Function	Survey total	Meta-analysis %	Tolerance Survey Vs Meta-analysis	Business and Management Survey %	Business and Management Meta-analysis %	Tolerance Survey Vs Meta-analysis
Knowledge structure	39	53	-14%	33	33	0%
Time	76	Not analysed as an individual factor	NA	69	Not analysed as an individual factor	NA
People	96	Not analysed as an individual factor	NA	93	Not analysed as an individual factor	NA
Technology	49	Not analysed as an individual factor	NA	54	Not analysed as an individual factor	NA
Finance	53	Not analysed as an individual factor	NA	45	Not analysed as an individual factor	NA
Reflection	51	47	+4%	40	55	-15%
Physical Spaces	59	Not analysed as an individual factor	NA	59	Not analysed as an individual factor	NA
Virtual Spaces	69	Not analysed as an individual factor	NA	67	Not analysed as an individual factor	NA
Communication	69	81	-12%	63	83	-20%
Motivation	91	42	+49%	86	71	+15%
Combining Knowledge	81	Not analysed as an individual factor	NA	76	Not analysed as an individual factor	NA
Extending Knowledge	77	68	+9%	75	64	+11and
Artefacts	61	83	-22%	54	79	-25%
Culture	91	51	+40%	90	71	+19%
Structure	82	39	+43%	87	50	+27%

Table 6.6 comparison of survey and meta-analysis data against KM constructs identified in the meta-analysis

Table 6.6 demonstrates convergence, but there is also divergence. *Motivation* generates a much more intense signal in my survey findings (+49% and +15%), suggesting a greater importance in practice, which, it could be argued, is not being picked up in academic literature. My initial meta-analysis was biased towards academic sources while the survey had a practitioner bias.

Knowledge Structure has a -14% variation in comparison to the meta-analysis; however, this could possibly be explained via the Business and Management bias in the sample as a whole; this is justified when isolating the discipline, where there is 0% variation.

Reflection has significant variation (-15% survey in comparison to the meta-analysis); this could be explained through the bias towards practitioner views in my survey over academic literature in my meta-analysis. This could be interesting, as it reinforces the gap between practitioner and theoretical views (see p. 99), where academic literature identified more of the constructs in the coding, from the literature meta analysis, than did the practitioner sources from the survey.

Other variations in the data comparison could signpost a direction for future research around particular areas in academic or practitioner research: *Communication* receives a significantly lower recognition (-20%) in the Business and Management survey responses, though 63% still agreed with its significance in the OKM system. The same could be said for *Artefacts* (-25%), though 54% still agreed with the assertion that it formed part of an OKM system. My survey, and its practitioner bias, provided a greater weighting towards the recognition of culture (+19%) and organisation structure (+27%) when considering an OKM system framework.

Reflecting on my survey tool, it could be considered that I made a mistake in isolating the catalysts of time, technology, finance and people, when this was not the case in the original meta-analysis; this inhibited a proper comparison of the data and, while data were collapsed and synthesised for the fractal analysis, it is a weakness in the analysis. The same could also be said for the separation of the 'spaces' construct into physical and virtual spaces.

My survey sample supported the socio-techno centric view of OKM systems, with 82% supporting this view, 1% the Techno-Centric view and 15% the HR-Centric view. What is interesting is that while the top-level findings agree with my meta-analysis findings, the bias towards the socio-techno centric view is much greater. It is interesting is that my survey is dominated by the *Business and Management* sector, which, according to the initial meta-analysis findings, is biased towards a HR-Centric view of OKM systems, whereas only 15% of the *Business and Management* survey population supported this. Respondents were also asked to weight the bias (using a split of 100%) towards people or technology according to their perception of OKM processes (Table 6.7).

N=56 T=Technology HR=People	**T 50 HR 50**	**T 40 HR 60**	**T 35-40 HR 60-65**	**T 25-30 HR 70-75**	**T 20 HR 80**	**T 10 HR 90**
	9 (16%)	1 (2%)	3 (5%)	23(40%)	17(30%)	4(7%)

Table 6.7 Survey respondents KM weighting Technology versus HR processes

In my survey (whole survey: n=91) 82% were in support of a blended approach to OKM systems in organisations and strongly skewed in favour of 'people'. Later in the survey I asked an optional question (Q. 7a), which asked for a subjective weighting between technology and people-based OKM systems, (n=56), 44 respondents (77%) weighted OKM as bias toward people with a split of 70:30 or greater, which suggests that they observe the field as being more HR-Centric in its grounding (more towards the managerial end of the KEn Diagram (see p. 26)). This aligns closely with my meta-analysis, where 69% of the Business and Management sample leaned towards a HR-Centric view of the world and all those from the survey (n=44) who supported a bias of 70-30 or greater towards people over technology self selected their discipline as *Business and Management*.

This strengthens the relationship between my meta-analysis and survey data, which is important when attempting to develop a case for similarity. The relationship between the datasets is important, as I selected the discipline within the coding of literature for the meta-analysis literature and the respondents self-selected their discipline in the survey; this suggests that the coding parameters for the disciplines fairly represented reality, at least in the case of *Business and Management*.

6.3.4 Susceptibility to a lack of completeness

My survey omitted two findings from the initial meta-analysis as a way to test the domain's susceptibility to 'incompleteness' in models, as suggested through the earlier discussion on dissatisfaction and model construction (see p. 76-82). Survey Questions (Q) 14 and 14a asked, "Do you believe anything has been missed from the list above [relating to KM constructs]?" and, "If you answered 'yes', what do you believe is missing?" Of 91 responses 36 (39%) stated that constructs were missing.

Of those, three (3% of the survey total) identified *Context* or an associated coding as being omitted; for example: "KM requires not just a structure, but also, perhaps better stated, a strategic approach to create, share and apply, which is applicable to the need" ("Strategic approach" falling within the coding parameters of '*Context*' (Appendix 3)). Only one (1) respondent identified *What Is Known* or related coding as an omitted construct.

This could be interpreted as demonstrating the vulnerability of the field to incomplete models, where, as suggested earlier in the met-analysis of models, 0 (zero) appeared to demonstrate all 16 functions and constructs identified in my initial meta-analysis. This aspect of the survey, while being a seemingly unique approach to survey design, potentially demonstrates the susceptibility of organisations to incomplete models, which has been suggested in my research to be a potential contributor to dissatisfaction with OKM systems.

Table 6.8 demonstrates how all other responses were coded against the original coding protocol.

Function/Enabler	Respondent input	Occurrence
Capturing and Storing	*Storing* *Acquiring* *Identifying knowledge* *Discovery*	1 1 2 1
Reflection	*Evaluating* *Appraisal and valuation* *Measurement*	1 1 1
Artefacts	*Publishing* *Codification*	1 1

Sharing	*Collaboration* *Connect people*	1 1
Context	*Context* *Applicable to the need*	2 1
Culture	*Culture* *Trust*	2 1
Catalysts	*People/Finance/Technology*	2
Motivation	*Incentives* *Passion* *Leadership*	1 1 7
Extending What Is Known	*Enhancement* *Creativity or Innovation*	1 1
What Is Known	*Knowing what you have* *Lack of knowledge*	1 1
Organisational Structure	*Organisational structure*	1
Using	*Leveraging* *Application* *Utilising*	1 1 1
Knowledge Structure	*Organising knowledge* *The order of information* *Data relations and knowledge linkage*	1 1 1

Table 6.8: Survey comments against coding protocol

It might be argued that some of the respondents did not understand my initial question, by the way in which their responses appear to be an extension of the initial question. For example, the following response to Q14a:

> "The concept of KM 2.0, which is coming into being with web 2.0. 2 most important characteristics 1. 'More Interactive' 2. 'No Physical Boundaries', which have numerous benefit" (Respondent, GS0882).

The essence of the response falls within the parameters for *Catalysts* with 'technology' as an enabler; the respondent expresses an emphasis on the opportunities proffered by emerging technology. It therefore does not signpost a missed construct. The coherence of the response was verified by cross-referencing it with that of Q13d, "Technology is required to make KM work", to which the respondent 'Strongly agreed'.

6.3.5 Addressing respondent feedback on missing constructs

Leadership (Table 5.8) was frequently identified as a missing construct amongst survey respondents, for example: "Committed leadership such as: "KM is a lot about behaviour, and needs to be modelled by leadership" and "Leadership backing and advoca(cy)" (Respondent, GS0862). However, I contend that Leadership is an aspect of motivation and not a separate construct in itself. Theorists such as Evans (1970) and Isaac *et al* (2001) amongst others have been discussing this for many years; linking path-goal, motivation and expectancy theory to demonstrate that leadership has both a positive and negative motivational influence over employees in an organisation:

> "We…explicitly link expectancy theory and leadership concepts to demonstrate that leader interactions with followers permit the establishment of highly motivational working environments" (Isaac *et al.,* 2001, p. 212).

Evans (1970) links motivation to leadership in context stating:

> "Supervisory behaviour will only have an impact upon worker behaviour and satisfaction if the following two conditions are met: a) Supervisory behaviour is related to the path instrumentalities by the worker. b) Path instrumentalities are related to satisfaction and performance" (p. 97).

It would therefore seem fair to link Leadership to the *Motivation* construct within my meta-analysis coding protocol (Appendix 3).

There were four ambiguous responses to Q14a (4% of the survey respondents): "Most likely something is missing because KM is no easier to define than is knowledge" (Respondent, GS0819), "Far too much to list here" (Respondent, GS0825), "Too many other components to list" (Respondent, GS0871) and, "Don't know, but lots" (Respondent, GS0890). These responses could be seen as outliers, representing only 4% of the survey respondents, but they warranted further enquiry. Attempts were made to contact all four respondents, one responded and the other three failed to respond to three rounds of emails. The respondent who made contact (Respondent, GS0890) was engaged via a phone call, using the RA to overcome bias; the conversation was not recorded, but the RA took handwritten notes. Respondent GS0890 was a practitioner with five years of KM experience. When asked if they would elaborate upon the comment, "Don't know, but lots", the response was, "Well there are lots of things that haven't been considered". When asked, “Can you please clarify, ‘lots’ through specific examples”. The response was, “Well, you know, things like, let me think for a moment. Leadership springs to mind and what about learning, and developing people to work in a community?” The respondent was then asked, “Thank you, is there anything else you would like to add?” The response, “No, that’s about it, I think”. In reviewing this data it did not present any new constructs for consideration, when compared against my original coding protocol.

Other specific responses included: Training, which surfaces through Respondent GS0890, discussed above, (2), Eliminating knowledge (2), Learning (1) and Change Management (1).

Training and Learning was discussed in Chapter 3 (see p. 84); where it was noted that several theorists identified Training or Learning as being critical to OKM processes (Chowdhury and Ahmed, 2005; Jennex and Zakharova, 2005; Azmi and Zairi, 2005). It was argued that this is a substitute for the knowledge creation process, which is not identified by these authors as being critical to the overall OKM system. Restating the argument, learning has been closely identified with the knowledge creation process, this is reflected in the function of ‘*Creating Knowledge*’ and constructs that inform this process such as those suggested by Revans (1980), such as ‘*What is Known’*, ‘*Reflection*’, ‘*Extending what is known’* (see p. 190-191). This is widely supported in literature as a way to activate knowledge, which was discussed in the literature review as a key component in an OKM system (Quintas, 2002) and missing in some OKM literature, such as Nonaka’s (1991) SECI model.

Eliminating knowledge resources or what could also be termed as ‘reassessing’ or ‘unlearning’ (a willingness to forgo what is already known, in terms of tacit knowledge (Rebernik and Sirec, 2007)) is addressed through a combination of *Reflection* and *Context*. Tranfield *et al.* (2003) stated, “knowledge is produced in the context of application” (p. 212). Eliminating knowledge resources is addressed in the constructs identified in the meta-analysis through a combination of *Reflection* and *Context*. For example: “knowledge is produced in the context of application”

Antonacopoulou (2006). Hori *et al.* (2004) explored this position, as put forward in Chapter 2 (see p. 88), positing that the user determines the context, which in turn determines the value of the process. Their work is represented in the literature review through the following formula: Representational Context [artefacts]+Conceptual Context [existing in the mind]+Real World Context [situated application]=Value. What is suggested here is that value is determined by the propositional knowledge that already exists, combined with the understanding of the individual or collective, against the situated need of the organisation, determined by time and place. Knowledge resources will therefore be re-enrolled, adapted, extended or considered redundant according to this formula. Value is gained through the ability of the knowledge artefact to contribute to a solution to the presenting problem. If the artefact cannot assist in solving the problem then it is discarded and its value diminishes, if it succeeds then its value increases with use. I also contend that "eliminating knowledge" bears a relationship with what some theorists refer to as an *unlearning* process (Rebernik and Sirec, 2007). This can be associated with the learning processes subscribed to by Revans (1980), as discussed in the literature review (see p. 88).

Further, if organisations utilise reflective processes to determine access to existing resources it might be possible to enhance the decision-making process, enabling value as a determining the risk factor associated with eliminating knowledge from *What Is Known* by the organisation. For example, this is demonstrated through NASA's OKM statement:

> "KM has an important place at NASA. The designers and builders of the Apollos and the Space Shuttles are close to or at retirement age…The lessons learned over the years must be retained, especially since the costs of some of them were measured in lives" (www.hq.nasa.gov, 2010)

In addition, a survey respondent from NASA, identified through the analysis of survey responses, where they referred to themselves as a NASA Engineer, their association verified by their email address, emphasised the risk of eliminating knowledge resources:

> "In the end, myself and many others will retire and nobody will have even attempted to capture our legacy knowledge. In some cases it is little to no loss, in others significant loss" (Respondent, GS0847)

I argue that 'eliminating knowledge' is a reflective process that needs to be risk and quality assessed, with Hori *et al*'s (2004) framework providing an operational framework to overcome the challenge. The decision to eliminate knowledge resources also carries with it an element of risk, which requires a feedback process or *Reflection*, which is where it is identified within the meta analysis constructs.

6.3.6 Enquiring into a consensus of KM definition

The literature review demonstrated a lack of consensus when it comes to defining the purpose for OKM systems (see p. 66-67). Survey respondents were asked to give their operational definition of OKM for comparison against the meta-analysis findings. Out of the sample pool (n=91) only one (1) of the respondents, a practitioner from North America with 10+ years of KM experience, linked OKM to the four functions identified in the meta-analysis and to organisational output.

> "A poorly named field of practice that attempts to define the objects, people, processes, and technology required to create, capture, share, sustain, and forget the Intellectual Capital that creates value for individuals, teams, organisations and the world" (GS0821),

Of concern, 32 respondents (35%) confused knowledge and information, which reinforces the need identified in Chapter 3 for organisations to define the resource that the organisation is attempting to coordinate:

> "Any strategy, which may be enhanced by technology, that continuously helps people find, select, organize, and communicate important information and expertise which allows the user to make informed decisions" (GS0819)

> "KM develops organisational intellectual and business resources, for the purpose of sharing and leveraging information to obtain advantage" (GS0884),

> "The ability to search and access information in various forms and locations supported by technology and by processes and systems" (GS0805),

Only one (1) respondent provided what could be said to be a technology-biased definition:

> "Manage both implicit and explicit knowledge by blending of IT and ICT" (GS0833),

The majority, 58 (64%) mentioned, sharing, whether related to knowledge or information:

> “KM to my firm: gaining more money from the shared knowledge available; spend less time at work, and get more work done” (GS0888),

> “The practice of capturing and combining data and information with the experience of experts to transfer knowledge to those undergoing a similar experience” (GS0869),

> “KM develops organisational intellectual and business resources, for the purpose of sharing and leveraging information to obtain advantage” (GS0851),

The sample returned 15 (16%) responses that could not be coded, for example:

> “We don't use a particular definition - it depends on the situation” (GS0890),

> “Cant. KM has to be defined in its context of application. KM manages the knowledge of something” (GS0817),

> “Necessary way how to come through global progress” (GS0842),

> “For me it's about organisation wide information flows and clearing ‘chakras’” (GS0806),

This validates the findings of the literature review (Chapter 3), in that there is a diffuse view as to the meaning of knowledge resources in an operational context and that there is no generally agreed definition for the purpose of OKM systems. This reinforces the need for the evidence-based definition put forward throughout my research.

6.3.7 Fractal analysis[11]

My initial literature meta-analysis data totals for functions and constructs were broken down according to discipline (Figure 9.1). This demonstrates self-similarity between the six OKM disciplines used in my research, as identified by Mekhilef and Flock (2006) (see p. 64).

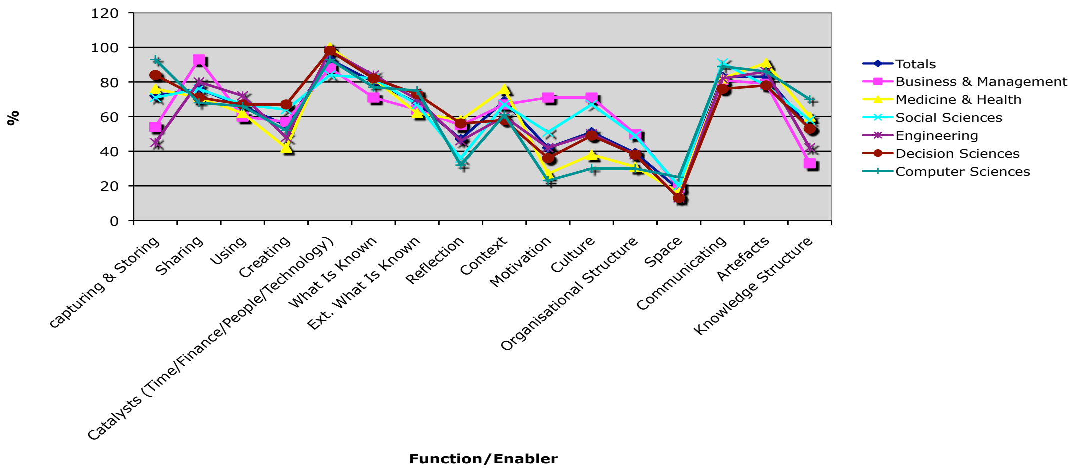

Figure 9.1: KM functions and construct totals: Meta-analysis of literature variation 1 (Griffiths and Evans, 2011)

[11] Elements of this analysis were first published in Griffiths and Evans (2011); the work presented here is solely my work, as stated in the introduction

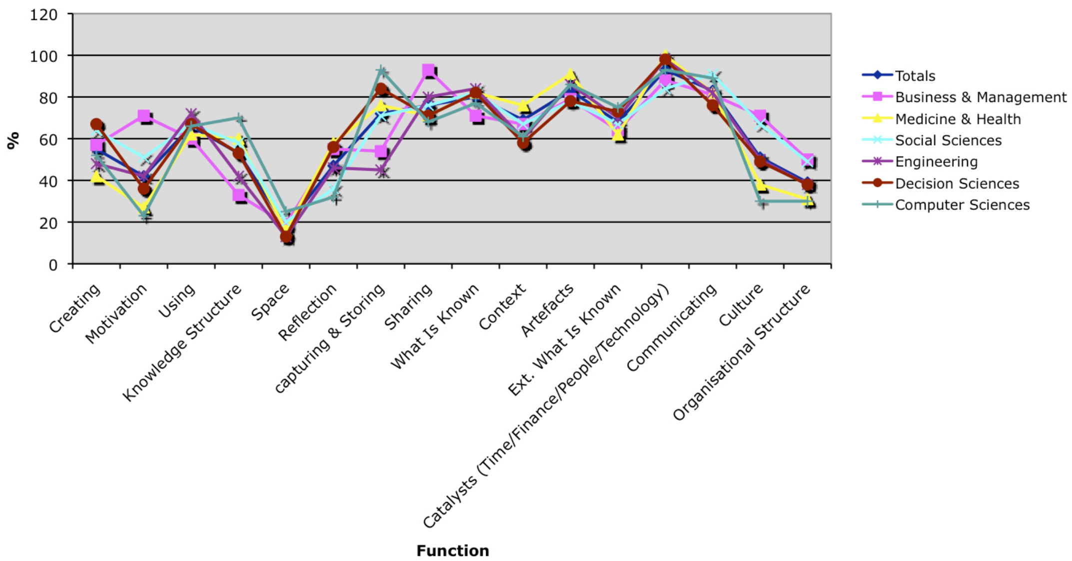

Figure 9.2: KM functions and construct totals: Meta-analysis of literature variation 2 (Griffiths and Evans, 2011)

However, various combinations of construct order are possible along the X axis (16!=2,092,278,988,800 permutations), which could distort the picture being presented in Figure 9.1, and the ability to analyse each variation is beyond the scope of this report. To overcome this limitation, I used a random number generator to select a variation of the construct order along the X axis (Figure 9.2), which demonstrates consistency in the data trends. This view (Figure 9.2) also assisted in identifying outliers for future discussion, such as the apparent inconsistency around *Motivation* within the discipline of Business and Management.

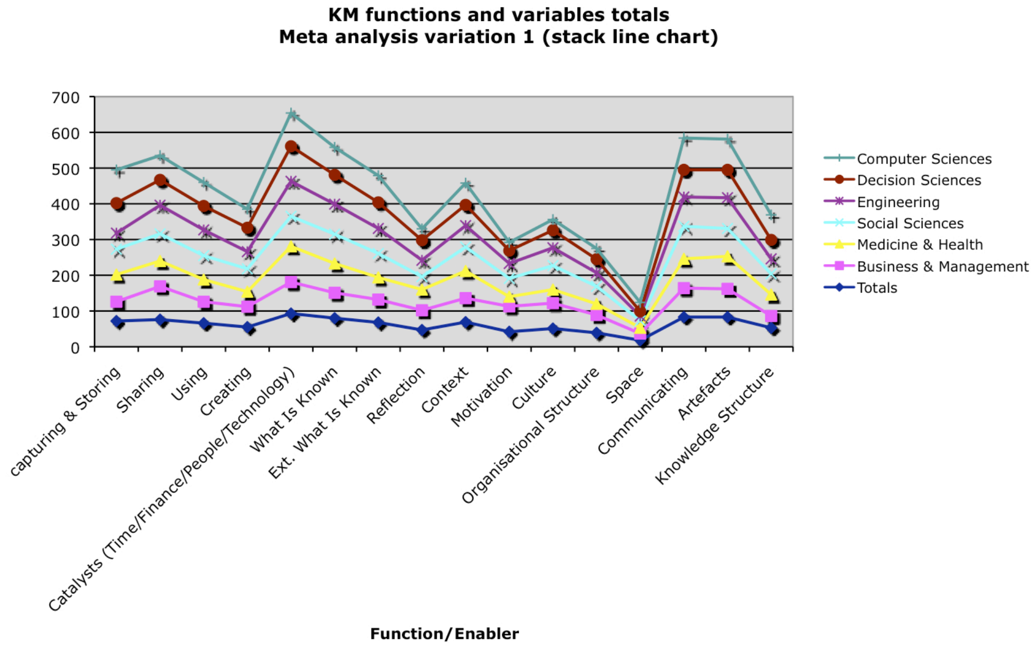

Figure 8.3: KM functions and construct totals: Meta-analysis of literature variation 1 (Stack line chart) (Griffiths and Evans, 2011)

For comparison, the data in Figure 9.1 was replicated as a stacked line chart (Figure 9.3), which demonstrates self-similarity more clearly. This indicates self-similarity across the key disciplines of KM presented by Mekhilef and Flock (2006) (see p. 64). These findings bring credibility to the assertion in the literature review that perhaps theorists and practitioners from across disciplines are speaking of the same functions and constructs when discussing OKM processes (see p. 75-82).

This self-similarity is repeated when the meta-analysis of the four OKM constructs of *Applying, sharing, acquisition and storage,* and *creating* (Figure 9.4) are examined. These constructs were selected in order to reflect upon findings of various authors, such as Qureshi *et al.* (2006) and Supyuenyong and Islam (2006), cited in the literature review (see p. 76), where I suggested these four constructs to be core aspects of OKM systems.

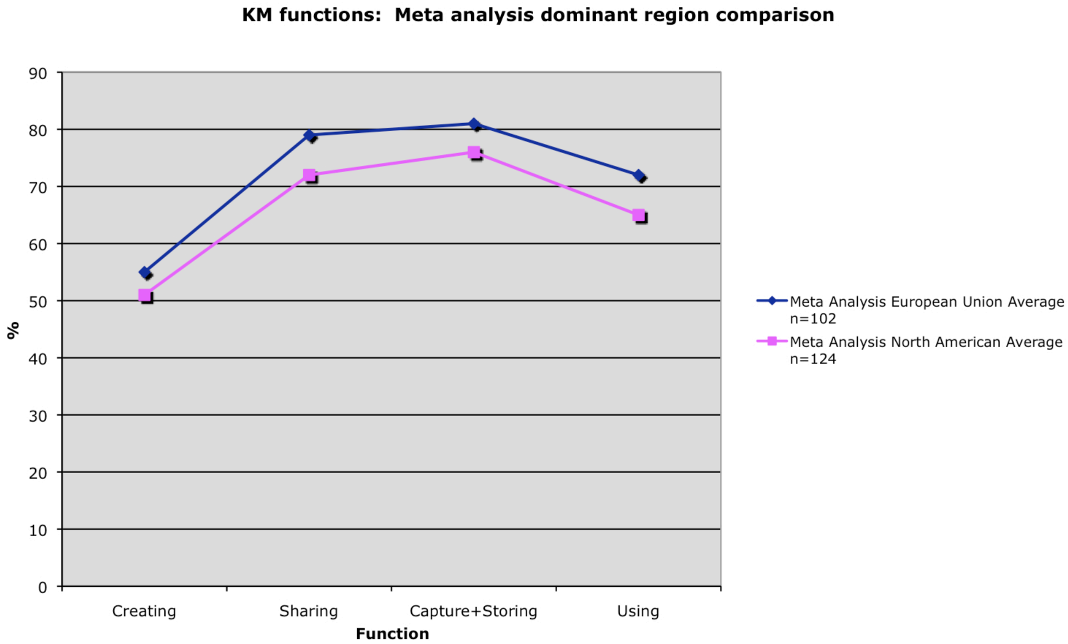

Figure 9.4: Meta analysis of literature dominant region (KM function totals) (Griffiths and Evans, 2011)

It should be noted that there are 24 (4!=24) possible variations of Figure 9.4 and that this is a randomly selected representation from those variations. Figure 9.4 suggests self-similarity between the meta-analysis regional findings of the European Union (n=102 of 287), North America (n=124 of 287) and that of the overall population (n=287). However, these two regions produce a bias in my meta-analysis data, representing 79% of the dataset (this could be an issue in the data, in that North America and European Union n=226 and other regions n=61), which may account for the regional self-similarity against the total findings. This said it establishes a strong link between European and North American data. Self-similarity continues when my survey data (n=91) is introduced for comparison (Figure 9.5). It is here that an outlier in the survey data emerges, the construct of *Capturing and Storing* knowledge in my survey data (whole data set, n=91).

Figure 9.6 demonstrates the Business and Management survey findings of the European Union (n=23 of 57) and North America (n=34 of 57) against the meta-analysis Business and Management findings, survey regional average, survey business and management average, European Union survey average and North

America survey average. There appears to be another outlier in my meta-analysis data for North America in the area of *Using Knowledge.* However, the meta-analysis data were biased (69/31%) towards academic literature, whereas the survey is biased (81/19%) towards practitioners, which could explain the anomaly.

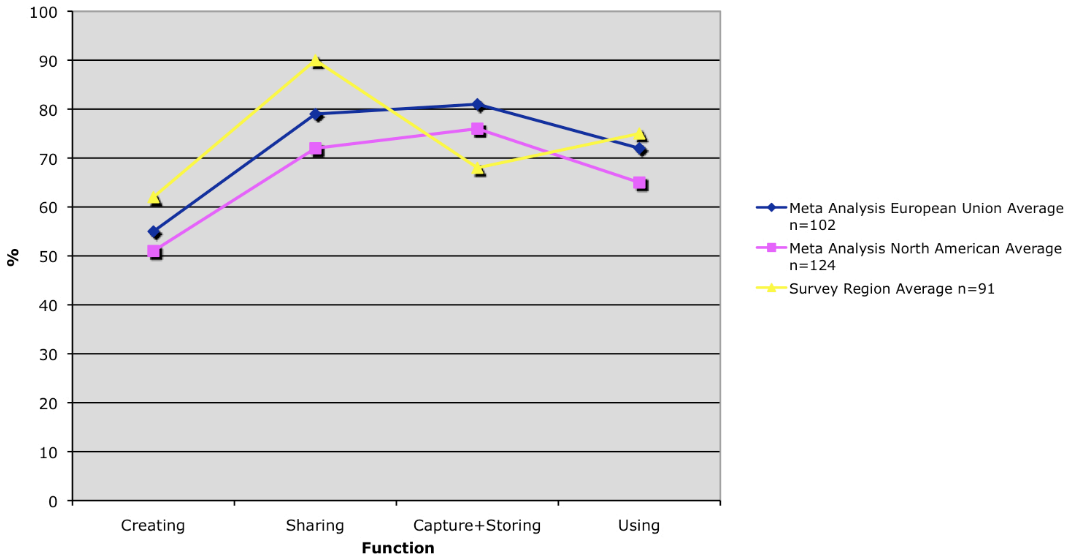

Figure 9.5: Meta analysis of literature dominant region KM function totals against survey total average (Griffiths and Evans, 2011)

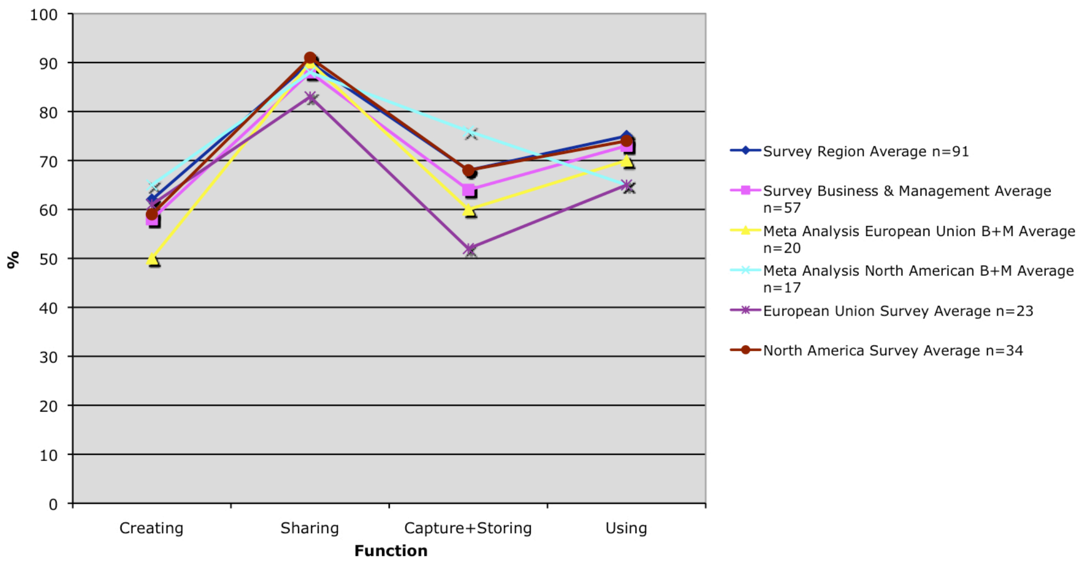

Figure 9.6: Business and management meta-analysis of literature/survey comparison against survey total average and North America survey average (Griffiths and Evans, 2011)

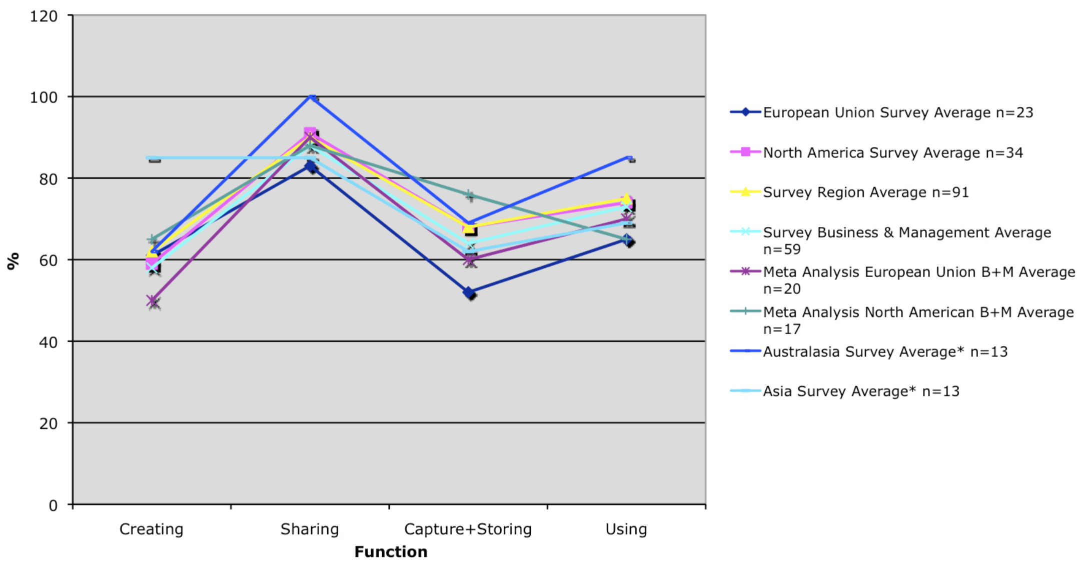

Figure 9.7: Survey average compared against Business and management survey/meta-analysis of literature totals (Griffiths and Evans, 2011)

My survey data provided results from several other regions of which only two provided sufficient data to input into the analysis (Figure 9.7): Australasia (n=13) and Asia (n=13). Figure 9.7 demonstrate the emergence of another outlier in the data, being, *Developing Knowledge* in Asian respondents. However, while the same percentage of respondents, 14%, from Australasia, support my general findings, it should be noted that this is a low response rate and therefore unreliable.

As previously stated, an interesting point of discussion is that my meta-analysis data is biased towards academic literature (69%), whereas my survey data is biased towards practitioners (81%). The survey supports the findings of my meta-analysis, while also demonstrating the potential for congruence between academic and practitioner worldviews. With this being the case, there is a strong argument for the development and acceptance of a unified model for OKM systems designed to coordinate knowledge resources.

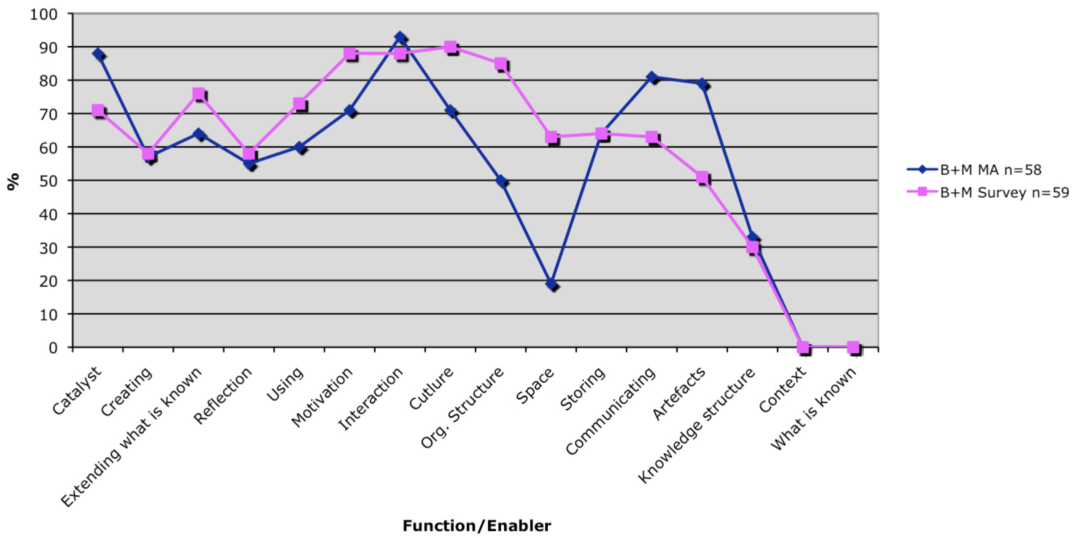

Figure 9.8: KM functions and constructs, Business and Management literature meta-analysis totals compared against Business and Management survey totals (Griffiths and Evans, 2011)

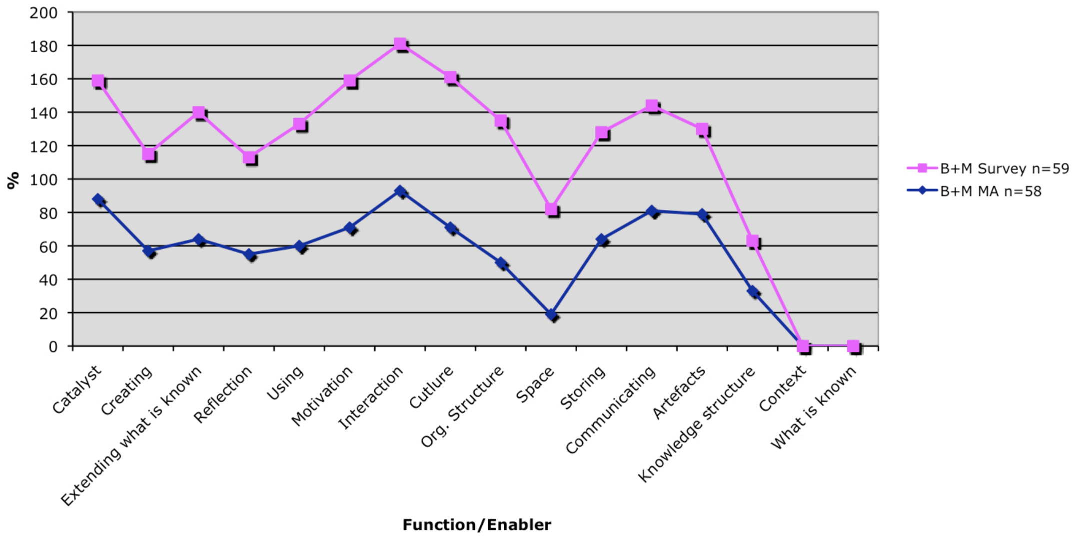

Figure 9.9: KM functions and variables (stack line chart) Business and Management meta-analysis totals compared against Business and Management survey totals (Griffiths and Evans, 2011)

It needs to be considered that, while self-similarity emerges within the datasets, there is also a case to be made for the examination of outliers, which presents a further caveat to be considered in the presentation of the data. Figure 9.8 is a comparison of the Business and Management data from both my meta-analysis and survey datasets. It demonstrates self-similarity, but also highlights outliers, which are open to interpretation. Figure 9.9 is a representation of the same data, this time presented in the form of a stacked line comparison used previously in Figure 9.3. This chart presents a clearer visualisation of self-similarity between the two data sets, but it is Figure 9.8 that highlights the need for further discussion into the divergence between academics and practitioners; my meta-analysis having an academic bias and my survey having a practitioner bias. The two 0% returns in Figure 9.8 were explained in Chapter 5 (see p. 148).

The fractal analysis demonstrates self-similarity in the discussion of OKM systems. However, as was demonstrated in my meta-analysis of models (see p. 194), it does not appear that a model exists that can respond to the constructs exhibited in my research. It is not possible to ascertain the reason for this, but, given the variation in language and the variety of functions and constructs in previous research (see p. 76-82), it would seem that there is credence to the position put forward earlier by Edwards *et al.* (2003), in that "relatively few articles are based on rigorous research, and most KM practice is not well informed by practice" (p. 49); Edwards' position is challenged further in the discursive conclusion (Chapter 7).

It should also be pointed out that my meta-analysis of models suggests that academic literature transmits a greater part of the OKM system whole, in terms of the number of functions and constructs transmitted in any given piece of literature, than practitioner sources; a position that is verified through the data presented earlier, where academic literature in the sample identified a greater number of OKM constructs than practitioner literature (see p.195).

In comparing and contrasting the findings of the soft and hard data I would argue that people are speaking of the same things, while sometimes expressing themselves in different ways; a popular position in science, as discussed in the Methodology (Abbott, 2001) (Chapter 4, see p.116). I believe my research provides the foundation for the development of an evidence-based approach to the development of a general framework for OKM systems design, development and diagnostics. This leads to the exploration of the proposition, below, set out in Chapter 5 (see p. 163), through a case study in an organisation:

> The K-Core model is a general model that can be used in organisations, regardless of sector or geographic location, to identify gaps in OKM systems for the coordination of knowledge resources through the application of a PIAT as a diagnostic method for enquiry.

6.4 Case study

This case study is focused on the K-Core model itself and is not concerned with organisational agreement with regard to its architecture. It looks to establish evidence for Lynham's (2002) requirements for the operationalisation of a theoretical framework (see p. 125). This will be achieved by developing observable and confirmable components that validate the claim that the K-Core model has functioned as a general OKM systems diagnostic, by surfacing gaps in organisational processes and procedures that impact practice.

6.4.1 Organisational Typology Findings

To contextualise the case study I will first report on the findings from the staff responses to the Mintzberg (1980; 1993) Organisational Typology survey (Figure 10). The following descriptors are taken from a standard typology tool developed at the University of Edinburgh, informed by the work of Mintzberg (1980, 1993).

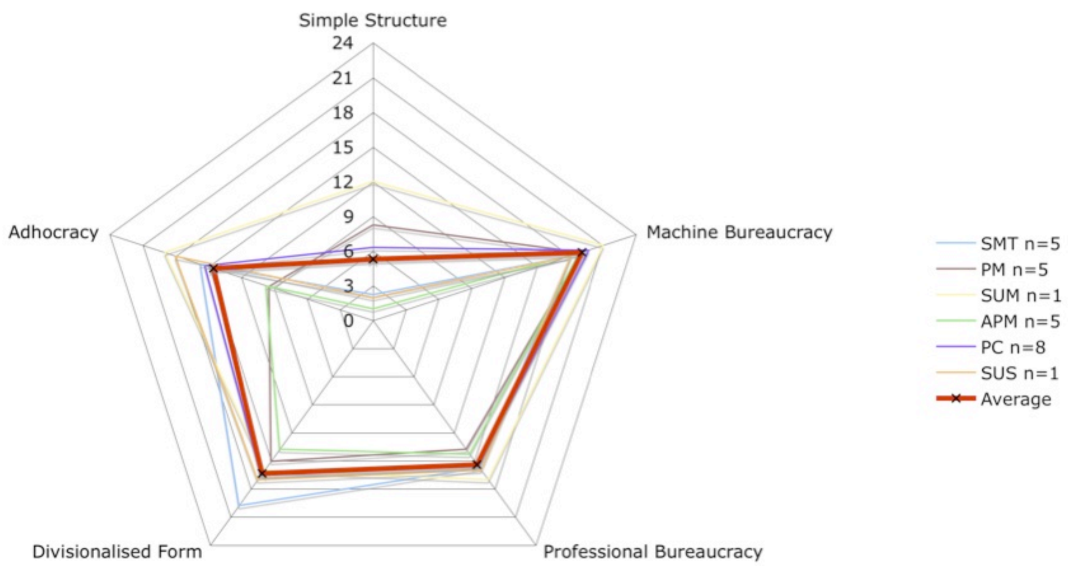

Figure 10: Organisational Typology Survey Findings

Primary Type - Machine bureaucracy

The organisation performs complex but repetitive work. Systems are designed for co-ordination and control. Standardisation is very important, and a functional organisation structure is usual. The machine bureaucracy is formal and predictable. Specialists develop systems for breaking down work into routine jobs. There is a high degree of inter-dependence. The top team are usually functional representatives who ensure that standards and controls are being developed and reviewed. Major strategic decisions require much teamwork at the top level, and sophisticated planning techniques are needed. Efficiency is a watchword, but much needs to be done to contain dissatisfaction. Top management ensure that adequate co-ordinating mechanisms exist.

Communication is needed to standardise operations and ensure that the top team's strategies are fully understood. Management by exception is the rule, so quick identification of abnormal events is crucial.

High Second - Divisionalised Form

The top team in each division works within the parameters set by headquarters. Performance requirements are fundamental, but provided that performance is deemed satisfactory, the division is allowed a great deal of operational freedom. The top team must operate like an independent business management group, not merely as representatives of functions. They are the only group who can give the division the leadership it needs.

Communication between the division and headquarters is largely formalised, dealt with by accountants. Detailed measures enable performance to be monitored. Too much day-by-day involvement from headquarters undermines the principles of divisional autonomy. Headquarters must be wary of excessive concentration on short-term results. The divisional top team must establish their unit's identity and establish a strategic direction, which is responsible for providing the creative driving force. This needs to be communicated throughout the division. Useful relationships may be created with other divisions in the same company to exploit particular areas.

Influencer - Professional Bureaucracy

Professionals or highly qualified people provide a skilled individual service. Power and control are widely distributed. Specialists set their own standards and must keep up to date with their professional work. The professional bureaucracy respects expertise and gives support to qualified individuals. High standards of selection are critical to recruit people with the right credentials and competencies.

The top team provides a forum in which organisational politics are dealt with. Communication requires great skill of negotiation and persuasion. Formal authority is a blunt instrument to be used sparingly with professionals. Much needs to be done to maintain a high level of professional development so extensive training is required. As individuals set standards, it is important that there are forums for professional discussions. Lack of co-ordination is often a major problem and relationships between professionals are difficult to orchestrate.

Influencer - Adhocracy

This is creative, flexible, informal and open. It consists of temporary ad hoc groupings, which are constantly changing as needs change.

The top team in an adhocracy has problems of control. Often they do not really know what is going on, as the issues are too complex for any but experts to understand. Work must be allocated to those who have the best chance of solving the problems, although there are no guarantees of success. Re-organisation is always taking place. The top team are concerned with ensuring that conflicts get aired - to find the truth. Innovation is difficult to control but senior managers must support "product champions" who drive new ideas through the system. The top team also deals with the wider environment, to try to obtain a flow of projects to keep the organisation going.

Communication in adhocracy is central to their effectiveness. People must be kept in touch with developments and they can often contribute creatively. There are frequent discussions about how to proceed, and teamwork is necessary for motivation and co-ordination. Informality and lack of rigid respect for status are necessary. Often uncertainty and ambiguity become confusing.

6.4.1.1 Implications of Organisational Typology Findings

PSUK(A) is predominantly a Machine Bureaucracy with influencing elements of a Professional Bureaucracy, Divisionalised Form and Adhocracy; while Project Set-up views the organisation differently to Project Management, their response rate is too low to assign any reliable value. Senior Management responses demonstrated a balanced view of the organisation, which is supported in the responses from Project Co-ordinators. However, Project Managers and Associate Project Managers view the organisation from the perspective of Professional and Machine Bureaucracy.

These responses reflect the Standard Operating Procedure approach to business within Project Services. It suggests a high dependency on working-under-direction, which brings an emphasis to organisational strategy or goals. It is important in this environment that review processes are implemented to ensure standards and reliability, which fall under the auspices of Senior Project Managers and the Senior Management Team. The aspect of 'management by exception' is interesting as it suggests a potential to focus on 'abnormal' events, which can often be interpreted as needing to be 'negative experiences' in order to deliver learning to the organisation.

The Divisionalised Form requires a strong strategic direction to be set, which provides the driving force for action. This bonds with the need for direction, suggested by the Professional Bureaucracy, and reinforces the importance on clear strategically aligned business goals to drive activity.

The Professional Bureaucracy influence leads the enquiry to examine Learning and Development aspects of knowledge resource development. Project Services conflicts with this typology in that it seems that standards are not set by individuals; they appear to be externally directed as opposed to being emergent from within Project Services itself.

The Adhocracy influence brings the enquiry towards knowledge flows and the reliability of knowledge being generated. This has the potential to be challenging, given the global nature of the function, which has to contend with a diversity of cultures and time zones.

6.4.2 K-Core Data Analysis - Findings

6.4.2.1 Key recommendations from data analysis

The Key Recommendations (KRs) I presented to the organisation are presented first, as a mechanism to systematically view the analysis and supporting evidence. From here, each K-Core function and construct is analysed individually with a summary being offered at the end of each aspect of analysis. A feedback box completes each section, which details links to KRs (Table 6.9) and the PSUK(A) Strategy Map (see p. 172) (dated May, 2007). These elements are presented to demonstrate the evidence for observable and confirmable components, as per Lynham's (2002) requirements for the operationalisation of a theoretical framework (see p. 125).

The Key Recommendations

Key Recommendation (KR)	Descriptor	PSUK(A) Strategic Link
KR-1 Strategic Planning Review	**A:** Strategic Planning and Business Goal development appears to suffer from a lack of monitoring and evaluation. It is recommended that Strategic Planning and Goal development be reviewed to incorporate SMART goals and Key Performance Indicators.	E1
	B: Understanding of strategy appears to be an issue throughout Project Services and it is therefore recommended that Learning and Development should structure intervention to improve this area.	E1
	C: It is recommended that a cross-section of staff be involved in the planning process to improve understanding of organisational needs and to assist in the identification of emerging issues. This has the potential to empower Project management Teams whilst releasing some of the pressure on Senior Managers to communicate all strategic issues.	E3 E4
	D It is a critical recommendation that a higher profile be given to knowledge-centric activities. Due to the perceived nature of the organisation, evidenced by the Organisational Typology survey, it would appear necessary to clearly state the value of knowledge-centric activities such as Acquisition and Storage of knowledge resources, Using Knowledge Resources, Improvement upon services or resources and the sharing of knowledge	E1

	resources. This should overcome the perception of essential knowledge processes being delivered by individuals.	
KR-2 Learning Training and Development Operational and Structural Review	It is a critical recommendation of this report that the structural and strategic alignment of the Learning/Training and Development function be a priority for intervention. This intervention is essential in order for Project Services to improve its adaptive capacity. It appears that the Training function within Project Management and Set-up is strategically misinformed and current training programs are not meeting operational or strategic needs. A fundamental issue with needs analysis as well as monitoring and evaluation causes this. Whilst acknowledging that the function is in its infancy, having been put in place over the last 18 months, it would seem essential to address this issue before the function's activities become too embedded and more difficult to restructure. The reporting structure appears fragmented and it is the recommendation of this report that the Training and Development function be realigned to report directly to the on-site Global Associate Director of Learning and Development.	E1 E2 E3 E4 P1 P3 P4
KR-3 Project-Centric Working	Knowledge within project Services is embedded within the people and there appears to be little in the way of structured knowledge capture activity. Knowledge appears stagnant, with pools of knowledge existing in isolation. Current operational practice seems to be a primary cause of this issue. Staff within Project Management currently work in teams of 2 to 3 people, incorporating a Project Manager and 1 or 2 Project Coordinators. The mentor program is utilised as a knowledge-sharing tool, but knowledge visibility is still low and there appears to be little in the way of quality assurance. A key improvement could be a move towards a project-centric approach to work programs. The findings suggest that Project Services would benefit from more effective knowledge movement. Therefore it is suggested that Project Coordinators spend 10% of their time working on a project away from their resident team. Resistance to change is a potential barrier to this recommendation, which will require further examination. It is therefore recommended that any action in this area should come as the result of consultation with staff. It is also recommended that a pilot study be initiated involving 5 Project Coordinators, possibly recent appointments. If the pilot were successful it would be recommended that the study be gradually escalated.	E4 P1 P3 C1
KR-4 Technology Functionality (Linked to Learning Training and Development)	**A** Time is an issue for all staff and current technology solutions appear to place a burden on human resources. It is recommended that search functionality be addressed as a matter of priority. **B** It also recommended that virtual spaces for interaction be explored to improve knowledge visibility, as current spaces appear unfit for purpose. Given the global nature	E4 E4 P9

	of the function it is recommended that Learning and Development explore interactive e-learning/communication solutions, such as virtual on-line classrooms using Adobe Connect and Google Wave. Technology solutions are needed to overcome some of the global barriers being experienced by Project Services. Technology solutions such as Adobe Connect also allow for rich knowledge capture. **C** Project Services do not effectively leverage existing knowledge resources, with many resources lying dormant. In order to overcome this issue it is recommended that access logs be implemented in order to monitor resource usage and ensure that the right knowledge is being accessed and shared. **D** Due to the global nature of the organisation, effort should be made to improve the way people interact through the use of video link technologies.	 E6 E4
KR-5 Harmonisation Of Processes	**A** Project Services need to examine all monitoring and evaluation processes. This is particularly important in the area of strategy development and the recognition of emerging Business Goals. There also appears to be a lack of reflective processes in key areas that are contributing to serious issues, such as critical incident re-occurrence and a lack of quality control in areas such as the identification and implementation of good practice. **B** Linking to technology solutions and knowledge visibility. It is recommended that Project Services implement a standardised indexing system for electronic files that links to search functionality. This would need to incorporate a key-wording process that would improve knowledge visibility. This would also assist in alleviating the time burden currently being experienced by staff. **C** Facilitation of knowledge sharing and global good practice by re-examining regional variances to find the best fit for the harmonisation of operational processes.	E4 E6 P1 P1 P1
KR-6 Knowledge Culture	**A** The current knowledge culture appears to be driven by negative operational experiences. It is a pivotal recommendation of his report that the lessons from critical success be captured, celebrated and disseminated with equal profile to overcoming critical failure. **B** There appears to be discrete practice that improves operational performance and yet has very low visibility. If project Services is to heighten the visibility of this work it would appear necessary to inform staff of the value of their work, such as through the recommendations made in KR1.	E4 P1 C1 E4 P1
KR-7 Knowledge Capture	**A** Knowledge capture appears to be a critical issue in the area of Project Set-up. There is a lack of direction in this area and there appears to be a danger that severe knowledge loss is possible in this area. **B** Current knowledge sharing activities lack a formal capture process, with much of the activity being driven by	E4 P1 E4 P1

	motivated individuals. This is on conflict with the Organisational Typology feedback, where as a Machine Bureaucracy it would seem important to give clear direction on what is expected in this area. Much knowledge is lost or has low visibility due to the capture methods employed in lessons learned and global forums. This links closely with Learning and Development and Technology issues. **C** Specialist projects operate without a formal knowledge capture process. It is recommended that electronic capture templates, that guide the knowledge acquisition process, be utilised within project tasks. An example of the latest research inn Project Management knowledge capture templates can be provided upon request. **D** Current knowledge capture techniques appear to be primarily text based. It is recommended that capture be extended to included knowledge rich artefacts such as hyperlinks, video and audio resources. It is also recommended that 'stories' of success and failure be captured using these same processes as opposed to sanitised text based accounts of incidents. It is suggested that this will allow people to connect with the story and improve the sense-giving and sense-receiving process.	E4 P1 E4 P1
KR-8 Human Resource Knowledge Visibility	As well as technology embedded knowledge there is the issue of human resources. Project Services is driven by knowledge embedded within people and knowing who has that knowledge would appear to be essential in order to ensure efficient and effective knowledge flows. This would also seem important in addressing the reliability of information being disseminated throughout the department. It is therefore suggested that Project Services develop a Human resource Directory that includes rich knowledge of the person and their experience, such as projects they have managed and special project teams that they are, or have been a member of. This information should be searchable by keyword and should incorporate a photograph of the person in their workspace; this has been highlighted as good practice in building connectivity between people, as well as links to documents they have uploaded. This should improve knowledge visibility and open knowledge flows globally.	E4 P1 P3 P4
KR-9 Effective leveraging of Human Resources	Human Resources should be selected for specialist projects and mentoring against competency standards. Current practice is arbitrary and it often appears that the most appropriate resource is not necessarily being applied to the task at hand. Given that the majority of knowledge is embedded within people and reliability is a key factor in saving time and improving efficiency and effectiveness, it would seem that this is a key area for consideration.	E2 E4
KR-11 Strategic alignment of recruiting practice against	Strategic and Operational competencies should inform the recruitment process. Current practice appears disengaged from strategic and operational needs. Job descriptions are out of date and have not been updated to reflect strategic development in the organisation. The recruitment process	E2 E4

strategic and operational needs	does not appear to consider operational requirements against strategic needs and therefore opportunities to improve team composition, which could impact efficiency and effectiveness, are seemingly missed.	
KR-12 Staff Empowerment	**Further Enquiry -** The enquiry suggests that Project Coordinator and Project Manager training are conditional as opposed to generative. In order to improve the adaptive capacity of the function it is highly recommended that the learning programme be reviewed to allow for greater visibility of individual need and for individuals to be involved in developing their own learning pathway against competency standards.	E2 E3
KR-13 Knowledge Blockages-Senior Managers	**Further Enquiry –** Knowledge blockages appear to exist between Senior Managers and Project Teams. It is beyond the scope of this enquiry to suggest solutions to this issue, but is strongly recommended that processes issues, such as feedback, be further investigated in order to better leverage existing knowledge.	E3 E4
KR-14 Time	**Further Enquiry –** Issues of time are widespread throughout this report. Whilst some of the Key Recommendations address processes to alleviate the time burden on Project Teams, there appears to be a much deeper issue, such as resource management, which falls beyond the scope of this enquiry, but appears to need wider consideration.	P2
KR-15 Artefacts to develop knowledge metrics, appraisal, Business Goals, emerging strategic needs and enable knowledge transfer	**A** There appears to be a lack of resources to support the capture of individual and team events that could inform Business Goals, emerging strategy and knowledge metrics. It is suggested that individual event logs be developed that detail learning events and collection and sharing activities. This can be driven by IT solutions, an example being PebblePad. Platforms such as this allow for blogs to be created by individuals that can then be shared with Senior Managers and, where appropriate, between teams. This can then be used to ensure that key knowledge is captured and made visible to Senior Managers to inform Business Goals, emerging strategy and the appraisal process. This can then directly inform metrics linked to Business Goal Key Performance Indicators. **B** Templates for good practice in knowledge capture should be created to improve opportunities for knowledge transfer.	E4

Table 6.9 Case Study Key Recommendations

6.4.3 K-Core 'Context' construct

The PSUK(A) Strategy Map was analysed with the following statements informing the enquiry:

- ***E1 Communication – Enable understanding of our strategy and how to***

contribute to it. This was identified as being important in providing context for knowledge work and in developing understanding of value drivers for stakeholders in the development of operational objectives.

- ***E2 Talent – Attract, develop and retain employees and develop an integrated career path within [PSUK(A)].*** E2 places importance upon Human Resource Development and links linearly with E4

- ***E3 Leaders – Identify and develop leadership to execute our strategy***. This suggested that leadership was pivotal in motivating stakeholders to contribute to the strategic needs of PSUK(A).

- ***E4 Culture – Develop a performance and knowledge culture focused on our customers.*** A key statement in this enquiry and one that links E1/2/3/6. This suggested that knowledge resources are valuable and are subject to continuing development.

- ***E5 Organisation – Continue geographic expansion and upgrade of [PSUK(A)] facilities.*** Implied issues for Training and Development in the areas of process harmonisation and the leverage of existing and emerging resources

- ***E6 Information – Upgrade IT platform to provide metrics to run the business.*** E6 suggested that IT platforms would inform aspects of knowledge resource monitoring and development.

- ***P1 Leverage the global footprint (processes, shared services, best practices).*** Linked with E4 to drive knowledge resource strategy and policy

- ***P2 Improve pipeline and resource management.*** Resource management, from the perspective of Human Resources, is raised as an issue during the enquiry and links with E4.

- ***P3 Improve customer communications and problem resolution.*** Links with P3 and P4

- ***P4 Set-up and manage projects effectively and efficiently.*** Links with E4 and P1

- ***P9 Develop innovative IT Solutions.*** Links with E4, E6 and P1

- ***C1 Effectively and efficiently meet my requirements and exceed my expectations.*** Links with E4 and P1

- ***C3 Develop innovative solutions to help me manage my changing [product] services needs.*** Links with E4 and P1

The Strategy Map was translated into operational plans in PSUK(A) via Business Goals. Business Goals were developed in template format by Senior Management as a menu of activity drawn down from the Strategic Map and aligned according to job role. Staff were then required to implement 5 of the template business goals and 1 personal goal, which could contribute to any area of the strategic map.

Using document analysis to analyse individual and team operational plans, there was a gap between strategy development and operational planning, with the following failing to be included in both the PSUK(A) Strategic Map and Business Goals:

> The absence of E1 (Communication) and E3 (Leaders): This was a concern as it could contribute to a lack of strategic knowledge and understanding amongst stakeholders and a subsequent lack of motivation to contribute to the organisation's strategic needs.
>
> Goals lacked a coherent and measurable focus, for example: E4 (Culture) had 2 Business Goals "Demonstrate active participation in departmental forums and meetings" and "Act as team rep for identified delegated task as per SPM/Departmental needs". These statements could be improved through the use of a SMART (Specific, Measurable, Achievable, Realistic and Time related) approach to goal development.
>
> E4 was pivotal to the engagement strategy, having influence over P1/P2/P3/P4/C1/C2/C3/G2. However, it only received the two Business Goals.
>
> P1, which reflected the 'One Voice' vision and mission of the organisation, did not receive a Business Goal. The absence of P1 could indicate isolated practice or low knowledge visibility within the organisation.

Reflecting on the Organisational Typology findings (p. 219), based on indicators of leadership dependency and working to direction, it indicates that further clarification is needed in order to facilitate the translation of strategy into Business Goals.

The PSUK(A) Strategic Map provided for the enquiry was published internally in May 2007 and had not been updated since. This despite emerging issues brought about by external and internal change. This is particularly relevant given Strategic Goal C3, which emphasises a state of constant change, driven by changing customer needs.

Business Goals provided a 'Goal Description', but there was no corresponding 'Performance Indicator'. This suggested the monitoring and evaluating of the Business Goal to be difficult, which could hinder success or emerging issues. The Goal Descriptions could also hinder this, in that many lacked SMART principles.

None of the non Senior Management staff interviewed in Set-up or Project Management could relate their work activities to organisational strategy. This though E1 in the PSUK(A) strategic map, points to this understanding being a priority. This was affirmed by the Managing Director, who stated at the research inception meeting that there was an expectation for the strategy map to be understood as it underpinned all activity within Project Services. This is important as staff were encouraged to develop their own business goals as part of their annual planning process. However, staff stated that personal goals were set by experience and were not related to strategy. An example of this emerged in interview DA36:

> "Unfortunately I don't think the strategy pulls down right through all the different tiers. The strategy is communicated to us at the start of the year and we receive a document... yet I don't think it's driven and the linkage is not made very well through the different tiers of management... Whilst there is a drive by Executive Management to improve those things, I don't think that at our level [our work] is linked into that directly"

This was reinforced by a Senior Manager, with the following response to the question, "*Do people understand the strategy and the value that they bring through their work?"*

> "I really don't think they do to be honest. We obviously have a strategy map and that is shared, but I'm not convinced that the team members actually see how what they're doing fits into the strategy map. And probably as Senior Managers that's something we really need to address....I really don't think we have that awareness" (Interview DA63)

This lack of understanding is evident throughout Project Services, demonstrated in a typical conversation about the development of personal business goals:

> *Interviewer: "Do you develop your own business goals?"*
>
> "They say yes, but I feel, no. I feel the goals are extremely restrictive and for example [at my level] I'd like to think that I have a good future in this company, but I want to put [higher position goals] in my business goals, because that's the job we actually do. We were told, no, you can't do that. That's not a goal to me [telling me to do my basic job function], I see a goal as something you aim for, something you want to do more, something over and above what you do. I pretty much do the work of a much higher level employee, but how am I to move forward and pick a goal if it doesn't relate to what I do?" (Interview DA71)

There was little evidence of strategic understanding in any of the interviews. Senior Managers were the exception, which, given the emphasis placed on the strategy documents in terms of context setting, is a critical process failure. There is also evidence that strategy was a top-down process, which could impact the identification of emergent needs and the adaptive capacity of the organisation.

> "We get shown strategy on a slide in a meeting. It's purely output, they don't take input....it highlights that we are reactive rather than proactive" (Interview DA11)

The lack of understanding of strategic goals and the importance of the process is highlighted in the following interview with a Senior Manager; discussing the links between individual Business Goal development and the PSUK(A) Strategic Map:

"I think there's probably not a direct link into that page [PSUK(A) Strategic Map]. It's more just a generic, this is where we're going and so we all know generically what direction we want to go. We want to improve business and we want to improve customer service. There are lots and lots of initiatives going on to try and improve things, so everyone has an input into the initiatives. It's more on an individual basis for people who want to get involved in things other than their actual goal….We try and link their interests to initiative that we have going on."

Interviewer: "I'm trying to understand the gap between the Strategic Map and the development of Business Goals, can you improve my understanding for me?"

"I think it's because it's totally different people that we don't interact with on a regular basis that are designing the Strategic Map. It comes from a very high level, it gets filtered down and we just take out bits that we think are relevant….They're probably thinking globally, this is where we want PSUK(A) to go. Whereas we are thinking, yes, we want to get there, but it's probably filtered down and diluted."

Interviewer: "What's the feedback process for yourself to feedback into the Strategic Map?"

"I think there's probably a gap there. I'd probably feed into my manager….[that feedback] would probably then get fed along to the General Manager."

Interviewer: "Is a lack of strategic understanding an issue?"

"No, I don't think it is an issue, which is why I'm probably not explaining it well enough. I don't think it is an issue and if I was to look at that [PSUK(A) Strategic Map], I wouldn't even remember what was on that map. I would need to think we're doing this for that and this for that, but I'm not aware and I don't have the map" (Interview DA25)

In exploring the links between context, individual job roles and performance requirements, the enquiry examined links between Human Resources, as the gateway to the company, and the way that the job description informs the recruitment process and business goal development:

Interviewer: "Has your job description been updated in the time you have been here?"

"No"

Interviewer: "Does your job description reflect the expectations of the job in relation to the business goals?"

"It's the very basic, basic, basics. There are so many roles [and aspects to the job] that I think could be highlighted better in the job description [the job description needs to reflect what we really do]. It needs to be a little clearer, then I can know that's my job and I'm ticking those off" (Interview DA71)

Key message

It is clear that there is a potential for a departure from organisation strategy due the failure to transcribe Strategic Goals to Business Goals. The issues emerging from this include a lack of strategic understanding, a possible lack of strategic leadership, a lack of harmonised practice and a failure to leverage available knowledge resources. This is explored extensively throughout this enquiry.
The monitoring of strategy against operational activity would appear difficult to implement due to the absence of SMART goals; issues include lack of strategic alignment and the identification of emerging issues for upward feedback into the Strategic Map.

This issue takes on significant importance when considered alongside the Organisational Typology feedback. The implications of a deficiency in feedback processes for Strategic Development and Business Goal Development are highlighted later in the analysis

- Informs KR-1; 12; 16
- Strategic Links – E1; E3

6.4.4 K-Core 'Culture' construct

Interviews suggested a knowledge culture that could be interpreted as 'negative', where document analysis of 'Lessons Learned' showed a heavy bias towards negative knowledge experiences; for example Project Management interview (DA77):

> “The only way you get noticed is if things go wrong”
>
> *Interviewer: 'Explain for me what you mean by that'?*
>
> “It takes a huge problem or issue with a study to get any profile or support from a higher level. Take away the issue and I am still left with the same amount of pressure and stress spread over a number of studies, but the profile and support is not there unless I have a problem. Without the problem higher management wouldn't know hardly any of the work I do to make things work for a sponsor”.

It was also represented in feedback from Project Set-up, for example:

> “There is not any feedback on a project really upon completion unless something really badly goes wrong...but otherwise I don't think there is that much [feedback]” (Interview DA83)

There was a perception of high performers emerging from project failure, which was referred to throughout all levels of staff; for example, interview DA77 was a relatively new staff member, whereas the following is from a senior staff member:

> “The only time we see success is as part of our survey process...you get a few emails...but then you get feedback like, don't let that slip now....We're not good at recognising when something has gone well. You're profile is not raised because your projects run too smoothly.....If you have an individual where something goes [wrong] on a project, it goes to Senior Management, there's a big deal over it and you turn your client around. Then you're the star performer. What's lost is the reason it got to that stage is that you were under-performing”

During interviews it emerged that little or no analysis was conducted to determine why projects became successful. Staff related success in their role to having to experience failure and, as a result, potentially valuable lessons from critical project success was not seen as important or valuable by the vast majority of staff. This could result in a loss of knowledge vital to business improvement process. When questioned as to why critical success wasn’t captured, staff spoke of issues of only having the time to focus on what’s important, being what goes wrong.

Some staff spoke of knowledge as power:

> "In some groups there appears to be a perverse pleasure in knowing how to do something, but hey, I'm not going to tell anyone" (Interview DA35)

While this feedback could be an outlier it could also, when coupled with the perception of high performers, be a potential blockage in the knowledge flow. This link is further explored in the same interview where it was said:

> "There seems to be a culture here, and maybe it's the target group of people who have been employed, but they are very upwardly driven"

This perception is supported in Interview DA86, where the interviewee was asked if they shared external resources that they had acquired to assist in their Project Management role – it could also be linked back to the organisational typology findings and confirms the use of Mintzberg's Typology tool as a way to contextualise the environment of the enquiry domain:

> "I share it with my PC. Because it's not [an official company] document or an SOP or PSUK(A) supported, I'm quite cautious about sharing information that I've gone and looked up"

The outlier nature of this feedback should be considered, but this feedback may be linked to the nature of the enquiry pool, where the majority of the staff could be perceived as being of the type being criticised in interview DA35. In the case of DA86 it could also be linked to issues of reliability, which are discussed in later sections.

Many staff spoke of a ''Them' and Us' culture when referring to relations between Europe and North America operations. North America was also the only region that received consistent negative feedback with regard to cooperation and harmonisation. This is discussed extensively later in this enquiry.

Key message

The Project Services function could be said to be driven by negative knowledge experience, which could be seen as a product of the Machine Bureaucracy typology, where management can focus on abnormal events – frequently seen as negative events driven by critical failures. The issue of knowledge as power is something that will be discussed in future sections as part of a discussion on knowledge business flows and extending 'What is known' by the organisation. The issue of 'us and them' is explored in more depth as the enquiry progresses

- Informs KR- 6; 14
- Strategic links – E4; C1; P1; P2

6.4.5 K-Core 'organisation Structure' construct

Organisational knowledge business flows were explored to determine the knowledge transfer processes. The enquiry looked not only for opinions, but root cause examples that could bring visibility to the problems. General examples of comments that stimulated further enquiry included:

> "Where I think there are blockages...challenges that come across, is when you are dealing with an outside department – like maybe programming, data management, technical support. The people not quite so involved with the clients.... My biggest challenge is getting them to copy me in on things. They might not think it's significant, but it is.... The challenge I come across is the appreciation of each other's job role" (Interview DA86)

and:

> "That's another story [global knowledge flow]. Sometimes you have to chase up other Project Managers if your regional on study or it's last minute getting information through and the study is about to launch and is typical between Atlanta and Europe....remembering to keep everyone up to date seems to be sometimes challenging" (Interview DA66)

The depth of enquiry brought forward persistent themes in specific areas. For example, several staff members raised the issue of flow between Project Management and Operational Client Leads (OCLs); staff with specific responsibility for 'high value' clients:

> "The occasions I worked with [OCL in North America] the knowledge she gave seemed fine and the client was happy with the outcome. However I felt [the OCL] told them we could do something, that we could turn around the changes they [the client] wanted to make, quicker than we could actually do it. This is false advertising to the client and if the OCL says that it can be done within 2 weeks and it's not done the client holds you to that. The problem then has to be raised at a senior level to get resolved " (Interview DA96)

When asked what action was taken to avoid a re-occurrence of the blockage in the knowledge flow, Interview DA96 stated:

> "Originally the problem was escalated with the Senior Project Management, Senior Finance and with the OCL. I feel that basically there was no action taken upon. It got to that point and no further action was taken. I tried to chase it up to find out what had happened and there doesn't seem to be any visibility on who took this action on board and who is responsible for it."
>
> *Interviewer: "What was the consequence for the client?"*
>
> "They are obviously not happy about it and they've raised it again to their higher management"

It suggests that Project Services are not always consulted in the decision making process between the OCL and clients. As demonstrated, this can inhibit service and create issues that could be avoided through consultation between OCLs and Project Services. In addition, Set-up and Project Management, detailing issues of knowledge flows between regions, raised numerous issues:

> *Interviewer: "Are SOPs [Standard Operating Procedures] adhered to globally?"*
>
> "No, there are cases I've found where, this is in the SOP, but yeah we don't do it that way"

Interviewer: "Give me an example that demonstrates what you mean"

"...The main thing I had arguments with other regions about was that I had put in the document you should be noting which version of the protocol and which version of the laboratory specifications you were working from to do the checks. I said that it should have been noting the signed date and version. Other regions came back and said that if you are on version 2 and it's signed and you know you've got version 3 and you know it's not signed yet, you should be checking against version 3 because it's the most current. We say you shouldn't, version 2 is what's signed, version 2 is what you should be checking from."

Interviewer: "...what are the consequences for the client?"

"They might not notice, with regard to this specific circumstance, but this causes the potential for things to get missed. Version 2 is signed. Version 3 adds a test. You shouldn't be adding that test until version 3 is signed. To me, you can't be reporting out that test until the new version has been signed off. If you're doing your check against version 3 and are looking for that test then you could be putting something out there that's not approved yet"

Interview DA06 highlighted the inconsistency of practice amongst teams working with the same client:

"I work quite heavily with one particular client...I feel that I'm still pushing the boundaries to some degrees with this client, still trying to find things out and share it with the team. I think there's a lack of consistency between the different groups [working with this client]. I think the breakdown comes there. I could be working on one data management thing and we know the data has got to be in a particular format, but maybe another Project Manager doesn't know that because there's not that documentation there. That consistency across studies....This is a problem in Location UK(A), but particularly in the US...but I guess the problem is that we're not sharing information correctly. There's not that clear flow of information between the different Project managers that have worked with different teams....I think it's very important that we have something in place to make things very visible and to have some consistency across the different studies"

A further example was offered during interview DA67

"The process for [specific project related issue] are completely inefficient. The programming team are based in the US and the programming is instrumental to the success of [project issue]. So straight away you've got problems because you can't speak to people face-to-face. We just don't have enough support here and I've raised this a number of times"

The issue of regional blockages was often linked to a lack of harmonisation of processes and issues with local working solutions:

> "Even though we are this massive global company with global SOPs, the way the regions function are completely different. We find it quite frustrating that the way things work in Europe is not the way things work in America. Things that we have to do to get our kits validated through each department and the issues we come up with the States should come up with as well because the databases are practically identical. It just shows us all that we don't work in exactly the same way. They seem to have massive work-arounds, disregard things in the way things should be set-up within the databases that causes us issues and never seems to cause them issues. We thinks its very strange that we can have [issues] stopping a validation with out laboratory who are saying that the way things are set up we cannot analyse these samples, and identical scenario set up in America there are no problems with it. They seem to have a lot of departmental work-arounds that we don't understand and have never been told about"
>
> *Interviewer: "Why is not this knowledge shared?"*
>
> "The 'One-Voice' thing is fantastic if it worked in practice. It doesn't work in practice as far as I can see....We follow SOPs as much as we can do...We don't see America following SOPs at all"
>
> *Interviewer: "Does this have client implications and, if so, can you give me an example?"*
>
> "We had a study in PSUK(A) (Europe) where we were sending studies to America for analysis. The Set-up Manager followed the process flow the way it was supposed to happen - This particular sample needs to be tested on this particular analyser, this is the code within PSUK(A) and sent them over as part of a validation procedure. It went over, everything was fine and then it came back that this particular analysis was not set up in America. They said they were still in the process of validating it to make sure the data their getting form their analysers is consistent. So the Set-up Manager asks to be told when it will be validated and they were given a time frame and they were left to pick it up. They [the Set-up Manager] chased a few times, but then you get to a stage where the study has actually launched and you've handed over to Project Management. It never got picked up that it was set up incorrectly and it's only just come back to really bite us in the last month and a half. And some samples got lost in transit because they set up a new procedure, what's called a work transfer, and a lot of samples were lost. It's all because the States never ever fully formally told us that they had finished their validation and they never did anything with the numbers that were sent

to them. There was an investigation, but everybody [in the US] just covered their back as far as we're concerned" (Interview DA53)

This was not exclusive to North America, as demonstrated in interview DA77:

"I've had sponsors question the way we version documents because a PM in Asia had made changes to a Lab Manual already shared with a site, but didn't update the version or date – this is something we should do if the manual has already been shared externally"

Interviewer: "Is this standard practice?"

"I think so. I can't remember where I learnt to do it, but it's written down somewhere. Things like this happen a lot though. We do things one way and other regions do things another way"

Interview DA83 reinforced the issues within Project Set-up:

"Atlanta seem to work through the work flow processes a lot quicker than we do...like a lot quicker and obviously they're doing something different. They can't be working the same as we are. I think it would be a good idea if someone from here actually went over to Atlanta to observe their processes. I wonder if things are being done correctly, because I think things get missed"

Interviewer: "Are you aware of any consequences of these differences?"

"I've had regional studies where there are things that I've caught, where things aren't correct, but I don't know what the final consequence has been because it has been out of my hands by then"

Interviewer: "Have you raised this as an issue?"

"I've raised it in a meeting once and I've taken it to [Senior Manager]...[nothing happened], but I think it's really important to go and see what is going on. You can speak to someone on the phone and you miss out little things that are important. You may not think they're important, but they really are"

These challenges were recognised on a wider scale by Senior Project Managers:

Interviewer: "Are processes used between the regions consistent and if not why is that the case?"

> "No, it's not consistent. The best way I can answer is, I don't know, which will tell you that it's probably not. I know that there are certain things that are done the same way...the training in certain key tasks...but how to be a Project Manager, the ethos of it and what you focus on as a group...I don't have any great awareness of how Atlanta manage things and that tells you that I would be surprised if there was a consistent approach"
>
> *Interviewer: "Are there any issues that come about because of that?"*
>
> "Yes. I would say so. [Example given] and the consistency in the way that documents are prepared for clients varies. There are inconsistencies, but they come up when there is a formal investigation process, where it comes up that we thought it was done one way and Atlanta say, well it's not done that way over here and it is certainly true the other way around as well" (Interview DA07)

There was widespread acceptance of deviations in operating processes, but there was little knowledge and understanding as to why the deviations occurred. Interviews demonstrated an impact on client relations, but there was still a distinct lack of transparency between the Project Services regional partners.

A lack of knowledge sharing was frequently raised in discussions about knowledge business flows. Common blockages were reported between Senior Management and internal stakeholders external to Project Services, such as the following example of Quality Investigations (QIs) that progress through Senior Managers and QA:

> "A couple of examples. One was a centrifuge purchase, where the wrong centrifuge was supplied twice in the same study. It was put down to human error, but I think that something could have been done with the training. A document that actually trains them how to do a centrifuge purchase. For example a checklist, which actually asks them to check the size of the centrifuge and have you done that. That would have been beneficial in making sure that never happened again. Another example is where we have a process when we receive samples into the frozen sample area. If there's a question on that receipt, sometimes samples are put into a holding freezer pending the answer to that question. However, what's supposed to happen is that when the question is resolved then the tubes are issued to whatever department needs them for testing. I've raised incidents where that hasn't happened"
>
> *Interviewer: "What are the consequences for the client?"*

"The consequences for the sample one is that they don't get the reports, they don't get the testing done. In the worst-case scenario, not only has it not been tested, by the time it's been identified the sample is out of stability and can't be tested. In the case of the centrifuge it means that patients are coming onto site and the site cannot process the samples"

Interviewer: "How do other Project Managers know about this investigation by QA to avoid this happening again?"

"They wouldn't know about it at all, that's not shared. I think it's to do with the volume and collation of it [the investigations]. We don't look for trends or process improvements and it comes down to workload. It takes a lot of time to mange resources like that" (Interview DA35)

Knowledge business flow problems also included Senior Managers. The following being a typical response:

Interviewer: "Okay, so you have an incident, which has gone through to your Senior Project Manager, how do you receive feedback?"

"From personal experience, mostly the odd email. Yeah. Or sometimes you've been there when the resolution has been made and you have to write it down yourself and write it up on a spreadsheet online somewhere" (Interview DA71)

Another typical response was demonstrated in interview DA77:

Interviewer: "So you take it [the scenario] to your senior Project Manager, what happened next?"

"I don't really know. I've asked for feedback and chased it up quite a few times, but I've never really heard anything and so I've just not bothered with it for a while"

Interviewer: "Does this have any significance to your work programme or is it just an inconvenience?"

"I wanted the feedback for my Business Goals, so yeah, I think it's kind of important."

Interviewer: "What was the final outcome?"

"…I gave up and just didn't bother putting it in my goals. To be honest, I learnt that I don't take anything to my senior unless it's something going wrong"

Interviews frequently brought about critical discussion of the knowledge business flows between Senior Project Managers and Project Teams. The perception being that Senior Project Managers acted as a 'black box' where issues were resolved, but there was frequently little or no feedback to improve knowledge and understanding of the process of progression or resolution. There was the potential for emerging issues to be lost due the perception of staff that Senior Project managers did not have the time to deal with everything that was happening within the teams. This could also inform the negative knowledge culture discussed earlier.

Key message

Internal knowledge business flow issues need to be addressed. OCLs should be working with Project teams to ensure a consistency of message and a deliverable service. There is also a lack of feedback from other internal departments, such as Quality Assurance, which could inhibit generative learning and adaptive capacity. It also suggests issues of a low visibility of what is known by the function. There is also a suggestion of blockages to knowledge business flows around the Senior Project management position, which is explored extensively throughout this research.

- Informs KR- 4D; 5A; 5B; 5C; 12; 13; 14
- Strategic links – E4; E6; P1; P2; P9

6.4.6 K-Core 'Knowledge Structure' construct

'Technical' knowledge resources were electronically stored and staff could not demonstrate a common indexing or filing system, which could enable the leveraging of uploaded resources. It was common for people within the same team to file identical documents in different locations. Feedback was unanimous relating to information overload and not being able to locate the right information/knowledge when needed most:

> "There are lots of resources and our biggest challenge is that there is so much that trying to find anything is so hard. What you really want is an index card or for someone to show you: I'm looking for this - go to here. There's so much information and a lot of that is lost when somebody leaves because only that person knew where to find something. Our biggest challenge, and certainly mine as the years go on,...is actually finding it [the resource]. Knowing where to look. I wouldn't know where to look, for example in lessons learned, because they are not categorised in any way" (Interview DA86)

This demonstrates the low visibility of knowledge resources, which leads to dormant or lost knowledge artefacts. Interview DA99 demonstrated that this was a global issue for the organisation.

> "There's so much information and it would be so much better if we could utilise it across the different functional [global] groups, but where would we have access to that information because [it seems] that certain people can only have access to certain things"

This challenge of knowledge visibility was further surfaced in Interview DA67:

> *Interviewer: "The lessons learned from investigations, where are they located and how would I find them?"*
>
> "If there any investigations raised, and if it's an official investigation, then they're always stored. So they are study specific and I personally, and a lot of the team, don't have access to the system, but we can speak to our senior to have them pulled. We don't have access to the system that captures all the information, it's only Senior Managers that have access. However, if we wanted to share any information, the actual form we use to complete is stored on our local drive under the study specific project code. So we can actually access them."
>
> *Interviewer: "So, am I correct in understanding that this information is mainly for Senior Managers?"*
>
> "Yes, but if it was my study then I would know the study code and I could go onto the local drive and access that. If another team brought lessons learned to a forum and gave us the project code then we could go into the relevant folder on the [IT system] and find the initial investigation and the close out"
>
> *Interviewer: "Am I correct in understanding that the lessons learned from the investigation is on a system that only the Senior Manager has access to?"*

“Yes”

Interviewer: “Are the lessons learned in these investigation specific to your project exclusively or do they have relevance to other project teams regionally or globally?”

“No they're not study specific. Any mistake that's made can potentially happen on any other study. So what we're encouraged to do by our QA department is to bring them to forums to give teams an awareness about the issue and give others the project code. So they can then ask the team involved or access the *idrive* for more information”

There was also a serious problem with regard to knowledge capture and dissemination processes, which is explored later in this enquiry.

The enquiry exposed challenges within the SOP indexing system. This was to be addressed as part of the deployment of a new system. However, while staff responses suggested that the indexing system was being addressed, there was far less confidence that a harmonised approach was to be taken on the informal aspects of storage, such as lessons learned or knowledge captured as part of the Global Project Managers Forum.

It should also be noted that search functionality within the new system was being questioned due to searches being limited to SOP index numbers, which the user must have a knowledge of in order to access the correct document. Problems of knowledge structure can be linked to issues of time and technology, which is discussed in the next section.

Key message

Technology solutions were lacking in essential functionality. The challenges were causing time issues for staff and left the potential for knowledge resources lying dormant or lost. Key functionality issues appeared to fuel apathy towards capturing, storing and re-sing value adding knowledge resources. This has the potential to drive re-occurrence issues that are discussed later in the findings.

- Informs KR- 4
- Strategic Link – E4; E6; P9

6.4.7 K-Core 'Catalysts' construct

6.4.7.1 Time

Time problems were reported in all interviews, with many staff stating that system processes and workload restricted the time available for collaboration, feedback and analysis.

> "Time is just not available [to do value added work]. We lack an effective capacity-planning tool. So, basically if you look at the allocation of studies, if you look at the group as a whole certain clients are aligned within certain teams. So where possible when a new study award comes in it is aligned within that team. So if you have a large client who has a very strong pipeline you might have 8 or 9 studies in that programme all coming into the one team. If that group is unlucky enough to have another big, active client you could have multiple studies being allocated simultaneously to an individual. This unbalances the work between the teams. Secondly within the pods, the PM/PC pods, it's very difficult because you can look at them one week and say they have capacity and the next week they can have no capacity and in fact be overloaded. We don't have a good capacity tool to identify where there is resource and without that I don't think we will ever find the time to have the opportunity for self-learning, development and process improvement" (Interview DA35)

Interview DA67 further demonstrates how time issues impacted knowledge performance:

> "We have an issue with resource. The way the department is set-up it's under resourced. It's been through periods where it's obviously worse. A lot of the teams have too many studies. Therefore you don't have as much focus or commitment or dedication to [everything that could be done] on each of your studies because you are diluting your performance. As a result you can't devote quality to everything you work on"

During discussion regarding QIs and root-analysis processes, time was again surfaced as a problem:

> "As part of a QI investigation there's supposed to be a root-analysis cause, but, I don't know if I should say this, but I don't think they want to know what the real root analysis cause is a lot of the time"
>
> *Interviewer: "Why do you say that?"*
>
> "Because a lot of it, I think, is down to the workload being too high. I've been told that's not an acceptable thing to write on it, but I believe sometimes it is the root cause. It's why things are missed, but it's like we can't be seen to be writing that on the QI. I think that if that's what's happening it should be addressed" (Interview DA83)

Time was also spoken of frequently when discussing why feedback was not given or applied:

> "We don't have the time...we're trying to do a little bit, but it tends to fail. You maybe have a working group that will go off and do something, but it's getting the feedback and having the time to absorb the feedback and incorporate it into your day-to-day work. It just doesn't exist" (Interview DA11)

Key message

Time was raised in a high proportion of interviews. It is beyond the scope of this enquiry to suggest solutions to resource capacity planning, but if the function intends to improve adaptive capacity, as suggested through strategic link C3, it is an important area for further enquiry. Some of these challenges could be addressed through more efficient technology solutions, which is addressed in KR-4.

6.4.7.2 People

Executive management saw PSUK(A) as being driven by the knowledge that resided in its people. Technology-based resources appeared inadequate for purpose and therefore there was a reliance on individuals to communicate what they know. However there was a problem in the dissemination of and access to knowledge embedded within the individual, which emerged as a challenge throughout this enquiry.

Operational processes were centred on pairings of Project Managers and a single project Coordinator. There were examples of Project managers with two project Coordinators, but this was rare. One of the implications for this was that knowledge could become invisible, where individuals who build power relationships absorb it; knowledge flows into this individual, but little or nothing emerges out of this person unless the individual sees benefit in such a transaction. Evidence of this can be seen in earlier sections. Other implications include critical knowledge loss, which is explored later in the enquiry. Obstructions to knowledge business flows and a lack of technology driven knowledge visibility can also have a negative impact on performance as demonstrated in earlier sections.

While there was a structured induction process, there was also a high reliance on mentors to deliver On The Job training solutions; for example Senior Managers considered 80% of an employee's training to be delivered in this way. However, it appeared that there were no criteria in place for the selection of a mentor and none of the staff interviewed were aware of training or guidelines in this area. However, the PSUK(A) Resource Planning Business Goals stated that all staff should, "Actively participate in employee training and mentoring by looking for opportunities to support team or department training requirements. Following mentor guidelines". Further analysis of the organisation's systems demonstrated that mentor guidelines did exist within the organisation's online training zone; however, they were found under mentor guidelines for a different area of the business, and none of the staff interviewed in Project Services were aware that these guidelines existed.

The interviews produced numerous examples of shortfalls in the mentor process:

> "The [mentor process] can fail drastically depending on workload and time available. So, for example, you have a PM and PC pairing and you have another PM who has a PC come in. The PC is assigned an experienced PC as a mentor, but the experienced PC has a very high workload and doesn't have the time for the new PC to really sit with them and go through everything. Then it's not effective. If the new PC has questions that point of contact is there, but that point of contact doesn't have the time to sit with them....effectively they're on their own and rely on SOP and training that's

> available and while it might look as if it works on paper, it doesn't work in practice....what we're good at in here is covering for things. The PC will fall down, but we'll cover it. There's a PC out there right now who doesn't have a clue. They were assigned a mentor, but the mentor just didn't have time to go through certain processes with them and so they had to ask about different people in the department. By doing things this way you don't get a consistent source of information. Luckily the PM was experienced and was able to pick up the slack. The problem is that you have this person who really needs trained and somebody sitting with them and you end up having someone who is trying to carry them as well as train them because the mentor process doesn't work and its overwhelming" (Interview DA47)

Interview DA03 is a further example of concerns in this area:

> *Interviewer: "So you are saying that the message from the mentor process is not entirely consistent?"*
>
> Not entirely, no. I'll give you an example.... I had a new PC and one of the messages that has come from peers and Seniors and other people is that [this process] is really good "because you can mould that person into how you want them to be". I felt that I wanted them to be able to do the job and have the right information. Now, I've always felt a little inadequate because I've never been a PC, I came straight in as a PM.. So therefore I feel as a mentor that I am unreliable as a mentor for that role. So what I do for my PC is point her in another direction....There's no training really. Nothing but my own knowledge....I don't believe I've been given any training that would allow me to be a mentor....It's who fancies being a mentor...it's assigned on requests' [not ability] and goals.... It goes through to the Senior and when the opportunity comes, there you go. I would have hoped or expected that if you were going to be a PC mentor that it would be specified this is the role you're going to do, but where is the framework or structure to support that"

This Project management/Project Coordinator gap also emerges later in the enquiry.

All staff were asked, "*What is the visibility of Training and Development in this process?"* In all cases staff responded to the effect that Training and Development had no visibility within the mentor process. Staff were also asked, "*What is the feedback from your Project Manager or Senior Project Manager on your performance as a mentor?*" Staff could not provide any evidence to support a mentor feedback process.

Key message

Project Services relies on people to support the knowledge dissemination process, with Senior Managers stating that most of knowledge dissemination is informal and individually driven. However, knowledge resources were relatively stagnant and embedded within pods of people - this is supported in future sections. Mentor selection, much like specialist project selection to be discussed later, appeared arbitrary and lacking in competency drivers; given the reliance on mentoring for On The Job training, which, according to Senior Project Managers, accounted for 80% of training provision, it is essential to get the best people delivering the best possible knowledge. This would could also assist in harmonising processes and improve the reliability of knowledge being disseminated.

6.4.7.3 Finance

Not examined as part of this enquiry; this limitation is explored in Chapter 7.

6.4.7.4 Technology

Following on from the previous section, staff were asked how they knew whom to speak to in order to access the most reliable information/knowledge? In all interviews staff invariably stated that it was about 'whom you know and whom they know'. If the immediate network was unable to assist it appeared to be standard practice to solicit answers through a global or regional email; for example, "In this job you have to ask somebody. The difficulty then is you have to pick somebody that knows what they're talking about and that's when things become grey" (Interview DA86)

A Human Resource Directory that would allow people to surface the knowledge held within the community, making it more visible, did not exist. Though document analysis of competitors demonstrated a high level of coupling between people through mechanisms such as Wikipedia-style Human Resource Directories, the assurance of anonymity in this case study does not allow for the disclosure of these organisations as it would reveal the sector and the potential for identification of the case organisation.

The implications for this lack of resource included stress upon individual workloads, as the search for the right knowledge impacted not only the person who needed the knowledge, and the time required to locate it, but also the wider network that became engaged in the location process. Interviews also demonstrated that once the answer was found that the solution wasn't captured for future re-use; the potential implications for this are demonstrated in later sections.

Technology emerged as contributing to low knowledge visibility throughout project Services, which is dealt with extensively in later sections of the enquiry.

Key message

Building on the findings of earlier sections and analysing the people-centric nature of Project Services, it is essential for the organisation to consider the development of an effective Human Resource Directory that can facilitate linking the people to the best available knowledge resources at the time they need it. This could also contribute to the opening of knowledge business flows between regions, which would provide a catalyst for the harmonisation of processes.

- Informs KR-2; 3; 4; 8; 9
- Strategic links – E1; E2; E3; E4; P1; P3; P4

6.4.8 K-Core 'What Is Known' construct

This section looks at what was known by the Project Services team, where it resided, how it was accessed and how it was reused to bring value to the business.

There was a problem of knowledge visibility across all operational activities within Project Services; for example, the problem of document location was raised throughout the interview process:

> “I brought this up when I was a Project Coordinator; there's no consistency in where we store information. So, for instance on a study level, just making sure that if you're moving to a new study or if you needed to access information for a different study you would expect to find it in the same place as you would file for your own studies. There was some talk of someone doing something about this – trying to establish some consistency on where information is stored; whether it's documents relating to a specific study or general feedback and answers to questions. But this process was never really seen through to the end as it wasn't high up on the radar with Senior Managers at the time....and because of that nothing really came out of it of any worth. There is no consistency on how we do things globally, but on another level there is potentially no consistency on how someone in Location UK(A) will do something. Take for instance the storing of documents during the set-up phase of a study. I know where a set-up manager will store a database design document purely because I know that set-up manager and I have worked with them before, but different managers will store them in different folders and you have to know the manager to know where they will store the same document. This is because we have an outdated filing system that is not relevant any more. It may have been relevant 5 years ago, but we do things differently now” (Interview DA06)

Implications for low visibility were explored further, for example in interview DA06:

> “Something happened [very recently] where I took over a study...I was asked to find the new version of the lab manual updated with this, this and this information. So I went to find the last version of the lab manual and could not find it anywhere. So instead of being able to make a small change to the lab manual and have it distributed to sites in Europe within a couple of days, I actually took a week to create the lab manual from scratch based on a hard copy that I had. This impacted the client because it delayed the time line required to provide information”

Challenges frequently surfaced regarding the dissemination of what was known across project teams globally. For instance knowledge held within the different regions was not always shared. The following highlights a breakdown in disseminating what was known between South America and Europe:

> "With areas such as South and Central America, I didn't fully understand the process of shipping materials from Latin America to North America. I didn't understand the customer's processes, their use of the couriers involved, things like this. This caused us issues in the client's misunderstanding of the process. How that is affecting specimen stability and affecting the dilution of certain samples. We had a high dilution rate on that study and I think that was because of the way the study had been set up from Europe, globally and a lack of understanding of how these samples must be moved between sites in Latin America to our facility in Atlanta. There was a lack of understanding here in Europe on how these samples should be managed" (Interview DA12)

Interview DA93 highlighted another lack of knowledge visibility:

> "The Global Logistics Tool – which I think, since I've started, I've seen maybe two emails about and it gives so much information on a global level.... There was an occasion where my PM was out of the office, senior was out of the office and I had a Sponsor asking about shipping into a specific country; did we need pro-forma invoices, did we need this that and the next thing. A lot of the time you can pick up the phone to our logistics department and they can talk you through it, but I couldn't get somebody in logistics to talk to. I sent out an email to the department as I would normally if I couldn't get the answer to a question. Getting any form of response form that took 2 to 3 hours. In that time I got two emails from the sponsor saying 'I really need this information – I really need this information' and I had no idea that this tool existed at the time"

In both of these examples, amongst many others, when asked how the learning from the experience was captured, or how they raised awareness of the solution to the problem outside of their team, the typical answer was "it's not'" and/or "we don't". Interview DA81 discussed similar issues of knowledge dissemination between regions:

> "I think there's a downfall there. I would usually feed it [knowledge gained] back to my senior, but I think there's definitely a downfall in making sure everyone is aware of it. Certainly I would let me regional managers know, but in so far as a global, let everyone know, update and communicate it, I think there's a downfall"

Challenges of re-occurrence frequently emerged, becoming what could be interpreted as a typical response in questions relating to problems of knowledge reuse:

> "I've thought for a while that if there is an incident an investigation is raised, like with QA, [then] where's all the visibility of all these [investigations]? Do they just go into a huge hole after they've been investigated? Because there's been instances that I've been aware of where things have happened in the past and they've happened again. So, if there's been an investigation raised previously and appropriate solutions were put into place the first time then it shouldn't be re-happening. Obviously, because there's no visibility of that, people aren't aware that these things can happen...It's not as if there's this massive list of things that have happened and how to avoid them" (Interview DA96)

This was not an isolated incident, as demonstrated in Interview DA27:

> "I would expect QA to come back and say "yes we've heard of that before" [relating to re-occurrence issues]. I found a problem with a test being selected if it came in on a retest kit. There's supposed to be a little 'a' on the label if we're doing HBA1C on that. For some reason on the retest kits that little 'a' wasn't coming out. So if they sent the retest kit back HBA1C wasn't getting selected, causing deletions. I found the problem was happening a couple of times on my own study and I happened to be kinda talking about it and a PM behind me said, "yeah, that's happened on mine". One of the other PMs then said "Yeah that's happened on mine". It's through that I found out, it is not just me and if it's the 3 of us then it can't just be us. This has to be kinda through the board. I then raised the investigation and took it to QA. They said they'd heard it before, but they though what they had done back at the time might have fixed it. It didn't, obviously....This was a big issue causing cancellations...and had a big effect on the client"

Re-occurrence problems were not unique to Project Management, with Interview DA67 demonstrating similar concerns in Project Set-up:

> "[The problem] has happened with a number of key clients. We had programming over here for a week to give us some training. Training that I thought wasn't very efficient, because of the nature of the programming it wasn't particularly clear. I've ended up putting together process for myself. I now [due to the nature of the issue] wont submit programming until I have a call with the US to make sure that the specs are correct and I've encouraged other staff to do the same if they're working on complex studies"
>
> *Interviewer: "So you've developed your own work-around?"*
>
> "Absolutely. I don't think the process is the best, however....there is a lesson learned based on this type of issue"
>
> *Interviewer: "Has this work around been shared?"*

> "Certainly on a regional basis. When the programmers were here I recommended to the field team that if they have any complex programming that they initially have a call with the US to make sure they have an assigned programmer and tester so that everybody is in the loop and everybody knows exactly what is required. This process works for me because I've had my fingers burned so many times"
>
> *Interviewer: "What do you have to do to make this standard practice?"*
>
> "To be honest, I got support form the Senior Manager here to have an assigned programmer and to have calls. In terms of that globally, I think this is more of a Europe issue....I gave my feedback to my senior at the time about the training and my other suggestion was with programming being so vague and also so specific, I suggested that we had examples of programming text defined for an easy study, a medium study and a very complex study, almost like a template that we could refer to. The problem is that the US didn't agree."

These challenges were also linked to deficiencies within monitoring and evaluation processes:

> "The QI process is fine on paper, but nobody checks to see if you implement the Action Plan… [CAPA (Corrective and preventative action) Plan] and so nobody knows if what you're saying actually works or even if you actually do anything about it [the problems]" (Interview DA77)

The challenge of leveraging existing knowledge to overcome re-occurrence problem was also discussed with Senior Managers, where they confirmed findings from earlier interviews:

> "If there are day-to-day minor incident and rumblings we tend to move on. This is something that I do believe we have a massive gap with. In that we are not very good at learning lessons properly and making sure that everybody tries the best they can to not make the same mistake again, by being aware of what happened and how it was resolved. There are ways we can do it, through Lessons Learned and that incident being documented. From that incident there will be a process change or a look to update the SOP, but unless it gets to a particular level, I don't think anything ever changes" (Interview DA07)

the following is a good example of challenges associated with knowledge being embedded in people and not being available for reuse:

> "If you take away the person, where's the information? I've come up against this when I've had to take over on things and it's like what's happening and where's what....I moved over to help a new PC who's PM had left. I didn't at that point have access to the old PMs emails and it was like a dead trail. I couldn't find anything. [The project is not captured anywhere]. It should have been, but they didn't do things. Like we have summary sheets that should detail the important information on our project and should be held on file. Basically anybody should be able to then look and see any current issues...that hadn't been done. We then looked silly in front of the client, having to ask questions that we shouldn't have had to ask' "
>
> *Interviewer: "What was done about this?"*
>
> "There wasn't anything done"
>
> *Interviewer: "Was it raised with a Senior Manager?"*
>
> "Yes, it was ongoing issue that we knew about...those projects were kind of in limbo for a while"
>
> *Interviewer: "Was anything done to ensure that didn't happen again?"*
>
> "Not that I'm aware of....it could happen again'....The problem is that I don't think that summary sheets are in an SOP. It's definitely best practice without a shadow of a doubt....I've never seen an email come out to the department. You could argue that something should have happened. That the issue should have been raised...the thing is that hypothetically, if a PM goes out of the office unexpectedly, the PC should have all the information that the PM does and so nothing should go amiss...but it depends on the circumstances" (Interview DA27)

This issue of insufficient knowledge capture within summary sheets, or existing processes, was not an isolated incident.

Many interviews identified inconsistencies in capture, with responses acknowledging that it should happen, but that it didn't always happen as it depended on the Project Manager: "Quite a few [PMs] use them, but not all. It's best practice but it's not standard practice" (Interview DA01). There was also inconsistency within the mentoring process. There were no standard mentoring guidelines and the knowledge exchanged during any given mentoring relationship was firmly grounded in what the mentor observed as being important to them as an individual. During interviews it became clear that these challenges had been raised with Senior Managers, but action was only taken if they believe it to be a serious issue and what was considered 'serious' was unclear.

A lack of knowledge capture could have wider implications on the organisation's service provision and potentially its competitive advantage, as demonstrated in Set-up interview DA53:

> "Extensive knowledge is embedded within people that you can count on the fingers of one hand.... If 4, maybe 5 people were to leave set-up would fall to pieces...because nothing would be there retained...Nobody takes notes or writes things down and this knowledge will be gone. People just want the quick fix for their particular issue to be done there and then"

This is reinforced as being a critical, for example interview DA83:

> *Interviewer: "From what you are saying, it doesn't appear as if the knowledge is deposited anywhere, would that assumption be correct?"*
>
> "Very much so, it's infuriating. It's not deposited. Say there's a certain number of people in set-up now, we'd be up ****-creek because there's a lot of stuff in people's minds that is not documented anywhere. I think a lot of our processes aren't documented properly. Not only that, where can you find it. You can spend an hour trying to find something on how to do something. It will take you longer trying to find the instructions on how to do something than to do the thing and there's just so much that's in people's heads, which is why we started the set-up bible."

An isolated example of knowledge capture was identified, where staff within Project Set-Up had created an unofficial document, the 'Set-up Bible', in an attempt to save time answering questions and to capture valuable information that might become lost. The document had been created in Microsoft Office Word format to allow for key word search using the 'Find' function. The document was loosely designed around a 'wiki' concept where anybody with Project Set-up could update the document by adding their knowledge along with their initials, time and date. In this way people reading the document knew who to speak to if they had further questions in the topic area. It also allowed for the tracking of reliability, where if someone uploaded incorrect information it could be tracked back to the source and corrective intervention given. However the document had low visibility as there was concern expressed that its development would be restricted if its existence became known within the North America region. These concerns were due to the lack of Quality Control associated with the document, which could bring into question its reliability. This lack of willingness to extra-ordinary practice could also be linked to the control element associated with the Machine Bureaucracy typology findings, discussed earlier.

The 'Set-up Bible' was not the only instance of what could, potentially, be regarded as good practice, but that was not visible to Senior Management. This was demonstrated in interview DA35:

> “There is a format within my own team meeting that we trialled, which is sharing knowledge. It's was very informal and was a case of let's spend half an hour at our team meeting discussing if anyone has found out anything in the last week that's been beneficial to them. It can be an IT solution, a short cut to one of our processes. It was very ad hoc, but was ten times more beneficial than anything I've found in lessons learned.”

Key message

As highlighted in previous sections, knowledge resources have low visibility and are often left dormant or lost. There are also particular issues involving knowledge capture processes; some of which seem to result from a lack of understanding of the need for knowledge capture, which could be attributed to a lack of business directive emanating from a lack of strategic understanding. Of concern is the lack of knowledge sharing that takes place, with repercussions being re-occurrence, which could be avoided. There is some discrete evidence of what could be considered to be good practice, which could assist in developing more effective processes against Project Service needs.

- Informs KR- 3; 4; 5; 6; 7; 15
- Strategic links – E4; E6; P1; P3; P9

6.4.9 K-Core 'Extending What Is Known' construct

This section looks at knowledge sharing and business improvement processes. Focus was given to how resources were acquired and how ideas were shared and progressed towards implementation.

When asked if the acquisition and sharing of new knowledge resources was important to their job role all staff responded in the positive, for example: "Yes, definitely...we work on [projects] where we can't possibly know everything about…a client" (Interview FB68). These resources were then defined as documents, such as journal articles, and Internet based blogs, white papers and the like. However, responses typically indicated that newly-acquired resources were not being shared:

> "I save [resources] on my own personal computer because at the moment I don't think that people would know that it would be there for them to go and refer to"
>
> *Interviewer: "Why do you think that?"*
>
> "It's not something that is encouraged, I don't think. I do it for myself. I don't think to save it somewhere for everybody else to access. To be honest if I made people aware that it was there, I think it would be a bit of a waste of my time to go through all that effort to set up a Share Point folder because I don't think it would get used" (Interview DA39)

This could explain the perception of 'knowledge as power' expressed in earlier sections. Examples such as this also indicated that the organisation's knowledge needs, in relation to its outputs, was not being communicated.

Some staff demonstrated a desire to contribute to service improvement. However, there were blockages in technology provision that hindered the process and there was a perception that line managers were not always receptive to new ideas.

> "The first thing I think of is feeding back patient reports to [clients]. We fax the reports to the site...and it causes a lot of extra work for us because obviously a site can have a fax machine that is not plugged in or is turned off. I'd say it then takes me say 2 hours of my day resending faxes. Why can't we

> have an automated email system? The argument is that email wasn't very secure, but I don't think that is necessarily true”
>
> *Interviewer: “Where would you go to find out if anyone else has had this problem and how they've overcome it?”*
>
> “I don't think there is anything, there is not one resource. The first thing I would do is go to my Senior Manager to mention it, but I don't think it will be acted upon. There is not a central place where you can share ideas or where we can see common ideas and how we can look at implementing them”
>
> *Interviewer: 'Why do you not think it will be acted upon?”*
>
> “I don't think that when you have good ideas that they are necessarily listened to. I think small changes to small internal processes get listened to, but if you have an idea that maybe kind of improves the bigger picture it just falls by the wayside” (Interview DA39)

While it became clear in subsequent interviews that the fax issue was being addressed as part of a systems overhaul, its existence and purpose was not clear to all staff that were interviewed. This related to the manner in which information was disseminated throughout the organisation. However the last piece of feedback on the lack of a common knowledge portal and perception of process improvement input is still of interest and is a theme that was discussed throughout the majority of interviews. The following is an example of why some staff believed that service improvement was a waste of their time; which can be cross-referenced to motivation, discussed later.

> “There’s not much point in looking at service improvement. I barely have enough time to do my job at the moment without worrying about improving things….and when you do get good ideas nothing gets done about it.”
>
> *Interviewer: “Why do you think that is?”*
>
> “It takes too much time to do anything and so nobody really bothers…it just takes too much of everybody’s time…it’s better to just keep it to yourself and work around the problem” (Interview DA77)

Early in the interview process a ‘Kit Wastage’ project was identified as being of importance to all project teams. The project was given high importance, partially due to a £250k payback that was given to a major client as a result of kit discrepancies on a project three months prior to this case study enquiry. This was then used during the enquiry as a benchmark for knowledge development visibility. All staff interviewed stated that this project had significance for projects that they were involved with. However, visibility was limited to staff who knew the two people running the project. None of the staff interviewed could provide details of the status of the project and none could provide an example of how they had contributed to the development of the 'Kit Wastage Tool'. This lack of visibility was acknowledged during a Senior Project Manager interview (DA07):

> "It's maybe a very good example as a very bad example. It's a good example of how sometimes these projects or initiatives are not as visible as they could be. It could be that there hasn't been a lot of activity and that's why it hasn't been very visible, but that, as an example, is not the most visible project we've seen. It's in the goals and everyone has it in their goals. It' just that the focus dissipates through the year…naturally perhaps they're not as focused as they are on other goals."

The lack of visibility and understanding of who was working in any given area was a common theme during the interviews and links to the earlier discussion on the potential need for a HR Directory:

> "Unless emails are going out, you wouldn't know who's working on what. Because nobody [seems to know what I'm doing]. Unless I put a sign up on my desk saying I'm on a working group, nobody actually knows....As far as I know, I've never seen anything that says this is who is working on this working group or that working group" (Interview DA93)

Knowledge was predominantly shared via a process of escalation, which was, in the main, driven by the individual. To clarify, individuals raised issues with their Senior Manager and if there was perceived value in the discussion it was brought to a Regional Forum, which was an on-line discussion between large numbers of staff working on similar projects in a given region. It was then progressed, if it was considered to be of significant enough interest, to a Global Forum, which comprised online discussion between groups of 50+ staff. Outcomes of this process, if the issue was heard, was a trigger for the lessons learned process.

One particular challenge with this method was that the lessons learned process lacked a coherent direction. Accepting that the process could be successful, knowledge resources were captured through the lessons learned process, but there did not seem to be an effective or efficient way in which to access this information for reuse. Due to the on-line, text-based, nature of Global and Regional Forums there was no guarantee of attendance, or that the people in attendance were engaged with the process. Details of agenda items were captured in minutes, which were stored within the global electronic storage system, but the detail, in the examples available to this research, were difficult to understand and links to existing resources were tenuous at best. For example, seven examples of minuted lessons were given to seven different project managers and only two were able to locate any of the lessons mentioned in the minutes; this though they were actually involved in the original projects being referred to in the minutes.

Locating information from past meetings was time intensive and required individuals to manually open and scan meeting minutes in order to find relevant information – a common indexing system did not exist. The process was heavily criticised by staff at all levels, with Interview DA35 providing insight into issues surrounding the lessons learned process:

> "Lessons Learned is about postulating. It's not giving the information I need that would improve my role. Now that might seem quite harsh, but people tend to have lessons learned as part of their goals and it tends to put a different slant on it when compared with the intention of lessons learned. I feel Lessons Learned should be brutally honest: I didn't do this, I didn't do that and it caused this incident, take full ownership of it – Not that you are blaming yourself, but this is the reason why it came about. I can give you numerous instances...where by the second slide you've switched off"
>
> *Interviewer: "How do you feedback on this apparent failure of lessons learned to provide you with the things you need to become more effective in your role?"*
>
> "They [Senior Managers] don't solicit that kind of information"

This is supported in all interviews where staff could not provide an example of feedback given to the author of a lesson-learned presentation. More concerning was that new staff, defined as being within their first six months of employment, were unaware of the lesson learned portal and experienced staff, being employees with two or more years of experience, who had uploaded lessons learned, had not accessed the system for extended periods of time – in some cases they had not used the system for over two years. This indicated that the knowledge acquisition, storing and sharing capability of Project Services was limited and potentially damaging, given the strategic drivers set out in earlier in this Chapter; having a detrimental impact upon individual and organisational adaptive capability. Of concern, Senior Management's perception was that current practice was effective, which reinforced the need for an examination of existing monitoring and evaluation processes:

Key message

Knowledge resource development is an area of concern, which is linked to issues of time, a lack of direction, which can be associated with the Organisational Typology feedback in section 2.0, and appropriate use of human resource assets. In the example of the Kit Wastage project, two relatively inexperienced project coordinators, who possibly did not appreciate the complexities of developing a global tool, were managing it. This relates back to previous discussions on the identification of competences for positions as mentors or leads on specialist projects, and the need to ensure that the best person possible is deployed in the role. There were also issue of technology functionality, which have been extensively discussed in earlier sections. Issues of time were raised earlier and the argument for further enquiry is supported in this section, with links emerging that could effect staff motivation, discussed later in this Chapter.

- Informs KR-3; 4; 6; 8
- Strategic links – E4; E6: P1; P3; C1

6.4.10 K-Core 'Artefacts' construct

Codified knowledge resources were under-developed, with the content made available to this enquiry lacking depth. Resources were predominantly text-based and lacked audio, visual and hyper-link resources that could aid in knowledge transfer process.

Staff had a low awareness of drivers that influence the need for knowledge rich resources, which was evidenced in discussion around staff understanding of the strategic drivers that inform operational planning processes. Knowledge capture was individually driven, and guidelines for good practice in resource development could not be identified during interviews and the organisation could not provide any documents to support a template. It should be pointed out that the Global Learning and Development Manager stated that such a framework did in fact exist. Lessons learned were primarily based in Microsoft Power Point, which had the capability to incorporate audio, video and hyperlinks, but this was not being exploited to its full potential.

Staff did not log key events that could inform current Business Goals and emerging strategy. There was no evidence of metrics to determine evaluation or a return on investment from operational knowledge activities, such as sharing logs, learning logs or event logs. This is supported in the next section, where staff stated that the informal feedback process was stimulated from memory, as opposed to a continuous recording process that was used as a point of reference during periodic performance reviews. This was also cross-referenced with discussions on feedback or reflective processes.

- Informs KR- 1; 15
- Strategic links – E1; E6

6.4.11 K-Core 'Reflection' construct

There was a lack of evidence to support the monitoring of Strategic Development and PSUK(A) Business Goals. The implications for this were discussed extensively at the outset of this enquiry. It was demonstrated throughout the interview process, where staff stated that Business Goals were reviewed during formal and informal appraisal meetings. However, there was no requirement to log trends or events for contribution to that process. In all interviews staff were unable to provide an example of a situation where performance indicators were discussed in Business Goal development and/or review.

> "As part of the appraisal process you will write up your achievements, which is part of our catch-up with our Senior Managers"
>
> *Interviewer: "Is this compared against Business Goals?"*
>
> "Not in the catch-up meetings, no" (Interview DA81)

The problem of a lack of review and tracking progress throughout the year emerged frequently during the enquiry, regardless of position within Project Services:

> *Interviewer: "The extra work you do, does it feedback into your Business Goals and your appraisal?"*
>
> "I would put it in my appraisal that that's what I did. In your appraisal you put in your comments on what you have achieved over the year, so I would include it in that. It's down to me to feed it back."
>
> *Interviewer: "How do you keep track of what you have done?"*
>
> "In progress chats"
>
> *Interviewer: "How often do they happen?"*
>
> "Every six weeks"
>
> *Interviewer: "Do they happen regularly?"*
>
> "[laughs] most of the time."
>
> *Interviewer: "What happens then when you miss a meeting, does it happen in week 7 or do you wait until the next scheduled meeting in week 12?"*
>
> "In my experience, week 12."
>
> *Interviewer: "During that time, what do you do to keep track of everything that goes on to feed into your appraisal?"*
>
> "I don't. I come to my appraisal to try and think over the past weeks."

> *Interviewer: "Are you required to keep a log that would allow you to capture the events for feedback into the progress chats?"*
>
> "Not required, but I do know some people who do have a document that they update, just to keep a note for [themselves]" (Interview DA75)

The enquiry also examined to what extent performance was compared amongst Senior Managers to produce a whole picture for comparison against overall goals and strategy:

> *Interviewer: "Is performance [related to performance against Business Goals] collated and shared amongst Senior Managers?"*
>
> "Yes and no. Probably not as much as we should or could be doing. The reason I say that is that the goals are determined at the beginning of the year and that's essentially it for the year. Each Senior project Manager will review the goals with individuals or if its for a Project Coordinator, the Project Manager for the Project Coordinator we only see it going out signed...In terms of feeding that all back up again and then reviewing it say again to say, how did we do with these goals, that's something we don't do quite so well" (Interview DA07).

Due to ethical problems this case study cannot provide evidence on Training and Development practice as there was only a single Training and Development Officer interviewed and therefore, due to the interviews being conducted under the guarantee of anonymity, key information cannot be published in these findings.

However, from interviews conducted with other staff, it is possible to state that the function was isolated, with a low view of existing strategic and emerging needs. For example, a snapshot was captured in the following senior management interview:

> "The training they [staff] receive is relevant for them to do their job....In terms of their training, I think their training meets the needs for what they have. In terms of development, in terms of increasing their awareness and their knowledge, I think that it just occurs" (Interview FS67)

Staff were asked about Training and Development's visibility of emerging issues, within areas such as specialist projects, Quality Investigations, lessons learned, the Global PC/PM Forum and self-directed learning needs emanating from the appraisal process. In each case the response was either that Training and Development had little or no visibility of these challenges; an example of this is visible in earlier discussions on the mentor process. There was also a gap in existing training programmes, where an externally-hired Project Manager was not provided the information, or did not have the same level of knowledge, as an internally-promoted Project Manager:

> *Interviewer: "How effective was your training programme for the Project Manager role?"*
>
> "I think, coming in as a Project Manager, there are some technical areas [understanding]...that you're not going to have initially. I got given a quite experienced Project Coordinator to work with, which is good because she had the knowledge, but with that comes the challenge of managing someone who has slightly more [knowledge] than me."
>
> *Interviewer: "Looking at that[lack of knowledge], how do you feedback on the gap in training?"*
>
> "I don't think it does, but it is a gap that should be identified by your Senior Project Manager"
>
> *Interviewer: "Have you made your Senior Project Manager aware of that gap?"*
>
> "Yes"
>
> *Interviewer: "And what is the outcome of that feedback?"*
>
> "I'm not quite sure that [this type of feedback] is addressed. I feel to an extents it's sink or swim" (Interview DA96)

This was also reinforced in other areas, such as Project Management's training in the area of Project set-up, where the interviews highlighted tensions that could potentially be addressed through a review of the training process. A good example emerged in Interview DA99:

> *Interviewer: "Explain to me how important it is to have a relationship with Project set-up?"*
>
> "I think it's really important because when it comes down to the sponsors and the clients are at you, you don't want to feel as though you're opposing the

department. We're both one team and it's important to have that sort of relationship and that interaction where we're going for the same goal here. To be able to support each other is really key. Sometimes it doesn't necessarily feel like that though."

> *Interviewer: "What do you feel is the issue there?"*

> "I think we see things in a different way from them, they see things for maybe six weeks and I'll have the project for years. So my view on nipping things in the bud and planning and strategising are very different to them. If there's any long-term problems they don't really see them, but we would have to deal with them. So we have the knowledge to say, I don't think that's going to work and I think we need to get a little bit more support from them to feel that's not an issue."

> *Interviewer: "Do you believe that this understanding is addressed during the [on-line organisation training programme module]?"*

> "I don't think it is. We're given a very broad and brief overview of everything they do, but they don't say how this impacts you and this is how you can help us. I don't think that you are there long enough and you're nor interacting with them enough to build up that relationship or contact. It's really just a mini lecture" (Interview DA99)

Similar concerns are highlighted in the following example:

> "I think it [training] is useful, but the way its set up is that your Project Manager organises your training plan and again you're accessing information on the shared drive on the computer, and there's limited spaces on these courses – they only take 2-3 people for every session. So, depending on how quickly your PM arranges things for you, you can either go to [on-line organisation training module] two weeks after you start or it could be up to six months after you start, depending on when the next available space is. I think some TLOs are useful to go to more or less as soon as you start...but some, if you go to quickly don't mean anything to you. For example I don't see the point in spending an hour with [set-up or finance] when you're still trying to get to grips with what your specific job role is"

> *Interviewer: "Did the [online organisation training module] give you enough information to understand their role and how you work together?"*

> "It covered the basics, but I couldn't tell you what a Set-up Manager or Set-up Specialist does on a day-to-day basis. I know they're obviously heavily involved in the set-up of the study, programming the database etc., but I took mine [TLO] too quickly, because I didn't know what I was doing, never mind a Set-up Specialist" (Interview DA39)

This problem was not particular to recent appointments, with the following coming from a senior member of staff:

> "[knowledge doesn't get shared between Project Management and Set-up] From personal experience, because I don't really understand how Set-up works. We have [online training modules developed]..., but they run through a checklist where they check off the points as they go through them. Even after that I still come back and now, going through studies, I have to ask my manager because I don't understand what's going on...I don't understand the way they work, I don't know what they need for the start of a study, anything like that" (Interview DA93)

Staff were asked how they provided feedback on the Training and Development process. Staff interviewed were unable to provide an example where the training and development function reacted to the needs identified above. This could have far reaching implications, as the Training and Development function in Location UK(A) had global responsibility, which impacted the organisation's monitoring and evaluation of the harmonisation of processes across its centres of operation. A good indicator of the lack of influence attached to the training and development function was demonstrated in a discussion on the outcomes of process error investigations, or Quality Investigations:

> *Interviewer: "As a result of the QI, what feedback or training did you get?"*
>
> "None really. So what happens is that it goes off. You fill it out with what's happened and how it could be prevented in the future and maybe you'll raise it in a meeting. But it just goes off somewhere and you'll never hear about it again"

It also appeared from the Learning and Development Organisational Chart that the function was not directly monitored from Location UK(A), reporting directly to North America; yet there was a Global Learning and Development Director situated within the same workspace in Project Services in the UK. This identified the need for an evaluation of the training and development management structure, as the availability of a Senior Manager within the UK operations would allow for a closer relationship between the function and the staff it is designed to serve, while also aligning training and development operations strategically and structurally.

Information Technology (IT) – The enquiry included aspects of IT monitoring and evaluation. There were no metrics for monitoring the use, sharing or development of knowledge resources; for example, access logs for lessons learned. The implications of this are that there was a lack of awareness of the value of knowledge resources and their ongoing use. Also, time saving issues, which could potentially optimise workflow and employee efficiency and effectiveness, were being missed and the process available to the employees to instigate change was itself time consuming:

> "There is a group called the BPCC...and that is basically like the IT team...[any suggestions on functionality] that goes to a meeting of this team. We present the issue at a meeting of this team, and it goes on a priority list along with all the other requests they have. [Criteria for change are examined] and that can be a very long process... A priority functionality issue was raised through a GPR meeting, which was then referred to the BPCC. That was started in February and the completion is expected in December of this year" (DA63)

Reflecting back on the knowledge acquisition process, where staff frequently submitted a global email to elicit a response to a problem, which could bring about reliability/credibility problems. This could bring about confusion, with regard to what is the correct process, which links to earlier mentioned issues around the time available for collaboration:

> "The problem [with the email responses] is confusion with processes. Like if you put a question out there about, this patient's visits wrong and should I get it moved or take it out completely. You'll get people saying, "Yeah, just do that". The somebody might say, "Hang on a minute, why do you need to do that? If it's for this reason then, no. If it's for this reason, then yes". Then it starts triggering what did I learn from my SOPs way back at the beginning and what's the actual process here because at the end of the day we're dealing with really important information. You ended up trying to think, what makes more sense?"
>
> *Interviewer: "Have you taken advice that has actually been the wrong advice?"*
>
> "Yes, actually in the past I've made mistakes [because of something I was told in the email response]. I moved information that I shouldn't have...it was actually somebody in the States [that caught this] who said, "I don't think so,

perhaps we should read up more on that". I then went back to the SOP and realised that I shouldn't have done that" (Interview DA71)

- Informs KR- 1; 2; 4
- Strategic links – E1; E3; E4; E6; E9; P1; P3; P4; P9

6.4.12 K-Core 'Motivation' construct enquiry

This section clarifies the factors that encourages staff to participate in Knowledge Resource-Based activities.

There was an absence of Strategic and Business Goal drivers in business planning processes, as discussed at the outset of this enquiry. What was seen as a key aspect, given the evidence produced thus far, was the absence of Strategic Goal E3 – Leaders: "Identify and develop leadership to execute our strategy". This is pivotal in that Senior Managers provided the driver that linked the personal motivation of the staff member with the goals of the organisation. There have been many examples throughout this enquiry where the knowledge and understanding required to deliver their motivation is missing, such as in the case of training and development. It was also evident that Project Managers and Specialist Project leads had not received any leadership training, though they played a fundamental leadership role within Project Teams and Specialist Projects. The majority of staff spoke of motivation coming from the appraisal process. However, there were serious challenges in the monitoring and evaluation of this area, which was discussed earlier. Time was also a frequent issue in discussions about motivation, which was also discussed earlier.

Staff found it difficult to recall leadership images when speaking of resource sharing or storage and acquisition; for example, "I can't give you an example of my manager sharing resources that would help me to solve problems…I have to do that myself" (Interview DA27).

Staff also related career progression and pay incentives as major influences over their activities. Discussions frequently exposed frustration with regard to a lack of understanding when it came to the career pathway, for example the progression from Project Coordinator 1 to Project Coordinator 2. Although, this did not fall within the remit of the enquiry, it did appear to be of significance to staff members when speaking of motivation, and was an unintended outcome from the interview process.

A large proportion of interviews stated that pay and bonus schemes were the main drivers for their actions at work: “My performance determines my bonus and that’s all I worry about. If I need to do something to get that bonus I will, but that’s all that I am really worried about” (Interview DA76). It is interesting that the organisation’s knowledge needs do not form part of the appraisal process and therefore employees could lack motivation to participant in knowledge-based activities. This is amplified by the organisational typology findings, where in a Machine Bureaucracy employees are often reliant on explicit direction.

The evidence from the interviews also suggested that staff did not value training or learning opportunities as a driver for motivation, and training was viewed as something that was ‘done to them’. This was evidenced by the lack of documentation available to me to demonstrate staff professional development; the only evidence presented being mandatory online training modules, based on procedures or role based competence training, such as presentation skills. Linking with their negative view of the career pathway, learning did not appear to be a key driver in the workforce. There was no evidence of staff taking responsibility for training or development based on their own emergent needs. This can be linked to the lack of visibility of Training and Development in key areas, such as appraisal feedback and QIs.

Staff spoke of motivation being linked to success, such as being acknowledged via line manager email or achievement recognition awards. This said the overwhelming feedback was that success was forgotten, as demonstrated at the outset of this aspect of the enquiry. There was also the suggestion in many interviews that success was not celebrated enough:

> "On a personal level, with sponsors being extremely happy with one specific project management team, it's not really shared very much. I think there's a lot of people that receive a lot of really good feedback from clients and it's not really shared very much...Their focus is on developing the business and they would prefer to look at areas we need to improve. It always seems to be, this is what's going wrong [and] this is how we need to fix it. Even further up, that's always the focus. It's never, you've done this really well, well done. Even if you get a 'well done' and a pat on the back, they always come back and say, but you need to do this" (Interview DA93)

Or, in interview DA68, *when asked 'How have your successes been celebrated?'* the response was, "I actually don't know".

Key message

There were a lack of clear leadership images that drive Knowledge Resource development activity, which could be attributed to a fundamental issue of Strategic Goals that are absent in the Business Goals. The leadership profile of Project Managers would also seem to be an area for further exploration. There would also seem to be a clear line of sight between the negative knowledge culture discussed earlier and the feedback process from Senior Project Managers. This is not to say that nothing is done with success, but it does appear to be quickly forgotten from the perspective of Project Managers and Project Coordinators. Personal development is seen as a training issue, as opposed to a development issue. This means that for many staff there is a perception that training is something they have to do and is done to them, when learning could be seen as a key driver in the motivation of staff. This could also be linked to the lack of generative feedback received from lessons learned and QIs. It could also be associated with issues of career pathways, which was beyond the scope of this enquiry.

- Informs KR- 2; 6; 12; 13
- Strategic links – E2; E3; E4; P1; C1

6.4.13 K-Core 'Communication' construct

As discussed earlier, staff could not demonstrate a knowledge or understanding of the ability of lessons learned to communicate their intended message. Staff also could not demonstrate a formal feedback process, linked to the creation and review of documents produced for reuse. There were no templates or guidelines for what should be captured in documents or the construction of key content. This has the potential to affect the ability of the document to communicate a clear, rich and concise message. The enquiry responses demonstrated this to be an area for consideration:

> *Interviewer: "How effective are [lessons learned] documents at communicating their message?"*
>
> "It can vary in terms of who has produced them. The level of experience that has gone into producing them, that sort of thing. There is a lot of variability with them"
>
> *Interviewer: "Of the documents you have created in the last [this is a senior member of staff] years, how much feedback have you received?"*
>
> "Not a lot. In fact, none" (Interview DA06)

Key message

Building on the evidence presented in earlier sections, the ability of electronic documents to communicate essential knowledge has not been a consideration for Project services. It is recommended that templates for the assembly of knowledge rich artefacts be developed for use throughout the function. It is also suggested that a review process be implemented as part of a Quality Assurance approach to the development of knowledge resources.

- Informs KR- 15
- Strategic links – E4

6.4.14 K-Core ‘Spaces’ construct

6.4.14.1 Physical Spaces

Physical spaces, according to the workspace floor plan, appeared to stimulate knowledge business flows and social interaction. Project Services occupied the second floor of the company headquarters with windows on three sides. Executive and Senior Managers had offices situated in an ‘L’ shape along two of the window aspects. The teams were grouped in desks of four, which were separated with a low level partition – everyone was visible at all times. However, my initial assessment, stimulated by the floor plan document, proved to be deceptive:

> “People stay within their own team or group. It should be better, because we have all the departments on one floor, but I don' think that people feel that they can approach other departments” (Interview DA93)

> “I don't think the space is very good [for sharing knowledge and meeting people]...For example I moved desks and you get comfortable with who you ask questions. Now I don't know the person two desks over from me and we don't talk. I don't really know what they're doing and they don't know what I am doing” (Interview DA22)

These were common themes and demonstrated that knowledge embedded within individual teams was actually very stagnant, with the lack of movement of staff potentially contributing to the low visibility of knowledge resources.

6.4.14.2 Virtual Spaces

Staff could not demonstrate the existence or use of virtual spaces for interaction. This was severely restricted by current technology solutions existing in the organisation and needed to be evaluated as part of a holistic review of technology driven KM solutions.

- Informs KR- 4
- Strategic links – E4; E6; P9

6.4.15 Feedback on the K-Core process from PSUK(A) Global Head of Project Services

The case study method (see p. xx), set out two states for success, one being the ability of the K-Core toolkit to meet the needs of the organisation in the enquiry. The following communication demonstrates that this was achieved.

"David requested and reviewed key documents including the [PSUK(A)] Strategy Map, Goals and Objectives and Job descriptions. He then set out to interview a range of staff at all levels following completion of a survey questionnaire. David met with the teams and provided consistent and informative updates as the interviews progressed. He was aware of an impending global meeting that I had planned at the end of November to set the scene for the senior management team to start to understand the plans.

David provided the draft and then final report within the agreed timeframe and spent time explaining the layout and content to me prior to reading it. I found the document to be well laid out and detailed in such a way that it was easy to understand the problem statements and then the evidence to support the observation.

Much of what David provided ratified my own thoughts and concerns based on the informal interviews I had with the teams, however the detail and evidence and the linkage to the strategy map have given much more credence to the observations such that I have used much of the Key Recommendations (with some examples detailed below) already and have spent significant time with both the senior management team discussing and agreeing to changes prior to dissemination to each of the regional teams. This also formed the basis of a 2-year plan, which has been shared with [executive management].

My intention was to try and respond to the KR-1 with the meetings and discussions and all the feedback I have had points to this being a strong positive first step. In addition in relation to KR-3 we have piloted the suggestion in Asia as we found it to be the most receptive region to change and in addition they were in a good position to take on new teams who would be receptive to this type of training and position as they had no previous experience on which to change from.

In relation to KR-5, I have created a Principal Manager position to help with harnessing processes and making them fully global, this position will be in place during Q2 2010 and will also be responsible for dealing with some of the other recommendations in KR's 6 and 7.

I have been highly impressed by the detail and the output, which has reflected and reinforced my own views and observations." (communicated by email, January, 2010).

6.5 Case Study conclusion

In responding to the case study framework put forward by Atkins and Sampson (2000) (see p. 163), it is necessary to declare to what extent the case study was successful. When considered in terms of Lynham's (2002) requirements for operationalisation of a theoretical framework (see p. 125), this case study provides observable and confirmable components that can be seen to validate my proposition (see p. 163) that the K-Core model has functioned as a general OKM systems model as a diagnostic for the coordination of knowledge resources.

This is evidenced by the breadth and scale of observable and confirmable components, surfacing gaps in organisational processes and procedures that were impacting operational processes, in response to the two sub-questions used to bind the Case Study enquiry, as set out in Chapter 5 (see p. 167). However, there are limitations to this claim, and these will be explored in the discursive conclusion (Chapter 7).

Part 3: Findings, Discussion and Conclusion

Chapter 7: Discursive Conclusion

My research has developed an argument for a new systems model that identifies common constructs that organise within the scope of OKM systems. An unusual blend of methods was applied (see Chapter 5), using SSM (see p. 128), and identified four common functions and twelve constructs (see p. 192) across OKM disciplines (see p. 64). These functions and constructs were developed into a model (Figures 8a through 8c, p. 151-152) and a proposition developed for testing via a case study (see p. 163). A diagnostic tool for OKM systems was produced (see p. 157), and a single case study confirmed the proposition (see p. 217). Research claims will now be progressed, contributions to knowledge discussed and limitations addressed.

7.1 Progressing research questions and claims

The following progresses the research questions and claims (see p. 23) introduced in Chapter 1.

Research question:

1. Does demand exist for a new Organisational Knowledge Management system model for the coordination of knowledge resources and why? 2. Is it possible to create a general model for OKM systems designed without a specific organisation or sector in mind, which can then be deployed as a diagnostic tool to identify weaknesses in Organisational Knowledge Management systems?

Research sub-questions:

1. Is there a persistent demand for OKM systems for the coordination of knowledge resources? 2. Can a methodology be applied that responds to the challenges of exploring a general model in the field of OKM systems? 3. Are there common constructs within OKM systems designed for the coordination of knowledge resources? 4. Is it possible to derive from the organisation of these constructs an evidence-based definition for the purpose of OKM systems designed to coordinate knowledge resources in organisations? 5. Can common constructs that organise within the scope of OKM systems be modelled? 6. Can a proposition for a general model for OKM systems for the coordination of knowledge resources be developed? 7. How might a general OKM system model be developed for use in an organisation?

8. How might a general OKM system model be operationalised to identify gaps in organisation processes designed to coordinate knowledge resources?

Claim 1 (Research Sub-Question 1): The need to coordinate knowledge resources in an organisation is a persistent one.

This is brought about by the need to establish an evidence base for investment of time and money in Organisational Knowledge Management systems. This resulted in a systematic literature review (see p. 58), which was triangulated against the findings of a second analyst (Lambe, 2011), who published a similar, though limited, version of the enquiry.

This means that researchers who describe systems for the management of organisational knowledge resources as a new approach are incorrect. It would also be incorrect to point to the youthfulness of OKM as the potential causality for the dissatisfaction being experienced in theory and practice (see p. 20). Therefore organisations can expand their time horizon for lessons learned in the management of knowledge resources. There is particular value that could be gained in studying innovation or systems for the coordination of knowledge resources during times of intense demand for competitive advantage, such as World War II (see p. 58). System developments during these times of societal pressure for competitive advantage could provide insight into the development of more effective modern OKM systems.

The future of OKM systems as a management tool for the coordination of organisational resources may be under threat from the sustained period of dissatisfaction put forward in Chapter 2, which could result in OKM systems being superseded or rebranded inside organisations. I would argue that while any evolution of OKM is a natural cycle of events, given the chronology and evolution of systems or concepts in Table 3.2 (p. 58), it will still be necessary to build credible, evidence-based methods to develop existing systems, regardless of any future evolution of the field.

Claim 2 (Research Sub-Question 2): Soft Systems Methodology (SSM) and hypothetico-deductive reasoning can provide a framework for evidence-based research into OKM systems.

Issues of dissatisfaction noted in Chapter 3 (see p. 99), with regard to the breadth and depth in existing OKM research, were addressed using SSM and hypothetico-deductive reasoning in tandem. This allowed me to generate commensurability amongst research methods when exploring OKM systems (Chapter 4, see p. 125). This provided a rich field of data that allowed me to improve credibility, reliability and transferability. It is suggested that this methodology appear to be unique in relation to existing OKM literature. This assisted me to develop a way to look at existing research with fresh eyes.

Researchers need to recognise deficiencies in existing OKM literature (see p. 99). If the value of OKM systems is to be enhanced then organisations require rigorous evidence-based applied methods that respond to real world problems. I do argue that dissatisfaction would continue to be an issue if this is not achieved. SSM allows researchers to use action-based research in a framework that embraces mixed methods, which is important given the tacit and the explicit knowledge that exist in duality within organisational knowledge resources across the KEn Diagram (see p. 26). The methods used in this research (see Chapter 5) provide researchers with a credible and trustworthy platform from which to continue enquiry into the OKM field.

Claim 3 (Research Sub-Question 3): It is possible to identify general constructs and functions for OKM regardless of discipline or geographic locations.

The need for the identification of OKM constructs is introduced across Chapter 3 (for example see p. 54; p. 66-67; and p. 76-82). The research then uses the methodology proposed in Claim 2, giving voice to practitioner and academic opinions in an extensive meta-analysis (see p. 183) and descriptive survey (see p.

197), with the findings being mapped using fractal analysis to demonstrate self-similarity in the data (see p. 210).

Theorists and practitioners have been discussing self-similar or common constructs that organise within OKM systems for the management of organisational knowledge resources, across sectors. This allows organisations and researchers to focus on developing evidence-based operational OKM systems that align knowledge resources with an organisation's value drivers, such as market value (Figure 4, p. 56). It also allows researchers to have more confidence in exploring the transferability of design and findings across sectors. Finally, my research surfaced a problem within the majority of OKM literature explored in the meta analysis of literature and models, in that the external drivers that influence the need for OKM systems are often omitted or neglected; this is discussed further in this Chapter (see p. 283).

Claim 4 (Research Sub-Questions 3 and 4): An evidence-based definition of purpose for OKM systems is possible.

This need for an evidence based definition of purpose for OKM systems was identified in Chapter 3 and a response developed using a meta analysis of OKM literature (see p. 183), which was triangulated against a survey (see p. 197), to surface self-similarity or commonality across OKM systems designed to coordinate knowledge resources (see p. 210), leading to the development of the following evidence-based definition or purpose statement for these systems (see p. 193).

> KM works to coordinate the acquisition and storage, application, sharing and development of knowledge resources, both technical and managerial, against the strategic and operational needs of the organisation

The need was further evidenced by the fact that only one research survey respondent provided a definition that reflected the four functions of OKM systems identified in this thesis (see p. 192):

> "A poorly named field of practice that attempts to define the objects, people, processes, and technology required to create, capture, share, sustain, and forget the Intellectual Capital that creates value for individuals, teams, organisations and the world" (GS0821, see p. 223)

Research survey respondents frequently confused the concepts of information and knowledge (see p. 208), which reinforced the recommendation from the literature review that researchers and practitioners should take care to define what it is they are setting out to coordinate within OKM systems. In this way they can ensure that they are developing the most appropriate strategy for the coordination of knowledge resource against organisational needs, the needs of the individual (Table 3.4, p. 84) and the external environmental drivers (Figure 3, p. 50).

This means that organisations and theorists can begin to create a coherent frame of reference for discussions encompassing the management of organisational knowledge resources. At the moment OKM processes are relatively unbound, increasing the abstractness of the concept and opening the field to what has been described as mismanagement or fads (for example, see p. 77). These boundaries are open to challenge, but, given the current state of dissatisfaction (see p. 19-20), this boundary setting is necessary to allow for discussion around the common purpose of OKM systems for the coordination of knowledge resources. To support this, the evidence-based definition for the purpose of OKM systems (see p. 193) and the KEn Diagram (see p. 26) are offered as boundary setting mechanisms for these systems.

Claim 5 (Research Sub-Questions 6): The development of a proposition for a general model for OKM systems is reasonable.

The proposition for a general model was developed in response to theorists (Spender, 1996; Mekhilef and Flock, 2006; Heisig, 2009; and Lambe, 2011) who have been calling for a general model as a representation of Organisational Knowledge Management systems. The following is introduced in Chapter 4 (see p. 163):

The K-Core model is an OKM systems model that can be used in organisations, regardless of sector or geographic location, to identify gaps in

systems for the coordination of knowledge resources through the application of a PIAT as a structured diagnostic method

The proposition was developed based on the outcomes of fractal analysis (see p. 210), which was developed, using a Logic Modelling approach, into a falsifiable object, the K-Core model (see Figures 8a through 8c, p. 151-152), to represent OKM system domains focused on the coordination of knowledge resources (Figure 1, p. 26). This model was then used to inform a Participatory Integrated Assessment Tool (see p. 157), which was operationalised as a diagnostic tool to probe existing internal OKM systems.

This demonstrated that a response to the call for a general OKM systems model from theorists such as Spender (1996), Heisig (2009) and Lambe (2011) is possible, progressing the research position from one of discussion to one of action. I have presented an evidence-based proposition and tested it (Claims 6 and 7). My proposition now exists as a refutable statement that allows other researchers to progress and develop my research towards a more robust response to the call of Spender, Heisig and Lambe. I would argue that my research provides credible and trustworthy findings that strongly support the belief of these authors that a general model can be constructed.

Claim 6 (Research Sub-Questions 6): Common constructs that organise within OKM systems for the coordination of knowledge resources can be modelled.

As described in Claim 5, the outcomes of the meta analysis and fractal analysis were developed into an illustration of common functions and constructs that organise within the scope of Organisational Knowledge Management systems. This process produced a new model, the Knowledge Core (Figures 8a through 8c, p. 151-152).

Progressing Claim 5, the K-Core model exists as a refutable model of common constructs that organise within the scope of OKM systems for the coordination of knowledge resources. This allows organisations and researchers the opportunity to compare and contrast current system design against common constructs identified within OKM systems across multiple sectors and geographic locations. Specific areas of concern have subsequently been identified, including the lack of recognition for 'Space' as a construct (see p. 287) and the ranking of constructs in order of critical importance (see p. 298).

Claim 7 (Research Sub-Questions 7 and 8): The K-Core model, developed as a general OKM diagnostic model for the coordination of knowledge resources, can be applied.

The model and toolkit, as described in Claims 5 and 6, were operationalised and evidenced via a single in-depth case study (see p. 217). This confirmed the proposition developed in Claim 5, supporting requirements for the operationalisation of a theoretical framework (see p. 125) by providing observable and confirmable components that give credibility to the claim.

This extends Claims 5 and 6, bringing credibility and trustworthiness to earlier claims. Organisations now have access to an evidence-based diagnostic tool that can identify gaps in existing systems that could be impacting the value contribution of knowledge resources to the organisation. There are concerns as to the use of the diagnostic tool being limited by the tacit knowledge that resides within me as the researcher, a problem discussed later in this Chapter (see p. 302)

7.2 Further contributions to knowledge of OKM systems

7.2.1 OKM Environmental drivers

The identification of the impact of external environmental drivers upon OKM systems, see the section on the Knowledge Economy (Figure 3, p. 50), is rare within the wider body of OKM literature accessed in this research. Authors often speak of the organisation's external environment without contextualising it or its impact upon internal organisational systems. OKM systems exist as a response to an organisational need. Researchers are often content to leave the external environment as a black box, where its influence upon the organisation is not clear. OKM literature gives ample focus to the way in which OKM systems provide an operational response, but on many occasions it is unclear what the system is responding to in strategic terms. It is in this way that OKM systems become a point of departure, when they are actually a response to needs driven by the external environment, which impact the organisation's strategy and/or operations. In order to improve understanding in this area, it is recommended that researchers take greater care to contextualise the environment that drives the need for OKM systems.

7.2.1.1 The duality of OKM systems

The literature review used the KEn Diagram (see p. 26) to position OKM systems in a space of duality that encompasses the views of technical/procedural/explicit /object and managerial/organisational/tacit/process organisational knowledge resources. OKM literature has tended to oppose this, with a recommendation being the need to move from a mode of dualism to one of duality (see p. 36), or harmony, where organisations need to become comfortable with the tacit/the explicit co-existing to varying degrees in the same system as the environment moves between the complicated and complex domains.

The findings in Table 6.1 (p. 183) highlight the difficulties being faced by each of the six OKM disciplines, put forward by Mekhilef and Flock (2006) (see p. 64), in finding a balanced view of the field. This brings understanding to potential shortcomings, in terms of each discipline's alignment against the environment in which OKM systems operate. For example, in Business and Management there is a 69% bias towards a HR or managerial-centric view of OKM, which could inhibit the field through a failure to acknowledge the benefits technology can bring in optimising the coordination of these resources; for example storage, global access and the connection of a dispersed workforce. In Social Science, the literature polarised towards one extreme or the other, reinforcing the notion of dualism put forward in Chapter 2 (see p. 34-35). This directs researchers to be careful in presenting their approach in order to address the concerns of authors such as Edwards *et al.* (2003) (see p.22) who stated, "relatively few articles are based on rigorous research, and most KM practice is not well informed by theory" (p. 49).

Interrogating the data from the practitioner based survey, 82% of respondents favoured a blended approach to OKM; positioning them in what could be termed as the 'sweet spot', where in the KEn Diagram (see p. 26) organisations accept that knowledge resources will incorporate varying degrees of the tacit/the explicit. However, drilling down into the data, 78% of the respondents believed OKM processes to be more HR or managerial-centric with a weighting of 70:30 or greater over the Techno or technical-centric view. Therefore, even here there was note of caution with regard to how data are interpreted, especially when considering the subjective nature of opinion; there can be no way to know what constitutes 100% of a knowledge resource outside of the purely technical domain, and therefore any opinion as to the weighting of the tacit/the explicit is conjecture on the part of the respondent.

It is not possible to determine which dataset is more reliable, meta analysis (see p. 183) or survey (see p. 197), but evidence pointed towards a more HR or managerial-centric view of OKM systems in the survey, with its practitioner bias, in contrast to literature, with its scholarly bias, which gave the impression that OKM systems are more strongly driven by technology solutions in the technical or techno-centric view. This directed the need for further enquiry in order to find out the reason for this and to bring closer understanding between practitioners and researchers when discussing OKM systems in practice. The flow of knowledge exchange between practitioners and academics is further discussed later in this Chapter (see p. 288).

7.2.1.2 A lack of completeness in OKM literature

Table 6.1 (p. 183) demonstrates that common constructs exist across the six KM disciplines put forward by Mekhilef and Flock (2006) (see p. 64). However, only 3% of the OKM literature sample in the meta analysis of literature acknowledged all 16 of the constructs identified. Moving back to the need for variety to regulate variety (Ashby, 1956) (see p. 74), it can be argued that when 97% of the literature fails to recognise the full scope of the system it is written to describe or develop, then there has to be a consequence for the modelling process.

The lack of completeness is acute, brought into focus in the findings around the bias inherent at the technical/managerial extremes of the KEn Diagram (see p. 26) (also see p. 201-202). Techno-Centric (technical, procedural or explicit focused) literature produced only one article that addressed all 16 functions and constructs that were found to organise within OKM systems. The position does not improve when altering the setting to between 13-15 (90%) functions and constructs, where the Techno-Centric view produced a nil return. This means that in 23% of the OKM literature sample used in this research only one piece of literature (less that 1%) identified a range of between 13 and 16 functions and constructs identified in the meta-analysis; this was compared to the Socio-Techno-Centric view (blend of the tacit/the explicit), where 28% of the OKM literature represented the same range of constructs or functions in the meta analysis sample. This serves as a warning to researchers and practitioners who find themselves entrenched in an extreme view of the world, in that they run the risk of failing to engage with limiting functions or constructs that are needed to regulate OKM systems for the coordination of knowledge resources.

One of the core arguments of this thesis is that OKM systems are complex adaptive systems (see p. 68-75); where it is said that models designed to regulate these systems must meet variety with variety, having as many modulators within the regulating system as exists in the environment itself (Ashby, 1956) (see p. 74). The current lack of completeness, within existing OKM system models focused on the coordination of knowledge resources, did not indicate this to be the case (see p. 194), which directed me to argue the potential for system failure. This has been demonstrated to be an issue in practice (see the NASA LLIS case example, p. 29) and will require further research in order to determine the impact upon practice, which I have already begun (Griffiths and Moon, 2011). I also suggest that this lack of completeness is surfaced through the persistent dissatisfaction reported in the literature review (for examples see Chapter 1).

The lack of completeness in OKM literature is a reoccurring problem and one that does not seem to have been made explicit in OKM research outside of this thesis. It is also a persistent issue, given that Edwards *et al* (2003) (see p. 22) brought light to it almost a decade ago. This is a challenge for the field and I recommend that researchers help raise awareness of the problem through professional and academic journal publications.

7.2.1.3 The issue of 'Know-What' and 'Know-How' in literature

My literature review found that OKM literature suffers from issues of coherence between 'Know-what' and 'know-how'; for example, where the concerns of Edwards *et al.* (2003) (see p. 22) are again reinforced when exploring McElroy's (2000) claim that the function of 'knowledge generation' or 'development' in OKM systems is often taken for granted (see p. 190). His statement gains currency through the fact that only 55% of the OKM literature in the meta analysis sample addressed this function and constructs that organise around this function; for example, *Refection* or *Motivation* only surface in between 42% and 47% of the literature meta analysis sample – this was only 61 pieces of literature (see p. 192). This directs researchers to take more care in their acknowledgement of OKM system functions and constructs, where understanding is required in order for know-what to be translated in to know-how. Of significant importance for researchers is that this issue has been recognised for well over a decade, and, as much of the literature within the literature meta analysis sample is post-2000, demonstrated that, through until 2009, the impact of the issue upon theory and practice was not being sufficiently recognised.

7.2.1.4 Space

In analysing the common functions and constructs for OKM systems, it became evident that the *Spaces* construct receives little treatment in the literature (Table 6.1, p. 183), though I would argue that this is an important catalyst for the engagement and socialisation of people; evidenced through the work of Nonaka (2000), where he evolved his original thinking on SECI to involve *Ba,* or space, for knowledge activities to be activated (see p. 92), and in the W.L.Gore case example of KM system thinking in organisations (see p. 32). With representation in only 17% of the meta-analysis OKM literature, I suggest that exploration as to the reason for the discrete nature of this construct is required in order to understand and raise awareness of its potential as a limiting construct in a regulating model for the coordination of knowledge resources.

7.2.1.5 The flow between the registers of theory and practice

The discussion on the knowledge exchange between academics and practitioners emerged in Chapter 3 (see p. 99). This was reinforced throughout the findings; for example, peer-reviewed OKM models for the coordination of knowledge resources were found on average to be 67% complete in relation to the 16 functions and constructs identified in the research, while other models, such as conceptual consulting models, were only 60% complete. Regardless of view, and progressing the discussion around a lack of completeness from earlier in this Chapter (see p. 285-287), models that are between 33% and 40% incomplete cannot be representing OKM systems as a whole and reinforce the variety missing from OKM systems that are designed to regulate the environment for coordination of knowledge resources. This is important when dealing with complex environments, such as those involving OKM systems (see p. 68-75), and pulls the discussion back to the implications for a lack of completeness (see p. 203-204), which I would argue to be system failure and practitioner dissatisfaction. Also, academic models are more complete than those developed by practitioners, which identifies the need for a closer relationship between practitioners and researchers in order to progress OKM systems thinking.

Disturbances in the knowledge exchange between academics and practitioners appears in other areas of this thesis, such as variation in the perceived importance of particular OKM system constructs; for example, the frequency of *Motivation*, as an indicator of the intensity of recognition of its importance as a construct within the system, being mentioned in OKM literature increased by 49% in the survey (practitioner bias) over the meta-analysis (academic bias). Conversely, *Reflection* was seen as less important (-15%) in the survey over the meta-analysis. This indicates that greater consideration of the flow between the registers of theory and practice needs to be considered. This could lead to improving satisfaction by surfacing a greater understanding of the constructs that organise within OKM systems, especially when considering that 43% of survey respondents in the research findings stated they were dissatisfied with the models they were currently using (see p. 198).

7.3 Extending the discussion: Addressing the gap between the registers of theory and practice

The problem of transfer between theory and practice is discussed throughout this thesis, such as the need to include understanding of underpinning theory, where Spender (2008) highlighted the lack of attention to Adult Learning Theory in OKM literature (see p. 82). However, I have offered little in terms of a focused recommendation, which this section will now address.

Harloe and Perry (2004) suggested that academia, specifically Higher Education Institutions (HEIs), have a duty to transform knowledge production into economic competitive advantage; "…to fulfil this role, universities must produce exploitable knowledge and facilitate its diffusion" (p. 214). To enable this there is a need for universities to continue to engage with industry in order for knowledge to be disseminated, developed and exploited for the wider good of the society that they serve. In terms of OKM, this is championed by the OECD in their reports entitled, "KM: New Challenges for Educational Research" (2003) and "Education Today" (2009). In both reports the OECD advocated the need for a research strategy that can acquire, store, generate and share knowledge with the wider business community as a way to develop dynamic capability and adaptive capacity. To facilitate this the OECD recommended a triumvirate of researchers, practitioners and policy-makers to develop knowledge that can better contribute to the needs of society. This progresses the narrative towards the emergence and importance of Mode 2 research[12] as a consideration for research strategies developed by practitioners and academics engaged in OKM systems thinking.

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[12] Mode 2 research was conceived to close the space between theory and practice, bringing an applied, co-generative approach to knowledge generation, where knowledge could be created in tandem with practitioners, thereby allowing for wider exploitation (MacLean *et al.,* 2002)

Mode 2 research gained prominence through, "The new production of knowledge" (Gibbons *et al.* 1994). It surfaced through the perceived lack of knowledge being produced by HEIs that related to the problems being experienced by practitioners and society. Mode 2 research was conceived to close the space between theory and practice, bringing an applied, co-generative approach to knowledge generation, where knowledge could be created in tandem with practitioners, thereby allowing for wider exploitation (MacLean *et al.,* 2002). In contrast, Mode 1 only focuses on basic theoretical or knowledge. This addresses in part the challenges surrounding existing research (see p. 99). Mode 2 research is not without its critics. It is said that Mode 2 merely brings a new name to a process that was already in existence; the argument being that basic theoretical knowledge (Mode 1) could not exist without the knowledge of reality. It is also said that Mode 2 is one concept in a field of alternatives, such as, "Finalistic Science, Strategic Research, Positivistic Science, Innovation Systems, Academic Capitalism and Triple Helix" (Hessels and Lente, 2008, p. 741). However, according to Hessels and Lente (2008) it is the most visible concept and, as such, is adopted in this discussion.

This discussion points towards a pivotal role for HEIs in bridging the registers of theory and practice, where academic research into OKM systems can inform the development of organisations and their competitive advantage and vice versa.

7.3.1 A framework for assessing OKM models

In developing the research design for the evaluation of OKM models it became evident that an agreed framework for what constitutes a good model did not exist for OKM systems. In order to address this gap I adopted the work of Bacharach (1989) and Rasli (2004) (see p. 95). There is an opportunity here for further enquiry, with guidance being needed for researchers as to what constitutes a good model for OKM systems focused on the coordination of knowledge resources.

7.3.2 Overarching dissatisfaction in the OKM field

The causal links between the need for OKM systems and dissatisfaction in its performance have been explored and inferences drawn, but there is a need for further research if the root cause for the dissatisfaction is to be fully understood and addressed. I have already begun this work through an executive management survey (Griffiths and Moon, 2011) with 354 respondents from 52 countries. Preliminary results that demonstrated links between a lack of variety in systems and dissatisfaction were introduced in Chapter 2 (see p. 36).

7.4 Research limitations

7.4.1 Issue of K-Core model illustration

There is a problem with the illustrative K-Core model (Figures 8a through 8c, p. 151-152). While the model accounts for the triumvirate of individual, organisation and process (Knowles *et al.,* 2005) (see p. 84), the representations of the individual and organisation are not explicit in the model illustration. The model therefore fails the test of 'scope', put forward by Spender (1996); more importantly, it fails the SSM CATWOE test as put forward in the Chapter 4 (see p. 126) by Platt and Warwick (1995), and, as such, my model needs to be amended to reflect these conditions in order for the model to meet these criteria. However, taking into account Platt and Warwick (1995), CATWOE must be met in SSM Stage 7 and this stage, as demonstrated in Table 4.3 (p. 128), and the final step of my hypothetico-deductive research, is an ongoing process to be explored further through my postdoctoral research.

7.4.2 Challenging research beliefs

Step seven of Checkland's (2000) SSM process requires 'taking action' after 'comparing feasible and desirable changes'; a process in hypothetico-deductive research where "competing alternatives have been tested and rejected" (Table 4.3, p. 128), which includes opposing philosophical and methodological alternatives. This is a partially unmet challenge by my research, brought about by limited time.

Therefore it is not possible to determine whether Checkland's (2000) CATWOE conditions (see p. 126) have been met at the time of writing.

Taking the pragmatist viewpoint, my research is one way of looking at the world; there might be other methods, which could be more or less valuable than those applied in this research. It is for the researcher and wider society to decide, a view supported by Hawking *et al.* (2010). I subscribe to the notion that there are alternative lenses from which to view an enquiry into OKM systems.

Ultimately, as suggested by Zhu (2010), the hardness of fact in science is contingent upon the hardness of previously negotiated agreements between the subject for enquiry, its situated community network and the practical consequences of events (see p. 102). My research has situated OKM systems within the field of practice, but grounded it in theory, using Checkland's (2000) SSM and hypothetico-deductive approach. This method allows me to overcome issues of research belief and alternate paradigms for enquiry: "Recycle the procedure until a hypothesis is generated, tested, and supported on one or more occasions and its competing alternatives have been tested and rejected" (Table 4.3, p. 128). While this thesis does not allow for the completion of this stage, I would use post-doctoral research to enrich the credibility, trustworthiness and transferability of the existing findings through an exploration of my research through alternative paradigms and case examples. I have already begun work in this area, for example, Griffiths (2011) demonstrating ongoing work towards Checkland's (2000) seventh stage, 'take action'.

7.4.3 The need for ongoing research to address Checkland's seventh stage and the final step of hypothetico-deductive reasoning

The need for ongoing research is an issue, where research is in a continuous state of becoming without a definitive conclusion. This, along with challenges of time, cost and access, will always leave research susceptible to critique (Goldacre, 2009). Taleb (2007) cautioned that even the most robust research strategy could not account for the opportunity for outliers.

In response to the above, I have presented a falsifiable proposition (see p. 212) and model (Figures 8a through 8c, p. 151-152), and I will continue to test my findings while providing other researchers with the evidence to allow them to develop their own approach to the problems presented in this thesis. This approach will allow for the refinement of the K-Core model as a diagnostic tool for the coordination of knowledge resources under a variety of organisational conditions such as size, culture, geographic location, structure and sector. I see this as a strength in building the credibility, transferability and trustworthiness of the research and is accepted in SSM research through Checkland's (2000) seventh stage and the final stage of hypothetico-deductive research (Table 4.3, p. 128).

7.4.4 The challenge of quantitative data confidence

A potential limitation of the data analysis of the literature meta-analysis (see p. 183) and survey (see p. 197) is the confidence level and confidence interval that underpins the data; this could be important as it conveys the level of certainty being provided by the research data – the most popular confidence level being expressed as 95% (Loftus and Masson, 1994). Though it is acknowledged that in mission critical research (for example, medicine) higher levels of certainty are required.

Using Creative Research Systems Survey Software (www.surveysystem.com/sscalc.htm), it was possible to determine the confidence level and interval of the data that informs my research. In the case of the meta-analysis the deviation is +/- 6%; and with the survey the deviation is +/- 10% with 95% confidence. For example, the data in Table 6.2 (p. 184) would mean that the survey findings for '*Acquiring and Storing'* knowledge, at 95% confidence, demonstrate agreement within a range of 57-77% of the population; '*Sharing*' knowledge between 85-97%; '*Developing*' 52-72%; and '*Using*' 56-76%.

It would be possible to narrow the range by increasing the survey population, but this was not possible due to the time, research network and resources available to me. For example, to achieve a +/- 5% confidence interval, the survey would need a minimum population of 384.

It might be argued that this variation could impact the fractal analysis and subsequent argument for self-similarity. I disagree; the research has pragmatic validity, where the research provides the basis for a reflective understanding of a complex environment, an environment that by nature cannot be reduced to component parts or cause and effect relationships (Huxham and Hibbert, 2008); this type of validity being achieved by questioning the underlying value of the enquiry against the domain of the enquiry and being willing to look at cause and effect in a manner beyond that of traditional linear (inter)relationships between variables (Worren *et al.,* 2002).

I would also argue that the research has social validity through its acceptance by the wider community (Huxham and Hibbert, 2008); demonstrated, for example, via the publication output and award detailed in Appendix 12. As such, the research develops pragmatic validity, where conceptualisations of reality allow the researcher or practitioner to observe the theory in the same way that they would see their world; reflecting upon the theory for application in their own domain (Huxam and Hibbert, 2008).

I have also presented this research through publications and conferences (Appendix 12) in response to the need for transparency and falsifiability and in this way it opens the findings to be refuted. If a challenge is put forward, a response can be considered according to the Stage seven of Checkland's SSM. I would also argue it to be the natural way of science (Hawking et al., 2010), where theories are found to be valid until proven otherwise.

7.4.5 Findings: Issues of language and cultural relativity

During this research it became evident, through, for example, Paulin and Suneson (2012) (see p. 76), that there is a problem with the language that informs the OKM field. Theorists, such as Holsapple and Joshi (2004) (see p. 91), have attempted to address this by creating a unified language, but their methods have been questioned and, given the scope, maturity and scale of the field, it would seem fair to say that it is too late for any one individual or group to create a re-orientation toward a single agreed language framework.

I argue that the proliferation of terminology will continue to be a hindrance to the development of OKM systems; my research demonstrates self-similarity, but the domain is still vulnerable to the continued risk of misunderstanding – a problem that is an enduring one (for example, see Spicer, 1998).

I have attempted to mitigate the risk posed by this problem by publishing the coding protocols utilised in the study and by exposing the approach to expert audit triangulation (Patton, 2002) through academic journal publications and commercial reports (Appendix 12). The research has also been presented at academic and practitioner conferences in Bahrain, France, Singapore, China, Hungary, Russia, Italy and the UK. Beyond this, it would not seem possible to come to agreement on the language used in the development of the model itself.

In exposing the work to an international audience, as part of an audience review triangulation method (Patton, 2002), it became clear that people, with no bias according to their position in academia or practice, would recommend substituting the terminology used in the K-Core model: For example a participant in a roundtable event in Manama (Bahrain), suggested changing the function title for '*Using'* knowledge to 'Activating' knowledge. Through discussion it became evident that the participant was referring to the act of applying knowledge in an organisation, but he wanted to refer to it in terms of "activating' as he thought it better described what happened in his particular setting. It could be said that this was a better 'fit' within his mental schema. This serves to demonstrate the potential for the field to be continuously challenged though the variety of language used to describe functions and constructs within OKM systems. This said, the dispute was not in the meaning associated with the terminology, but in the label chosen to represent the particular construct within this person's mental model. Given the issues of language in the field, and the experience of researchers such as Holsapple and Joshi (2004), and the lack of adoption of their common OKM language, it would not seem possible to have consensus in this area. This is a weakness in developing a general OKM system model, which could impact its acceptance and implementation.

This problem could also be attributed to the dualisms that influence the field (see p. 36). These dualisms impact the foundations of OKM systems for the coordination of knowledge resources, and hinder the development of an agreed language. One of the outcomes discussed in this Chapter (see p. 284-285) is that these systems will require a blended approach between people (social based knowledge resources) and technology (object based knowledge resources). I argue that dualisms surface according to the context or mental model from which the researcher is viewing the system. What is required, regardless of world-view, is an acknowledgement of the external drivers for OKM systems (see p. 283) and the realisation that it is only through a blended approach, encompassing knowledge resources with varying degrees of the tacit/the explicit, that these systems can be fully operationalised. Duality is presented in this thesis as being an important view to take when exploring OKM systems. For example, it is evident in the mixed-method approach that underpins the research strategy, which is clearly dictated by the object and process based drivers for OKM systems, as described throughout the literature review, and evidenced in the case examples of practice at the outset of this thesis (see p. 29-36).

7.4.6 Limitations of stability of K-Core constructs across time

My research initially set out to establish the stability of OKM system functions and constructs through time. This was not achieved and, due to the paucity of relevant literature available for the time period prior to the early 1990s it is unlikely that any research could determine this with any certainty.

7.4.7 Issues of literature selection using the Mekhilef and Flock framework

I used a framework developed by Mekhilef and Flock (2006) in developing categories for OKM disciplines, the rationale for which was explained in Chapter 3 (see p. 64). However, as was pointed out in the methods Chapter (see p. 134), I did not have a clear definition of the meaning applied to the categories by the authors. Therefore, I acknowledge that if the meaning I developed diverges from Mekhilef and Flock's (2006) research then my intention to complement and extend their work would be negated. This said, without clarification from the original researchers, it is not possible to overcome this issue and until such a different view is offered it is plausible to assume that the approach I have taken has relevance to the original research framework.

I also stated in my Methods (Chapter 5, see p. 134) that I used personal judgement in assigning some literature to a category, where the core discipline of the literature was not clear, as it was a blend of Mekhilef and Flock's (2006) disciplines framework. This was necessary in order to avoid research inertia, where the researcher becomes consumed with interrogating detail that has little impact on the outcomes. This was overcome through the breadth and depth of the literature sample and the fact that this challenge only impacted 6% of the sample pool. In reviewing the process, it could be suggested that I should have made clear the impact of my judgement according to the individual categories, as this would have brought clarity to the actual number of articles per discipline that were affected by this potential researcher bias. I present this as a lesson to be taken forward in future meta-analysis research where the researcher is faced with a decision-making challenge such as this.

7.4.8 Confirmability of the meta-analysis

The literature review suggested there to be an issue in some OKM research, in the way that literature is selected for inclusion in research studies (see p. 99); for example, the biased selection of literature, as demonstrated in Conlley and Zheng (2009) (see p. 100). In order to minimise the potential for dissonance and improve the credibility of the findings, I implemented a random selection process where possible, for both literature and model selection in the meta-analysis methods. In addition I employed analyst triangulation to verify the findings of the lead researcher, which, again, minimises the biased view of the single researcher. This moves beyond the breadth and depth recommended by Tranfield *et al.* (2003) and overcomes the issues surfaced in the literature review with regard to deficiencies in existing OKM research (see p. 99). The drawback to this approach is that is not possible to exactly replicate the literature review, which impacts the confirmability of the enquiry by future researchers; a position recognised by Zhu (2010), citing the 'Thesis of Double Hermeneutic' (see p. 165). As described throughout the Methods Chapter, I have attempted to balance the strengths and weaknesses of the various methods against the OKM systems domain and it would seem, regardless of the rigour applied, that there would always be the potential for scepticism in research. However, I do not consider that this detracts from the value of the research findings presented in my thesis.

It could also be considered that the meta-analysis missed outliers within the literature sample and therefore missed discrete constructs that, according to Meadows (1982), could be the limiting construct within the domain (see p. 156). This would not seem to be the case. However, if a discrete construct does emerge then I would argue that it provides for the evolution of this research, as per Checkland's (2000) SSM Stage 7 (Table 4.3 p. 128). I would also argue that if new functions and/or constructs were to be revealed, the existing 16 identified in this research would remain, and additions would only serve to progress and enhance my research and further reduce the granularity of OKM systems.

7.4.9 Geographic and sector limitations

There is a potential problem in the geographic data collected within the meta analysis and survey; in that the sector data, drawn from a minimum sample of 40 per sector across the six key OKM disciplines identified in Chapter 2 (see p. 64), appears to be a reliable sample, but, in some cases, the depth of findings by geographic location is challenged by a lack of literature gathered from the region.

This is a weakness in the research strategy, but there is enough credible data to demonstrate the potential for the findings to be transferable, with the caveat that further research is required to confirm this. I also argue that this is addressed through social or pragmatic validity: For example Griffiths and Koukpaki (2010) was purposely published in a journal (International Journal for Knowledge Systems Science) that, at the time, was dominated by an Asian readership; our rationale being that this approach would expose the research to cultural challenge, of which there has been none. This was further supported by two visits in 2010 and 2011 to KM Asia (Singapore) and ICKM (International Conference on KM), Hong Kong (2009), which did not produce any challenges to the research.

The limitation of proportionate geographic coverage also impacted the survey, where the findings are limited through coverage error, as described in the Chapter 4 (see p. 142). While this does not impact the overall findings, it could impact transferability of the findings. It could be said that the survey design could have been better constructed, given the signposts of past failure of 'general' OKM research, such as that of Holsapple and Joshi (2004) (see p. 91). A contributing factor to this issue was the limited network of academics and practitioners available to me at the time of the survey. While it was not possible to overcome this challenge, given the time of the survey within the cycle of the doctorate process, I have attempted to limit the impact through triangulation methods (see p. 129). One additional lesson learned, when considering the diffusion of the survey tool, was the limited engagement with social media tools to bring visibility of the survey to a wider audience. I have observed during other research projects (Griffiths and Moon, 2011) that social media tools, such as Twitter, can increase the potential for greater response rates and geographical representation. I also noted that the geographic spread of respondents could be impacted by the perceived maturity of the field in any given geographic location and the propensity of respondents to engage with English as the language of choice within their environment. I therefore recommend that researchers using survey tools to further knowledge and understanding of OKM systems translate the survey tools into the language of the target country to improve the potential for an high response rate.

7.4.10 The perceived importance of constructs

My research did not determine the importance or the value of the identified OKM system functions and constructs. This is due to the nature of complex environments and the way in which constructs organise in a non-linear manner according to environmental disturbances (see p. 68-75). The findings only reflect the frequency of reference to the particular aspect of the OKM system within literature. The complexity of the OKM system domain makes it inappropriate to attempt to discuss a general importance or ranking of OKM functions and constructs as they organise according to environmental disturbances (see p.156-157). Also, it could be suggested that weaker signals in OKM literature, such as 'Space' (see p. 287) could occur from a lack of understanding, on the part of any given author, as to the negative effects attributable to their absence from the OKM system. However, there is a differentiation in the perceived importance of constructs within any given context, which is evidenced within the 'Range' findings (Table 6.2, p.184). This again demonstrates that the value of functions and constructs vary according the situated needs of the discipline/sector, but their existence, as demonstrated in the fractal analysis (p. 209), is the important fact. I also suggested, given the complex environment that OKM systems respond to as the knowledge resource environment moves between complicated and complex domains, that any future research attempting to generate a ranking for my functions and constructs, in terms of general importance, would be a mistake and misleading.

7.4.11 Survey limitations

The survey attempted to improve credibility through a secondary analysis of the selection process, where a RA contacted respondents to further enquire into their knowledge and understanding of the field and their credibility as contributors to the survey findings. However, this was only a sample of 15% of respondents, which could be too limited to generalise to the whole sample. This is a limitation of the doctorate process, where constraints of time, finance and access to support resources can impact the extent to which a researcher can interrogate the findings.

It could be argued that 98 usable survey responses is a limiting response rate, in both scope and scale, when discussing the potential for findings to impact the development of general OKM systems across sectors and geographic location (geographic limitations being discussed earlier in this Chapter, see p. 298). I have attempted to be rigorous in the approach to method used in order to increase the credibility and dependability of the findings. The impact of the research could be brought into question, but, when considering the triangulation methods I employed, I would argue that the findings are credible and trustworthy.

Survey respondents may have had difficulty aligning with a particular OKM discipline; this was compounded by the lack of definition provided by the authors in the original framework (Mekhilef and Flock, 2006) (as previously discussed in this Chapter, see p. 296). While attempts were made to contact the authors, the final judgement on definition (Appendix 1) was left to me. It could therefore be said that my interpretation of their 'six key OKM' disciplines may not be the same and could be an issue. I would dispute this, where the fractal analysis demonstrates self-affinity, regardless of the definition applied. As stated in Chapter 5, I categorised the OKM literature, according to my interpretation, but the survey allowed participants to self-select their category and there was self-similarity in the findings, which demonstrates that the categorisation was consistent. Also, as long as the definitions are consistently applied then the internal comparison across data sets seems valid.

A lesson learned through this research was the need for a balanced representation between data sets. For example, outliers were identified in the fractal analysis of the meta-analysis and survey data sets (see p. 210). These were explained through the bias in the meta-analysis towards academic literature and the bias within the survey towards practitioner respondents. However, more valuable findings could have been provided through a sampling strategy that accounted for equal representation between the registers of theory and practice and is a consideration for future research.

The value of the survey findings could have been enhanced if the responses had been linked to the knowledge intensity of the organisation and the subsequent intensity of their need to coordinate knowledge resources. However, I decided that the potential variables to be considered in the response to be onerous and beyond this current research; such as the interpretation of the phenomenon by the respondent; the situated perspective of the respondent within the organisation, according to their job role; and their interpretation of knowledge intensity according to their role, team, department or organisation as a whole. A logical next step in enhancing the value of the research is to explore the interconnectivity of the findings in relation to the knowledge intensity of organisations.

7.4.12 Limitations of K-Core application

One challenge for the development of the K-Core (Figures 8a through 8c, p. 151-152) is the need for a case study that removes me from the application of the diagnostic toolkit methodology in the field. The design of the PIAT (see p. 158) relies on the knowledge and understanding of a skilled mediator to sift, analyse and interpret the data. In this research it has been achieved through a case study with models and tools applied only by me, the designer. The question is whether the operationalisation of the K-Core relies on my tacit knowledge, or whether an independent researcher could replicate the process. If transference of the method proved to be reliant on my knowledge and understanding of the process then this would inhibit the portability of the K-Core as a diagnostic tool for organisations. If this were to be the case, it would suggest the need to consider the development of a self-assessment tool to replace the PIAT; in this way the model becomes scalable and amplifies its potential to penetrate the field as a general diagnostic tool. This is an enquiry that is underway and will continue to be progressed through my post-doctoral research.

7.4.13 The missing aspect of finance in the Case Study

The K-Core model identifies finance as an element within the '*Catalyst*' construct (Figures 8a through 8c, p. 151-152), but it was not possible to enquire into this area within PSUK(A). This was not permitted, due to limitations placed on the enquiry by the organisation, although I do not believe this impacted the outcome of the case study. This is not uncommon and appears acceptable:

> "One possible source of distortion in qualitative findings concerns how design decisions affect results…Limitations in the situations (critical events or cases) that are sampled for observation because it is rarely possible to observe all situations even within a single case setting" (Patton, 2002, p. 563)

This gap will become a focus for my post-doctoral publication in order to provide a more comprehensive view of the model and OKM constructs.

7.5 Conclusion

The persistent impression in OKM literature throughout Chapter 2 was one of dissatisfaction from both practitioner and academic sources. It is argued that this has resulted in a decline in the popularity of OKM as a strategic management tool (Rigby (2010) (see p. 19). However, the broader OKM literature has shown that the concept is well placed to respond to an organisation's needs, as driven by the Knowledge Economy (see p. 50).

The research responded to authors such as Spender (1996), Heisig (2009) and Lambe (2011), and their calls to produce a general model for OKM systems, focused on the coordination of knowledge resources. The fractal analysis (see p. 210) demonstrated self-affinity between the six OKM disciplines identified by Mekhilef and Flock (2006) (see p. 64) and provides strong evidence for the discussion of these systems in similar terms across sectors or geographic locations. It has also responded to the fact that a meta-analysis of OKM models (see p. 194) against the 4 functions and 12 constructs identified in the original literature meta-analysis (see p. 183) of OKM literature produced a nil return. It has furthered the research of Mekhilef and Flock (2006) and Heisig (2009) to demonstrate that while an existing OKM system model may not have bridged the six-disciplines of OKM or respond across sector boundaries, it is not to say that it is not possible, as demonstrated through the development of the proposition for a general OKM system model (see p. 163) and the subsequent testing of the K-Core (Figures 8a through 8c, p. 151-152) as a diagnostic tool for these systems (see p. 217).

OKM literature as a whole presents an argument that a generally agreed definition of purpose for OKM systems is not available or perhaps even possible. I would argue the former. The lack of completeness in the vast majority of OKM literature within the meta analysis sample demonstrates that researchers have not engaged with the depth of research, via a meta analysis or synthesis, that could provide a response to the presenting issue; it also appears that researchers have not attempted to produce an evidence-based statement of purpose for OKM systems, such as that undertaken in this research. At the same time there was strong evidence of commonality within the literature review, such as discussion around the core functions of OKM systems, the idea of knowledge resources existing as products and processes and wider agreement on the existence of tacit and explicit knowledge resources across sectors and geographic locations.

The findings have combined to signpost new knowledge to researchers and practitioners interested in OKM systems designed to coordinate knowledge resources. This contribution to the field is subject to limitations, which are acknowledged and addressed, but it is argued that the findings can significantly impact practice and reduce existing dissatisfaction in theory and practice.

My findings demonstrated that people, enabled by technology, sit at the heart of organisational systems designed to coordinate knowledge resources. This led to a discussion on theoretical strategies that exist for the management of knowledge, being the RBV and KBV of the firm (see p. 52). The discussion surfaced the challenges of applying an approach that treats the concept of knowledge as a tangible, explicit-based, resource, which moves away from social, intangible, processes related to knowledge resources residing within the person; linking this to the market value of the organisation and the contribution of intangible assets to that value. The research looked into the controversies surrounding the term Knowledge Management (see p. 61), finding it to be contentious, but concluding that the process is centred on the coordination of the internal organisational environment and not on the management of knowledge itself, which is accepted as residing as a discrete resource within the mind of the individual. Importantly the literature exposed the persistent need for knowledge resources within organisations, tracing the need and demand for the resource to the first industrial revolution (see Table 3.2, p. 58). Knowledge resources are suggested to exist along a continuum that moves between complicated and complex domains (Figure 1, p. 26) encompassing varying degrees of the tacit/the explicit. OKM systems were found to be devoid of an accepted definition of purpose (see p. 278), which, in itself, appears to be inhibiting satisfaction as the lack of accepted boundary creates a fuzziness that is a barrier to understanding of the system's purpose in an organisation. The lack hitherto of accepted boundary exposes the field to a wide range of language when expressing the constructs that fall under the gaze of those looking to manage knowledge resources; for example, the use of the term variables or Critical Success Factors to describe elements that fall within the scope of OKM systems. Exploring this problem led to the use of 'constructs' as the recommended term for elements within OKM systems. This conclusion was based on OKM systems being soft, open, systems that are non-linear, or complex in nature; as opposed to linear, cause and effect driven processes associated with complicated systems (see p. 68-75).

The research moved to address the findings of the literature review through the use of SSM (see p. 125), incorporating a blend of methods, including a meta analysis, survey, fractal analysis and logic modelling. The findings produced the following claims:

1. The need to coordinate knowledge resources in an organisation is a persistent one.
2. Soft Systems Methodology (SSM) and hypothetico-deductive reasoning can provide a framework for evidence-based research into OKM systems.
3. It is possible to identify general constructs and functions for OKM regardless of discipline or geographic locations.
4. An evidence-based definition of purpose for OKM systems is possible.
5. The development of a proposition for a general model for OKM systems is reasonable.
6. Common constructs that organise within OKM systems for the coordination of knowledge resources can be modelled.
7. The K-Core model, developed as a general OKM diagnostic model for the coordination of knowledge resources, can be applied (see p. 277-283).

The main implications for theory and practice are that the claims enable organisations to bring purpose and common understanding to the development of

OKM systems for the coordination of knowledge resources. Organisations can now access a diagnostic tool for these systems that responds to the constructs that organise within OKM as a complex adaptive system.

7.5.1 Concluding comments

Coming to academia after twenty years as a practitioner required me to challenge many of my fundamental beliefs, in terms of both theory and practice. I feel as though I have been on a journey of personal enlightenment that has brought with it a depth of understanding that I do not believe could have been achieved outside of the doctoral process.

I still assert that there is no one single way to look at phenomena in the field of Social Science, though I do believe, now more than ever, that an exclusive positivist view has the potential to do damage to the OKM field and should be considered with care. However, the doctoral process has allowed me to develop a tolerance for views and methods that would not have always sat comfortable with my worldview. I have had to learn to reconcile my views against the dualisms that are inherent within the OKM field. I may not like it, it may require me to be more restrained in my beliefs, but it has also made me more passionate than ever about change and developing the evidence that improves OKM systems development. I do not see this journey so much as an ending, but as a beginning.

“Every new beginning comes from some other beginning’s end” *Seneca*

References

Abbott, A. (2001) The chaos of disciplines, Chicago: University of Chicago Press

Ackoff, R. L. (1989) From data to wisdom, *Journal of Applied Systems Analysis,* 16, 3-9

Alavi, M., Cook, J., Cook, L. and Leidner, D.E. (2001) Knowledge Management and Knowledge Management Systems: Conceptual foundations and research issues, *MIS Quarterly,* 25(1), 107-136

Alavi, M. and Leidner, D.E. (1999) Knowledge Management systems: Issues, challenges and benefits, *Communications of the Association for Information Systems,* 1(7), 4-20

Albaum, G. (1997) The Likert Scale revisited: An alternate version, *Journal of the Market Research Society,* 39(2), 331-348

Allen, E. and Seaman, C.A. (2007) Likert scales and data analysis, *Quality Progress,* 40(7), 64-65

Allix, N.M. (2003) Epistemology and KM concepts and practice, *Journal of Knowledge Management Practice,* April [online]

Alstete, J.W. and Halpern, D. (2008) Aligning KM drivers with business strategy implications, *Journal of Knowledge Management Practice,* 9(3), September [online]

Alvarez, M., van Beselaer, C. and Sherman, R. (2003) Subject acquisition for web-based surveys, *Political Analysis,* 11(1), 23-43

Amidon, D. and Davies, B.E. (2004) Get in the zone, *Knowledge Management Magazine*, October 2004, 8(2). Retrieved: 1 October 2007 http://www.ikmagazine.com/xq/asp/sid.0/articleid.89A2E03A-AC37-47FD-A604-43834E43A7B9/eTitle.Entovation_get_in_the_zone/qx/display.htm

Amit, R. H., and Schoemaker, P. J.H. (1993) Strategic Assets and Organisational Rent, *Strategic Management Journal*, 14, 33- 46

Angus, J. (2003) KM's father Figure: Robert Buckman, *Infoworld Magazine,* [online] Retrieved: 18th December 2008 www.infoworld.com

Antonacopoulou, E.P. (2006). Modes of Knowing in Practice: The Relationship between Learning and Knowledge Revisited. In RENZl, B., and MATZLER, K. and HINTERHUBER, H. (Eds.)*, The Future of Knowledge Management, London*: Palgrave, 7-28

Arbnor, I. and Bjerke, B. (2009) *Methodology for creating business knowledge,* 3rd Edition, London: Sage Publications

Argyris, C. (1982) *Reasoning, learning and action: Individual and organisational,* San Francisco: Jossey-Bass

Argyris, C and Schon, D.A. (1978) Organisational learning: A theory of action perspective, Reading, MA: Addison-Wesley

Armstrong, M. (2006) *A handbook Of Human Resource Management Practice*, 10th edition, Cambridge University Press, Great Britain

Asgeirsdottir, B. (2005) OECD work on knowledge and the Knowledge economy, *OECD/NSF conference on 'Advancing knowledge and the Knowledge economy' January 2005*

Ash, J. (2001) Why is knowledge not working, *Scientific Computing*, May 2001. Retrieved: 17 August 2007 www.knowledgepoint.com.au/knowledge_management/articles/km_JA003.html

Ashby, W.R. (1956) *An introduction to cybernetics,* London: Chapman and Hall

ASLIB (1952) Harnessing knowledge, *Nature,* 170(July), 698-99

Atkins, C. and Sampson, J. (2000), Critical appraisal guidelines for single case study research, *Proceedings of 10th European conference of Information Systems, EICS*

Azmi, M. and Zairi, M. (2005) KM: A proposed taxonomy, *Bradford University working paper series,* 05/31, June

Babbie, E. (2009) *The Practice of Social Research*, 12th Edition, Belmont, CA: Wadsworth.

Bacharach, S. B. (1989) Organisational theories: Some criteria for evaluation, *Academy of Management Review,* 14(4), 496-515

Bandura, A. (1989) Human agency in social cognitive theory, *American psychologist,* 44(9), 1175-1184

Bandura, A. (2001) Social cognitive theory: An agentic perspective, *Annual review of psychology,* 52, 1-26

Barkham, P. (2008) What is the Knowledge economy, *The Guardian Newspaper,* July 17th. Retrieved: January 18th 2009 http://www.guardian.co.uk/business/2008/jul/17/economics.economicgrowth

Barnard, C. (1938) *The function of the executive*, Cambridge MA: Harvard University Press

Barton, J. (1999) *Pragmatism, systems thinking and system dynamics*, In:

proceedings of the 17th conference of the system dynamics society, Palermo Retrieved: 18th May 2012
www.systemdynamics.org/conferences/1999/PAPERS/PLEN2.PDF

Baxter, L. (2010) *How to research,* Maidenhead (fourth edition): Open University Press

Bearse, P. (1999) The fractal revolution, *The Ethical Spectacle*, September. Retrieved: 12th August 2009 www.spectacle.org

Beer, S. (1966) *Decision and control: The meaning of operational research and management cybernetics,* London, Wiley

Bell, D. (1973) *The coming of post-industrial society: A venture in social forecasting*, New York: The Basic Press

Bertalanffy, L. von. (1968) *General Systems Theory: Essays on its foundation and development,* New York, George Braziller

Bertalanffy, L. von. (1972) *The history and status of general systems theory*, IN: KLIR, G. (Ed), *Trends in General Systems Theory,* New York, Wiley, p. 21-41

Bhalla, A. and Lampel, J. (2007) Let's get natural: the discourse of community and the problem of transferring practices to KM, *Management Decision Journal*, 45(7), 1069-1082

Bhatt, G.D. (2000). Information dynamics, learning and knowledge creation in organisations. *The Learning Organisation Journal.* 7(2), 89-98

Bowen, G.A. (2009) Document analysis as a qualitative research method, *Qualitative Research Journal,* 9(2), [online]

Brown, T. A. (2006) *Confirmatory factor analysis for applied research*, New York: Guilford

Burns, R. B. and Burns, R. A. (2008) *Business research methods and statistics using SPSS,* London: Sage

Burns, A.C. and Bush, F. (2010) *Marketing Research,* London: Prentice-Hall

Bush, V. (1945) As we may think, *The Atlantic Magazine.* Retrieved: 7th October 2008 http://www.theatlantic.com/magazine/archive/1969/12/as-we-may-think/3881/

Call, D. (2005) KM – not rocket science, *Journal of KM,* 9(2), 19-30

Callon, M. (1986) Some elements in a sociology of translation: domestication of the scallops and fishermen of St. Brieuc Bay', IN LAW, J. (Ed), *Power, Action and Belief*, London: Routledge and Kegan, p. 196-233

Carter, L.F. (1968) Knowledge production and utilisation in contemporary organisations. IN: EIDELL, T.L. and KITCHEL, J.M. (Eds.), *Knowledge production and utilisation in educational administration 1969,* Columbus OH: University council for educational administration, p. 1-20

Carter, R., Martin, J., Mayblin, B. and Munday, M. (1986) *Systems, management and change,* London: The Open University

Chaim, Z. (2007) Conceptual approaches for defining DIK, *Journal of the American Society for Information, Society and Technology,* 58(4), 479-493

Checkland, P. (2000) Soft systems methodology: A thirty year retrospective. *Systems Research and Behavioural Science, 17,* S11–S58.

Chen, C. J., and Huang, J. W. (2007) How organisational climate and structure affect KM-- The social interaction perspective, *International Journal of Information Management*, 27(2), 104-118

Chiva, R. and Alegre, J. (2005) Organisational learning and organisational knowledge, *Management Learning,* 36(1), 49-68

Choi, B. and Jong, A.M. (2010) Assessing the impact of KM strategies announcements on the market value of firms, *Information and Management,* 47(1), 42-52

Chowdhury, M.S. (2006) Human behaviour in the context of training: An overview of the role of learning theories as applied to training and development, *Journal of Knowledge Management,* 7(2), [online]

Chowdhury, N. and Ahmed, M. (2005) Critical Success Factors affecting Knowledge Management Implementation in Oil and Gas companies: A Comparative study of four corporations. Retrieved: 18th November 2008. www.kmtalk.net/Paper_Oil_KM_Naguib.doc

Chun, M., Sohn, K., Arling, P. and Granados, N.F. (2008) Systems theory and Knowledge Management systems: The case of Pratt-Whitney Rocketdyne, *proceedings of the 41st Hawaii International Conference on Systems Sciences,* 1-10

Clark, C. (2009) Paths between positivism and interpretivism: An appraisal of Hay's *Via Media*, *Politics,* 29(1), 28-36

Clarke, T. (2001) The Knowledge economy, *Education and Training,* 43(4/5), 189-196

Clegg, S. (2003) Globalising the intelligent organisation. IN GARRICK, J. and RHODES, L (Eds.), *Research and Knowledge At Work*, Florence: Routledge

Cochran, W. G. (1977) *Sampling techniques* (3rd edition). New York: John Wiley and Sons.

Cohen, D. (2007) Enhancing social capital for knowledge effectiveness, IN: ICHIJO, K. and NONAKA, I (Eds.), *Knowledge creation and management,* Oxford, Oxford University Press

Cohen, K., Manion, L. and Morrison, K. (2007) *Research methods in education,* 6th edition, New York: Routledge

Conlley, C. and Zheng, W. (2009) Factors critical to KM success, *Advances in Developing HR,* 11(3), 334-348

Cook, S.D.N. and Brown, J.S. (1999) Bridging epistemologies: The generative dance between organisational knowledge and organisational knowing, *Organisational Science,* 10(4), 381-400

Creech, H. (2005) Success factors in KM, *International Institute for Sustainable Development.* Retrieved: 16th November 2008 http://www.iisd.org

CRLRA (Centre for Research and Learning in Regional Australia) (Australia National Training Authority and University of Tasmania) (2000) managing change through VET: The role of vocational education and training in regional Australia, Tasmania: Launceston

Crombie, K.I. and Davies, H.T.O. (2009) *What is…? Series,* 2nd edition, *Evidence Based Medicine*

Cross, B. (2004) The fractal imagination: New resources for conceptualising creativity, *The Complexity Society.* Retrieved: 1st August 2009 www.complexity-society.com/journal.html

Cross, R. (1998) Managing for knowledge: Managing for growth, *Knowledge Management,* 1(3), 9-13

Cruywagen, M., Swart, J. and Gevers, W. (2008). One size does not fit all – towards a typology of knowledge centric organisations. *Electronic Journal of Knowledge Management,* 6(2)*,* 101–110

Dawn, J., Bodorik, P. and Dhaliwal, J. (2002). Supporting the e-business readiness of small and medium sized enterprises: approaches and metrics. *Internet research: Electronic Networking Applications and Policy,* 12(2), 139-164

Davenport, T.H. and Probst, G.J.B. (2002) *Knowledge Management Case Book,* Germany, John Wiley and Sons

Dayan, R., Pasha, E. and Dvir, R. (2006) The knowledge management journey of Israel aircraft industry. IN: KAZI, A.S. and WOLF, P. (Eds.), *Real-life knowledge* *management: Lessons from the field,* Knowledgeboard, Electronic book

Dediu, H. (2011) *Steve Jobs's ultimate lesson for companies,* Harvard Business Review Blog. Retrieved: September 11th 2011 http://blogs.hbr.org/cs/2011/08/steve_jobss_ultimate_lesson_fo.html

DeLong, D.W. (2004) *Lost Knowledge: Confronting the threat of an aging workforce,* United States: Oxford University Press

Deutscher, I. (1970) Words and deeds: Social science and social policy, IN: FILSTEAD, W (ed.), *Qualitative Methodology,* Indianapolis, IN: Bobbs-Merrill, 25-42

Dew, K. (2006) Document analysis in CAM research: Part 2, *Complementary Therapies in Medicine,* 14, 77-80

Diakoulakis, I.E., Georpopoulos, N.B., Koulouriotis, D.E. and Emeris, D.M. (2004) Towards a holistic KM model, *Journal of KM*, 8(1), 32-46

Dicken, P. (2011) *Global Shift: Mapping the changing contours of the world economy*, 6th edition, London: SAGE

Dimitrov, V. and Fell, L. (2007) Autopoiesis in organisations. Retrieved: 8th September 2008 http://www.zulenet.com/VladimirDimitrov/pages/autoorg.html

Donkin, R. (2002) Measuring the worth of Human Capital, *Financial Times*, Published November 07, 2002. Retrieved: 19 Oct 2007 http://search.ft.com/ftArticle?queryText=measuring%20the%20worth%20of%20human%20capitalandy=0andaje=trueandx=0andid=021107000965andct=0

Dooley, K. (1997) A complex adaptive systems model of organisational change, *Nonlinear dynamics psychology and life sciences,* 1(1) 69-97

Drucker, P.F. (1959) Landmarks of tomorrow, New York: Harper

Drucker, P.F. (1988) The Coming of the New Organisation, *Harvard Business Review*, Jan-Feb, 45-53

Drucker, P. F. (2007) *The practice of management,* Classic Drucker Collection Edition, Oxford: Butterworth-Heinemann

Dueck, G. (2001) Views of knowledge are human views, *IBM Systems Journal,* 40(4), 885-888

Duncan, W.J. (1972) The knowledge utilisation process in management and organisation, *The Academy of Management Journal,* 15(3) 273-287

Durant-Law, G. (2005) SSM and grounded theory combined: A KM research approach, *ActKM Online Journal of KM,* 2(1). Retrieved: 3rd February 2009 http://www.actkm.org/userfiles/File/actKMjnl/2005/Soft%20Systems%20Methodology%20and%20Grounded%20Theory%20Combined%20-%20A%20Knowledge%20Management%20Research%20Approach(1).pdf

Easterby-Smith, M., Thorpe, R. and Lowe, A. (2002) *Management Research: An Introduction*, 2nd Edition, London: Sage Publications

Edwards, J.R. (2010) Reconsidering theoretical research in organisational and management research. *Organisational Research Methods,* 13(4), 615-619

Edwards, J.S., Handzic, M., Carlsson, S. and Nissen, M. (2003) KM Research and Practice: Visions and Directions, *KM Research and Practice,* 1(1), 49-60

Edward, T. and Rees, C. (2006) *International Human resource Management: Globalization, National Systems and Multinational Companies.* London: Pearson Education Limited

Evans, G. (1970) The effects of supervisory behaviour on the path-goal relationship, *Organisational Behaviour and Human Performance,* 5 277-298

Fang, T. (2009) Asian management research needs more self-confidence: Reflection on Hofstede (2007) and beyond, *Asia Pacific Journal of Management.* 27(1), 155-170

Fastovsky, D. E. and Weishampel, D.B. (1996) *The Evolution and Extinction of the Dinosaurs*, Melbourne: Cambridge University Press

Feldman, S. (2009) *Worldwide search and discovery software 2009-2013 Forecast update and 2008 vendor shares*, Document 219883, International Data Corporation

Felin, T. and Hesterly, W.S. (2007) The knowledge-based view, nested heterogeneity, and new value creation: philosophical considerations on the locus of knowledge*, Academy of Management Review,* 32(1), 195-218

Fereday, J. and Muir-Cochrane, E. (2006) Demonstrating Rigour Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development, *International Journal of Qualitative Methods,* 5(1), 80-92

Feyerabebd, P. (1993) *Against Method,* London: Verso

Fisher, A.G.B. (1933) Capital and the growth of knowledge, *The Economic Journal,* 43(71), 379-389

Flood, R. L. (2001) The Relationship of 'Systems Thinking' to Action Research, IN REASON, I. and BRADBURY, H. (Eds.) *Handbook of Action Research: Participative inquiry and practice,* London: Sage Publications, 133-144

Flyvbjerg, B. (2006) Five misunderstandings about case-study research, *Qualitative Enquiry,* 12(2), 219-245

Frappaolo, C (2008) Position paper: Implicit Knowledge, *Knowledge Management Research and Practice,* 6, 23-25

Freeman, R.R. (1977) Ocean and environmental information: The theory, policy and practice of KM, *Marine Policy,* 1(3), 215-229

Fuchs, C. (2004) Knowledge management in self-organising social systems, *Journal of Knowledge Management Practice,* 5, electronic online journal

Fulop, L. and Rifkin, W. (1999) Management knowledge and learning. IN: FULOP, L. and LINSTEAD, S. (Eds.), *Management: A critical text*, London: Macmillan Business, p. 14-47

Gibbons, M., Limoges, C., Schwartzman, S., Nowotny, H., Trow, M., and Scott, P. (1994) *The new production of knowledge: The dynamics of science and research in contemporary societies,* London: Sage

Giddens, A. (1974) Positivism and Sociology, London: Heinemann

Gilbert, T. (2006) Mixed methods and mixed methodologies: The practical, the technical and the political, *Journal of Research in Nursing,* 11(3), 205-217

Gillham, B. (2004) The research interview, Continuum, London

Glass, G (1976) Primary, secondary and meta-analysis of research, *Educational Researcher,* 5(10), 3-8

Goodyear, P. and Zenios, M. (2007) Discussion, collaborative knowledge work and epistemic fluency, *British Journal of Educational Studies,* 55(4), 351-368

Gold, A.H., Malhotra, A. and Segars, A.H. (2001) KM: An organisational capabilities perspective, *Journal of Management Information Systems,* 18(1), 185-214

Goldacre, B. (2009) Bad *science*, 2nd edition, London: Harper-Perennial

Greenwood, D.J. and Levin, M. (2005) Reform of the social sciences and of universities through action research. IN: DENZIN, N.K and LINCOLN, Y.S. (Eds.), *The Sage Handbook of Qualitative Research,* Third edition, California: Sage publications, 33-64

Grant, R.M. (1996) Towards a knowledge-based theory of the firm, *Strategic Management Journal*, 17(winter special issue), 22-109

Griffiths, D.A. (2011) Knowledge and learning at the new frontier: A case study in an emerging market, *Journal of Knowledge Management Practice,* 12(1), [online]

Griffiths, D.A. (2011a) *Knowledge Management: New principles for better practice,* London: Ark Publications

Griffiths, D.A. and Evans. P.E. (2011) Scaling the fractal plain: Towards a general view of KM, *Journal of European Industrial Training,* 35(8), 779-807

Griffiths, D.A., Koukpaki, S. and Martin, B. (2010) The Knowledge Core: A new model to challenge the KM field, *Journal of Knowledge Systems Science,* 1(1), 3-17

Griffiths, D.A. and Koukpaki, S. (2010) Are we stuck with KM: A case for Strategic Human resource Development, *Journal of Knowledge Systems Science,* 1 (4), 41-60

Griffiths, D.A. and Moon, B. (2011) The state of KM, *KM World Magazine,* 20(10), 16-17, 28

Gruber, T. (1993) A translation approach to portable ontologies. *Knowledge Acquisition,* 5(2), 199-220.

Guba, E.G., and Lincoln, Y.S. (1981) *Effective evaluation: Improving the usefulness of evaluation results through responsive and naturalistic approaches,* San Francisco, CA: Jossey-Bass.

Guba, E.G. and Lincoln, Y.S. (1994) Competing Paradigms in Qualitative Research, IN: DENZIN, N and LINCOLN, S (Eds.), *Handbook of Qualitative Research.* London: Sage, p. 105-117

Gupta, A.K. and Govindarajan, V (2000) Knowledge Flows within Multinational Corporations*, Strategic Management Journal* 21(4), p. 473-496

Halcomb, E.J. and Davidson, P.M. (2006) Is verbatim transcription of interview data always necessary? *Applied Nursing Research,* 19(1), 38-42

Hall, H. (2001). Input-friendliness: Motivating Knowledge Sharing Across Intranets. *Journal of Information Science*, 27(2), 139-146.

Handzic, M., Lagumdzija, A. and Celjo, A. (2008) Auditing KM practices: model and application. *Knowledge Management Research and Practice,* 6(1), 90-99

Hariharun, A. (2002) KM: A strategic tool, *Journal of KM Practice,* December. Retrieved: June 12th 2009 http://www.tlainc.com/articl46.htm [online]

Hariharun, A. (2005) Critical success factors for KM, *Knowledge Management Review,* May/June, 16-19

Harloe, M. and Perry, B. (2004) Universities, localities and regional development: the emergence of the 'Mode 2' university? *International Journal of Urban and Regional Research,* 28(1), 212-23

Hasanali, F. (2002) Critical success factors of KM. Retrieved 18th November 2008 www.kmadvantage.com/docs/km_articles/Critical_Success_Factors_of_KM.pdf

Havelock, R.G. (1968) Dissemination and translation roles, IN: EIDELL, T.L. and KITCHEL, J.M. (Eds.), *Knowledge production and utilisation in educational administration 1969*, Columbus: University Council for Educational Administration, 64-119

Hawking, S., Miodinow, L. and West, S. (2010). *The grand design* [e-book], London: Bantam Press

Hedlund, G. (1994) A model of KM and N-form corporation, *Strategic Management Journal*, 15, 73–90

Heisig, P. (2009) Harmonisation of KM – comparing 160 KM frameworks around the globe, *Journal of Knowledge Management,* 13(4), 4-31

Hempel, C. (1966) Philosophy of natural science, NJ: Prentice-Hall

Hessels, L.K., and Lente, H. (2008) Re-thinking new knowledge production: A literature review and a research agenda. *Research Policy,* 37, 740-760

Henry, N.L. (1974) KM: A new concern for public administration, *Public Administration Review,* 34(3), 189-196

Hillman, D.J. (1977) Model for the on-line management of knowledge transfer, *On-line Review,* 1(1), 23-30

Holden, M.T. and Lynch, P. (2004) Choosing the appropriate methodology: Understanding research philosophy, *The Marketing Review,* 4(4) 397-409

Holsapple, C.W. (2004) *Handbook on KM: Knowledge Matters,* Berlin: Birkhauser

Holsapple, C.W and Joshi, K.D. (1999) Description and analysis of existing KM frameworks, *proceedings of the 32nd International Conference on systems science,* 1(1). Retrieved: 5th July 2008 http://dl.acm.org/citation.cfm?id=875978

Holsapple, C.W. and Joshi, K.D. (2004) A formal KM ontology: conduct, activities, resources, and influences, *Journal of the American Society for Information Science and Technology,* 55(7), 593-612

Hori, K., Kakakaji, K., Yamamoto, Y. and Ostwald, J. (2004) Organic perspectives of KM: Knowledge evolution through a cycle of knowledge liquidisation and crystallisation. *Journal of Universal Computer Science,* 10(3), 252-261

Hoverstadt, P. (2008) *The fractal organisation*, Chichester: John Wiley and Sons

Huxham, C. and Hibbert, P. (2008) Organisation studies as applied science: The generation and use of academic knowledge about organisation use matters and matters of use, *AIM Research working paper series,* 066-June

Iftikhar, Z., Eriksson, I.V. and Dickson, G. (2003) Developing an instrument for KM project evaluation, *Electronic Journal of Knowledge Management,* 1(1), 55-62

Issac, R.G., Zerbe, W.J. and Pitt, D.C. (2001) Leadership and motivation: The effective application of expectancy theory, *Journal of managerial issues,* 13(2) 212

Jackson, M.C. (2001) Critical Systems Thinking and practice, *European Journal of Operational Research,* 128(2), 233–244

Jackson, M.C. (2009), Fifty years of systems thinking for management, *Journal of the operational research society,* 60(S1), S24-S32

Jackson, M.C. and Flood, R.L. (1991) *creative problem solving,* Chichester, Wiley

James, W. (1909) *The meaning of truth, A sequel to pragmatism,* New York, Longmans, Green and Company

Jennex, M.E. and Olfman, L. (2004) Assessing KM success/effectiveness models. *Proceedings of the 37th Hawaii international conference on system sciences.* Retrieved: 18th February 2008. http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1265571

Jennex, M.E. and Zakharova, I. (2005) KM critical success factors, *Management.com.ua.* Retrieved: 11th February 2008 http://www.management.com.au/strategy/str110.html

Johnson, R.B. and Onwuegbuzie, A.J. (2004) Mixed methods research: A research paradigm whose time has come, *Educational Researcher,* 33(7), 14-26

Jones, B.K. (2001) *KM: A quantitative study into people's perceptions and expectations in the developing Knowledge economy,* DBA Thesis, Southern Cross University

Kahneman, D. (2011) *Thinking, fast and slow,* London, Penguin

Kakabadse, N.K., Kakabadse, A. and Kouzmin, A. (2003) Reviewing the KM literature: Towards a taxonomy, *Journal of Knowledge Management*, 7(4) 75-91

Knowles, M., Holton, E.F. and Swanson, R.A. (2005) *The adult learner,* 6th edition, Burlington MA: Elsevier

Knowlton, L.W. and Phillips, C.C. (2009) *The Logic Model Guidebook – Better strategies for great results,* London: Sage publications

Kraaijenbrink, J. and Spender, J.C. (2010) The Resource-Based view: A review and assessment of critiques, *Journal of Management,* 36(1), 349-372

Kunda, Z. (1992) Can dissonance theory do it all? *Psychological Inquiry,* 3(4), 337-9

Lambe, P. (2011) The unacknowledged parentage of KM, *Journal of Knowledge Management*, 15(2), 175 - 197

Lawson, A.E. (2005) What is the role of induction and deduction in reasoning and scientific inquiry, *Journal of Research in Science Teaching,* 42(6), 716-740

Leadbeater, C.D. (1999) New measures for the new economy. Report presented at the international symposium on measuring and reporting Intellectual Capital: experience, *Issues and prospects, Amsterdam, 9-11 June 1999*

Leonard, A. (1999) A viable systems model: consideration of KM, *Journal of KM practice.* Retrieved October 2007, from http://www.tlainc.com/articl12.htm

Lerner, R.M. (2002) Concepts and theories of human development, 3rd edition, Mahwah, NJ: Lawrence Erlbaum Associates.

Levin-Rozalis, M. (2004) Searching for the unknowable: A process of detection — Abductive research generated by projective techniques, *International Journal of Qualitative Methods, 3*(2). Article 1. Retrieved DATE from http://www.ualberta.ca/~iiqm/backissues/3_2/pdf/rozalis.pdf

Lewis, M. and Slack, N. (2003) *Operations management: Critical perspectives on business and management,* London: Palgrave

Loftus, R.L. and Loftus, E.F. (1976) *Human Memory: The processing of information,* Wiley and Sons, New Jersey

Loftus, G.R. and Masson, M.E.G (1994) Using confidence intervals within in-subject design, *Psychonomic Bulletin and Review,* 1(4), 476-490

Luhman, N. (1986) The autopoiesis of social systems, IN GEYER, F. and ZOUWEN, J.v.D (Eds.), *Sociocybernetic paradoxes,* London, Sage, p. 172-192

Luhman, N. (1995) *Social systems,* Stanford CA: Stanford University Press

Luisi, P.L. (2003) Autopoiesis: A review and reappraisal, *Naturwissenschaften,* 90(49-59)

Lundvall, B-A. (2006) Knowledge management in the learning economy, *Danish Research Unit for Industrial Dynamics working paper,* 06-6, Retrieved: May 16th 2008 http://www.druid.dk/wp/pdf_files/06-06.pdf

Lundvall, B-A. (2007) KM and innovation performance, *International Journal of Manpower,* 28(3/4), 207-223

Lusty, I. (1942) Airline engineering management, *Aircraft engineering,* July, 201-2

Lynham, S.A. (2002) The general method of theory-building research in applied disciplines, *Advances in Developing Human Resources,* 4(3), 221-241

Ma, Z. and Yu, K-H. (2010) Research paradigms of contemporary KM studies: 1998-2007, *Journal of Knowledge Management*, 4(2), 175-189

Machlup, F. (1962) *The production and distribution of knowledge in the United States*, Princeton: Princeton University Press

MacLean, D., MacIntosh, R. and Grant, S. (2002) Mode 2 management research, *British Journal of Management,* 13, 189-207

Mandelbrot, B.B. (2002) *Gaussian self-affinity and fractals,* Harrisonburg VA: Donnelly and Sons

Marshall, A. (1890) *Principles of economics,* London: Macmillan

Martin, K.P. (2012) *Review of NASA's Lessons learned Information System*, Office of Audits*,* Report No. IG-12-012. Retrieved April 28th 2012 www.oig.**nasa**.gov/audits/reports/FY12/IG-12-012.pdf

Mason, J. (2006) Six strategies for mixing methods and linking data in social science research, *ESRC National Centre for Research Methods Working Paper Series,* 4/06

Maturana, H. (1981) Autopoesis: Reproduction heredity and evolution, IN: ZELENY, M. (Ed.), *Autopoiesis,* Boulder CO: West-View Press, 45-79

Maxwell, R. (1968) Presentation speech, *Information storage and retrieval*, 4(2), 87-90

McElroy, M.W. (2000) The new KM, *Knowledge and innovation: Journal of the KM Consortium International,* 1(1), 43-67

Meadows, D.H. (1982) Whole systems – Whole Earth models and systems. *The Coevolution Quarterly,* 98–108

Mekhilef, M. and Flock, C. (2006) KM: A multidisciplinary survey. In: CUNNINGHAM, P. and CUNNINGHAM, M. (Eds.), *Exploiting the Knowledge economy: Issues, Applications, Case Studies,* Amsterdam: IOS Press

Metaxiotis, K., Engazakis, K. and Psarras, J. (2005) Exploring the world of KM: agreements and disagreements in the academic/practitioner community, *Journal of KM,* 2005 9(2), 6-18

Miles, B.M. and Huberman, A.M. (1994) Qualitative data analysis: an expanded sourcebook, London: Sage

Miller, A. (2010) Realism, IN ZALTA, N.E. (Ed.), *The Stanford Encyclopaedia of Philosophy* (Spring 2012 Edition). Retrieved: 18th January 2012 http://plato.stanford.edu/archives/spr2012/entries/realism/

Miller, D. (2009) *George Herbert Mead: Self, Language, and the World*, Texas: University of Texas Press

Mingers, J. (2008) Management knowledge and KM: realism and forms of truth, *Knowledge Management Research and practice,* 6, 62-76

Mintzberg, H. (1980) Structure in 5's: A synthesis of the research in organisation design, *Management Science,* Vol. 26 No. 3, pp. 322-341

Mintzberg H. (1993) *Structure in fives: Designing effective organisations*. Englewood Cliffs NJ: Prentice-Hall

Mokyr, J. (2002) *The gifts of Athena: Historical origins of the Knowledge economy*, New Jersey: Princeton University Press

Moon, B.M., Hoffman, R.R., Novak, J.D. and Canas, A.J. (2011) *Applied concept mapping,* Boca Raton, CRC Press

Morse, J.M., Barrett, M., Mayan, M., Olson, K. and Spiers, J. (2002) Verification strategies for establishing reliability and validity in qualitative research, *International Journal of Qualitative Methods,* 1(2), 331-339

Mumford, A. (1997) *How to manage your learning environment,* London, Peter Honey Publications

Noor, K.B.M. (2008) Case study: A strategic research methodology, *American Journal of Applied Sciences,* 5(11), 1602-1604

Nonaka, I. (1991) The knowledge creating company, *Harvard Business Review*, November-December, 96-104

Nonaka, I. and Takeuchi, H. (1995) *The knowledge creating company: How Japanese companies create the dynamics of innovation,* New York: Oxford University press

Nonaka, I., Toyama, R. and Konno, N. (2000) SECI, Ba and leadership: a unified model of dynamic knowledge creation, *Long Range Planning,* 33 5-34

Nonaka, I. and Toyama, R. (2002) A firm as a dialectic being: toward the dynamic theory of the firm, *Industrial and Corporate Change*, 11, 995–1109

Nonaka, I. and Toyama, R. (2007) Why do firms differ? The theory of the knowledge creating firm. IN: ICHIJO, K. and NONAKA, I. (Eds.), *Knowledge creation and management,* New York: Oxford University Press, 13-31

Nubiola, J. (1996) C. S. Peirce: Pragmatism and logicism, *Philosopia Scientiac,* 1/2, p. 121-130

Nutting, P.G. (1918) The application of organised knowledge to national welfare, *The Scientific Monthly,* 6(5), 406-416

OECD (2003) *KM: New Challenges for Education Research*, Paris: OECD Press

OECD (2009) *Education today: the OECD perspective*, Paris: OECD Press

Olsen, W. K. and Morgan, J. (2005) A critical epistemology of analytical statistics: addressing the sceptical realist, *Journal for the Theory of Social Behaviour*, 35(3), 255-284

Pasteur, K., Pettit, J. and van Schagen, B. (2006) *KM and organisational learning for development* (Workshop background paper). Retrieved January 11, 2009, from www.km4dev.org

Paterson, B.L., Thorne, S.E., Canam, C. and Jilings, C. (2001) *Meta study of qualitative health research: A practical guide to meta-analysis and meta-synthesis,* Thousand Oaks CA: Sage

Patton, M.Q. (2002) *Qualitative Research and Evaluation Methods.* (3rd edition) Thousand Oaks, CA: Sage Publications.

Paulin, D. and Suneson, K. (2012) Knowledge transfer, knowledge-sharing and knowledge-barriers – Three blurry terms in Knowledge Management, *Electronic Journal of Knowledge Management,* 10(1) 82-92

Peirce, C.S. (1878) How to make our ideas clear, *popular scientific monthly,* (12) January, 286-320. Retrieved: January 2nd 2010 www.peirce.org/writings/p119.html

Pettigrew, A.M. (1997) The double hurdles for management research, IN: CLARKE, T. (Ed.), *Advancements in Organisational Behaviour,* Aldershot: Ashgate, 277-296

Platt, A. and Warwick, S. (1995) Review of soft systems methodology, *Industrial Management and Data Systems,* 9(4), 19-21

Polanyi, M. (1969) *Knowing and being,* London: Routledge and Kegan Paul

Popper, K.R. (1959) The Logic of Scientific Discovery; translation of *Logik der Forschung*, London: Hutchison

Popper, K.R. (1963) *Conjectures and Refutations: The Growth of Scientific Knowledge,* London: Routledge and Kegan Paul.

Pritchard, D. (2009) *What is this thing called knowledge,* London: Routledge

Quintas, P. (2002), KM in the 21st century, IN: CLEGG, BOOTH, CLARK and SOMINAN (Eds.), *Deciphering Knowledge Management*, New York: Springer

Qureshi, S., Briggs, R.O. and Hlupic, V. (2006) Value creation from Intellectual Capital: convergence of KM and collaboration in the intellectual bandwidth model, *Group Decision and Negotiation,* 15(3),197-220

Radford, M. (2008) Prediction, control and the challenge to complexity, *Oxford Review of Education,* 34(5), 505-520

Ragsdell, G. (2009) Participatory action research: a winning strategy for KM, *Journal of Knowledge Management,* 13(6), 564 – 576

Rahe, M. (2009) Subjectivity and cognition in KM, *Journal of Knowledge Management,* 13(3), 102-117

Rasli, M.D. (2004) *KM framework for the Malaysian constructing companies,* (IRPA Project No. 74320). Retrieved: December 18, 2008 from http://eprints.utm.my/4121/

Ray, T. (2005) Making Sense Of Managing Knowledge. IN: LITTLE, S. and RAY, T. (Eds.), *Managing Knowledge: An Essential Reader 2005*, second edition, London: Sage Publications 1-10

Reichertz, J. (2010) Abduction: The logic of discovery of grounded theory, *Forum: Qualitative social research,* 11(1). Retrieved: January 11th, 2011 http://www.qualitative-research.net/index.php/fqs/article/view/1412/2902

Remenyi, D. and Money, A. (2006) Reflections on how to be a theoretical researcher in business and management studies, *Irish Journal of Management,* 1(1), 23-43

Revans, R. (1980) *Action learning: New techniques for management,* London: Blond and Briggs

Revernik, M. and Sirec, K. (2007) Fostering innovation by unlearning tacit knowledge, *Kybernetes,* 36(3/4), 406-419

Riege, A.M. (2003) Validity and reliability tests in case study research: A literature review with 'hands' on application for each research phase, *Qualitative market research: An International Journal,* 6(2), 75-86

Rickman, H.P. (1960) *The Reaction against Positivism and Dilthey's Concept of Understanding*, London: The London School of Economics and Political Science

Rigby, D. (2010). Management tools 2011: An executive's guide, *Business Insights Management Tools and Trends,* USA: Bain and Associates. Retrieved January 23rd 2011 http://www.bain.com/publications/business-insights/management-tools-and-trends-2011.aspx

Rigby, D. and Bilodeau, B. (2007) Management tools and trends 2007, *A survey from Bain and Company.* Retrieved: 17th June 2008 http://www.bain.com/management_tools/Management_Tools_and_Trends_2007.pdf

Rigby, D. and Bilodeau, B. (2009) Management Tools and Trends 2009, *A survey from Bain and Company*. Retrieved 11th January 2009 http://www.bain.com/management_tools/Management_Tools_and_Trends_2009.pdf

Rigby, D. and Gillies, C. (2000). Making the most of management tools and techniques: a survey from Bain and Company, *Strategic Change Journal*, 9, 269-274

Rorty, R. (1980) *Consequences of pragmatism (Essays: 1972-1980),* Minneapolis, University of Minnesota Press

Roth, J. (2003) Enabling knowledge creation: Learning from an R+D organisation, *Journal of Knowledge Management*, 7(1), 32-48

Rusanow, G. (2001) KM critical success factors for competitive advantage, *Curve consulting.* Retrieved: 16th December 2008 www.curveconsulting.com/pages/Presentations/londonlegaltechebus_ro.ppt

Ryle, G. (1949) *The concept of the mind*, Chicago: University of Chicago Press

Sanchez, R. (2004) *Tacit knowledge versus explicit knowledge: Approaches to KM practice*, Working paper series, Department of industrial economics and strategy, Copenhagen Business School, 04-01

Santos, J.R.A. (1999) Cronbach's Alpha a tool for assessing the reliability of scales, *Tools of the trade,* 37(2). Retrieved: December 14th, 2010 http://www.joe.org/joe/1999april/tt3.php

Sarah, R. and Haslett, T. (2003) Learning is a process which changes the state of knowledge of an individual or organisation, *Monash University Working Paper,* 72/03 December, 1-14. Retrieved: 16th February 2008. http://www.buseco.monash.edu.au/mgt/research/working-papers/2003/wp72-03.pdf

Schutt, P. (2003) The post Nonaka KM, *Journal of Universal Computer Science*, 9(6), 451-462

Schmidt, K. and Carstensen, P. (1990) Work analysis theory and practice, *Work Analysis Theory and Practice: Riso National Laboratory,* 28-34

Senge, M. (1997) *The fifth discipline,* London: Century Business Publishing

Serat, O. (2008) Building Communities of Practice, *Knowledge Solutions,* Retrieved: 12th November 2010 www.adb.org/knowledgesolutions

Shanks, G., Tansley, E. and Weber, R. (2003) Using ontology to validate conceptual models. *Communications of the ACM,* 46(10), 85–89

Sharif, A.M. (2006) Knowledge Management: A neuro-hemispherical view of the field, *Knowledge Management Research and Practice,* 4, 70-72

Sisaye, S. (2001) *Organisational change and development in management control systems: Process innovation for internal auditing and management accounting,* Oxford, Elsevier

Smith, N. (2000) The utility of Popper's philosophy in biology, *Bio Essays,* (22)3, 309

Smith, P.A.C. (2003) Successful KM: The importance of relationships, *Invited paper – Universidad Central de Chile*.

Snowden, D.J. (2002) Complex acts of knowing, paradox and descriptive self-awareness, *Journal of Knowledge Management*, 6(2), 100-111

Snowden, D.J. (2010) Judgement and resilience in the context of KM, *KM Asia,* Singapore, November 23rd. Available from: http://www.cognitive-edge.com/presentationdetails.php?presentationid=74

Snowden, D.J. and Boone, M.E. (2007) A leaders framework for decision making, *Harvard Business Review,* 85(11) 68-76

Spender, J.C. (1996) Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal,* 17(special issue), 45-62

Spender, J.C. (2008) Organisational learning and KM, whence and whither, *Management Learning,* 39(2), 159-176

Spender, J.C. and Marr, B. (2005) A Knowledge-Based perspective on Intellectual Capital, IN: MARR, B (Ed.), *Perspectives on Intellectual Capital,* London: Sage, 183-195

Spicer, D.P. (1998) Linking mental models and cognitive maps as an aid to organisational learning, *Career Development,* 3(3), 125-132

Staat, W. (1993) On abduction, deduction, induction and the categories, *Transactions of the Charles S. Peirce Society*, 29, 225-237.

Stake, R. (1995) *The art of case research*, Newbury Park CA: Sage

Standards Australia (2001) *KM: A framework for succeeding in the knowledge era*, HB 275-2001, Sydney: Standards Australia

Stewart, T.A. (1997) *Intellectual Capital the new wealth of organisations,* London: Brealey

Stewart, T.A. (2002) The case against KM, *Business 2.0 magazine.* Retrieved 20 August 2007 http://money.cnn.com/magazines/business2/articles/mag/print/0,1643,36747,00.html

Supyuenyong, V. and Islam, N. (2006) KM architecture: building blocks and their relationships, *IEEE PICMT 2006 technology management for the global future*, 1210-1219

Taleb, N.N. (2007) *The Black Swan*, Second Edition, London: Penguin

Tellis, W. (1997) Introduction to case study, *The qualitative report,* 3(2). Retrieved 12th April 2009 http://www.nova.edu/ssss/QR/QR3-2/tellis1.html

The British Standards Institution (2001) *KM: A guide to good practice*, PAS 2001, London: British Standards Institution

The Economist Intelligence Unit (2006) Foresight 2020: Economic, industry and corporate trends, *The Economist.* Retrieved: January 12th 2009 http://www.eiu.com/site_info.asp?info_name=eiu_Cisco_Foresight_2020andrf=0

The European Committee For Standardisation (2004), *European guide to good practice in KM – Part 1: KM framework*, ICS 03,100.99, Brussels

The Lancet (1908) The Diffusion of Medical Knowledge, *The Lancet, January 4th,* 33-34

The Science Newsletter (1940) Defence requires knowledge, organised and implemented, *The Science Newsletter,* 38(3), 47

Thietart, R.A. and Forgues, B. (1995) Chaos Theory and Organisation, *Organisation Science,* 6(1), 19-31

Tiwana, A. (2000) *The KM Toolkit: practical techniques for building a KM system,* Upper Saddle River NJ: Prentice Hall

Toth, L. (2001) Participatory integrated assessment methods: An assessment of their usefulness to the European Environmental Agency, *Technical Report 64*, August

Tranfield, D., Denyer, D. and Smart, P. (2003) Towards a methodology for developing evidence-informed management knowledge by means of systematic review, *British Journal of Management,* 14, 207-222

Tuomi, I. (2000) Data is More Than Knowledge: Implications of the Reversed Knowledge Hierarchy for KM and Organisational Memory, *Journal of Management Information Systems,* 16(3), 103-117

Ulrich, W. (1994) Can we secure future responsive management through systems thinking and design, *Informs,* 24(4) 26-37

Van der Sluijs, J.P. (2002) Integrated assessment, In T. Munn (Ed.) *Encyclopaedia of International environmental change,* Chichester, John Wiley and Sons p. 250-253

Wang, H. and Doong, H. (2007) *Validation in Internet Survey Research: Reviews and Future Suggestions.* Paper presented at the 40th Hawaii International Conference on System Sciences, Hawaii

Watson, S. and Hewett, K. (2006) A multi-theoretical model of knowledge transfer in organisations: determinants of knowledge contribution and knowledge reuse, *Journal of Management Studies,* 43(2), 141-173

Weber, R. (2004) Editors Comments: The Rhetoric of Positivism versus Interpretivism: A Personal View. *MIS Quarterly,* 28(1), iii-xiii.

Weinstein, K. (2002) *Action Learning: A practical guide*, London, Gower

Wenger, E. (1998) *Communities of Practice: Learning, meaning and identity,* Cambridge, Cambridge University Press

Wenger, E., McDermott, R. and Snyder, W. (2002) *Cultivating CoP: A guide to managing knowledge*, Boston: Harvard Business School Press

Wernerfelt, B. (1986) A Resource-Based view of the firm, *Strategic management journal,* 5(2), 171-180

Williams, S.R. (1931) The collection and creation of knowledge, *The Journal of Higher Education,* 2(8) 415-419

Wilson, T.D. (2002) The nonsense of KM, *Information research,* 8(1). Retrieved: 8th August 2008 http://informationr.net/ir/8-1/paper144.html

Wisker, G., Robinson, G., Trafford, V., Creighton, E. and Warnes, M. (2003) Recognising and overcoming dissonance in postgraduate student research, *Studies in Higher Education,* 28(1), 91-105

Worren N., Moore K., and Elliott R. (2002) When theories become tools: toward a framework for pragmatic validity, *Human Relations*, 55 (10), 1227-1249

Yin, R.K. (1984) *Case study research: Design and methods*, 1st edition, Beverly Hills CA: Sage

Yin, R.K. (2009) *Case study research*, London: Sage

Yolles, M.I. (1996) Critical Systems Thinking, paradigms, and the modelling space, *Systems Practice,* 9(6), 549-570

Yueng, H, W-C. (1997) Critical realism and realist research in human geography: A method in search of a method?, *Progress in Human Geography,* 21(1), 51-74

Zhu, Z. (2010) Knowledge of the natural and social: how are they different and what do they have in common?, *Knowledge Management Research and Practice,* Vol. 8, pp. 173-188

Appendix 1: Definitions applied to Mekhilef and Flock's (2006) research framework involving Six KM Disciplines[13]

Business and Management

"The activities associated with running a company, such as controlling, leading, monitoring, organizing, and planning"[14]

Engineering

"The art or science of making practical application of the knowledge of pure sciences, as physics or chemistry, as in the construction of engines, bridges, buildings, mines, ships, and chemical plants"[15]

Decision Sciences

"Application of mathematical (quantitative) techniques to decision making. In OR, a problem is first clearly defined and represented (modelled) as a set of mathematical equations.

It is then subjected to rigorous computer analysis to yield a solution (or a better solution) which is tested and re-tested against real-life situations until an optimum solution is found. OR applies different approaches to different types of problems: dynamic, linear programming, and critical path method are used in handling complex information in allocation of resources, inventory control, and in determining economic reorder quantity; forecasting and simulation techniques such as Monte Carlo method are used in situations of high uncertainty such as market trends, next period's sales revenue, and traffic patterns. Also called decision science, management science, or operational research"[16]

Computer Sciences

"The study of computing, programming, and computation in correspondence with computer systems. This field of study utilizes theories on how computers work to design, test, and analyze concepts. Computer science usually

[13] I took the decision to utilise 'popular' or non-academic sources in defining the six disciplines identified by Mekhilef and Flock (2006) as I wanted to apply an approach that would transfer to practitioners in the survey. This was driven by the ultimate use of the K-Core model in an operational setting, which led me to use definitions that I believed would be understood quickly by practitioners.
[14] http://dictionary.reference.com/
[15] http://dictionary.reference.com/
[16] www.business dictionary.com

has a stronger mathematical foundation than a scientific one and on some occasions may not focus directly on computers and their systems"[17]

Medicine and Health

"The field concerned with the maintenance or restoration of
the health of the body or mind.
Any of the procedures or methods employed in this field"[18]

Social Sciences

"The study of society and social behaviour or
A science or field of study, as history, economics, etc.,
dealing with an aspect of society or forms of social activity"[19]

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[17] http://dictionary.reference.com/
[18] http://dictionary.reference.com/
[19] http://dictionary.reference.com/

Appendix 2: Systematic Literature Review 84 search terms

Knowledge Management
KM
Knowledge Management / KM China
Knowledge Management / KM Africa
Knowledge Management / KM Australia
Knowledge Management / KM United States
Knowledge Management / KM Canada
Knowledge Management / KM Australia
Knowledge Management / KM Russia
Knowledge Management / KM South America
Knowledge Management / KM New Zealand
Knowledge Management / KM Middle East
Knowledge Management / KM Asia
Knowledge Management / KM Europe
Knowledge Management / KM India
Knowledge Management / KM Critical Success Factors
Knowledge Management / KM Variables
Knowledge Management / KM Constructs
Knowledge Management / KM Success
Knowledge Management / KM Failure
Knowledge Management / KM Value
Knowledge Management / KM Communities
Knowledge Management / KM Organisations
Knowledge Management / KM Enterprise
Knowledge Management / KM Systems
Knowledge Management / KM Frameworks
Knowledge Management / KM Works
Knowledge Management / KM Does Not Work
Knowledge Management / KM Sharing
Knowledge Management / KM Generating Knowledge
Knowledge Management / KM Communities of Practice
Knowledge Management / KM Business and Management
Knowledge Management / KM Medicine and Health
Knowledge Management / KM Decision Science
Knowledge Management / KM Social Science
Knowledge Management / KM Engineering
Knowledge Management / KM Computer Science
Knowledge Management / KM Strategy Failure / Success
Knowledge Management / KM Operations Failure / Success
Critical Issues For Knowledge Management / KM
When Knowledge Management / KM Fails
When Knowledge Management / KM succeeds

Appendix 3: Coding protocol for thematic document analysis

Construct/Function	Coding Descriptors
Creating Knowledge	*Generating – developing – constructing – creating – producing – developing – innovate – new knowledge - inventing*
What is known	*What is known – basic knowledge – existing knowledge – past knowledge – instinctive knowledge – embodied knowledge – existing experience – exiting know how – reuse – existing knowledge resources – knowledge we are aware of – past experience – revive knowledge – originating knowledge – past decisions – prior knowledge – existing stock of knowledge – developed research – knowledge in assets – knowledge nuggets – historical knowledge – possessed knowledge – previous knowledge – formalised knowledge*
Extending what is known	*Question – new knowledge leading to new developments – combination – problem solving – idea creation – decision challenging – discovery – transform knowledge – when existing knowledge becomes tacit – creative questioning – creative thinking – extend knowledge – manipulate knowledge – expansion of existing knowledge – modification of captured knowledge – discovery through questioning – knowing why – new knowledge from old knowledge – knowledge adaption – inquiring – modify – altering state of knowledge – critical enquiry – knowledge added to existing knowledge – develop knowledge – enhance knowledge – engineer change – new knowledge added to old – things we could know – personalisation of knowledge – adaption - experiment*
Context	*Operational setting – relevant to action – according to sector – business strategy – job requirements – business definition – purpose – strategic intent – business direction – strategic imperative – variation according to department – purpose – goal and task – rule sets – shared understanding – context – organisational needs – individual needs – defined task – place of application – organisational purpose – policy and guidance – situational – location dependency – strategic requirements – circumstances – business requirements – situated practice – mission – business priorities - rationale*
Motivate	*Stimulus/stimulate – leadership – commitment – inspire – willingness – engage – reward – voluntary cooperation – recognition – encouragement – inducement – compensation – esteem and reward – Motivation – support – champion – drive – personal satisfaction – energise – celebrate success – desire – sense of purpose - expectation*
Share	*Socialise – interaction – sharing – social dialogue – cross pollination – Communities Of Practice – Collaboration – cooperative work – spread knowledge (socially) – exchange knowledge (socially) – teaming – networking – connect people*
Culture	*Expectations and values – organisational climate – atmosphere – trust – cultural environment – social values and ideology – organisational climate – promotion of spirit and harmony – human attitude – ideals – sociology of race – beliefs – ethos – social characteristics*
Organisational Structure	*Organisational hierarchy – corporate architecture – operational infrastructure – division of labour – human organisation in tiers – top down management – structure (organisational) – reconstructuring – decentralised – bureaucracy – autonomous departments, divisions and organisations – organisational forms – organisational design – organisational set up – social order*
Spaces	*Work locale – improving the way people meet – spatial distance – office environment (physical) – placement of offices – user interface design – knowledge spaces – shared information spaces – social settings – physical work environment – virtual work environment – psychic distance – proximity – physical infrastructure*
Using Knowledge	*Utilisation – use – effective action – exploitation – leveraging – act upon – implement – action – practice – mobilising knowledge*
Acquire & Store	*Acquisition – repository – storage – collect – Knowledge Management System – Capture – Knowledge Base – preserve – archive – warehouse – accumulate – gather – retention – library – recall systems – search – retrieve - access*
Communicate	*Disseminate – transfer – communicate – storytelling – articulate – diffusion – externalisation – retrieval – translating – delivery – expression of knowledge – interpretation of knowledge – transmitting – decode and recode – broadcast – emission of knowledge – communicative custodians – deliver knowledge – representational vocabulary – interactive metaphors – display – sense giving and sense reading – knowledge elicitation – portraying – pass on knowledge – metaphor – analogy – models – social proxies to portray digital communication - teaching - narrative*
Artefacts	*Textbooks – holders of knowledge (people) - routines – documents – codified procedures – products – services – stories – goods – processes – patents – codified knowledge – container for knowledge – reports – knowledge objects – metaphors – database – hard copy – knowledge representations – source material – digitised data – textual data – physical media – externalisation – publication – blogs – manifestation of knowledge*
Review	*Self examination – collective reflection – reasoning – judgement – feedback – evaluation – assess – retrospection – review – peer review – after action review – verify and validate – measure - test*
Catalysts	*Time, people – money - Human Resources – technology - [technology brand name] - finance, technology infrastructure - human capital - capital expenditure – investment – skills – abilities*
Knowledge Structure	*Knowledge system – knowledge architecture – organised lists – patterning – structure of knowledge – knowledge mapping – categorising – directory – organise knowledge – corporate memory architecture – yellow pages – structure documents – coding – indexing – framework or structure for storing – classify – systematisation of knowledge – knowledge or competency tree – functional design - collating*

[20]Appendix 4: Survey question set

1. Are you familiar with the field of KM either in theory or practice? Yes/No

2. Orientation? Academic/Student/Practitioner/Other

3. Please attempt to align yourself with one of the following disciplines: Business and Management; Engineering; Decision Sciences; Computer Sciences; Medicine and Health; Social Sciences

4. Where are you located? (Country choice)

5. What is your length of experience with KM? (Numeric choice)

6. Do you currently use any particular model(s) for KM, either in theory or practice? Yes/No

6.a. If you answered 'yes', how satisfied are you with it?

6.a.i. Do you believe that the model works for you in your environment?

7. Do you believe that the solution to KM lies within: Technology solutions/HR or people solutions/Both

7.a. If you answered 'Both': In evaluating your selection, what weighting would you give to 'People' and 'Technology' within the relationship (For example, is it a 50-50 split or would you give a bias in favour of one or the other)?

8. Using no more than a couple of sentences, provide your definition of KM:

9. What are the main functions for KM? In other words, what are the key things that KM should do in order for it to be successful?

10. What do you think is required to make those functions work?

11. Please answer the following using the scale between 1 and 5 (1 = strongly DISAGREE and 5 = strongly AGREE)

11.a. Capturing and Storing knowledge is a key function of KM

11.a.i. Capturing and Storing knowledge is a key function of KM -- Comment

11.b. Sharing knowledge is a key function of KM

11.b.i. Sharing knowledge is a key function of KM -- Comment

11.c. Developing Knowledge is a key function of KM

11.c.i. Developing Knowledge is a key function of KM -- Comment

11.d. Applying knowledge is a key function of KM

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[20] The term Knowledge Management was used in the survey, over Organisational Knowledge Management, as this is what practitioners would expect in an organisational survey.

11.d.i. Applying knowledge is a key function of KM -- Comment

12. Do you believe a key function has been missed out from the previous question?

12.a. If you answered 'yes', what do you believe to be missing?

13. Using the scale of 1 to 5 (1=strongly DISAGREE 5=strongly AGREE)

13.a. Knowledge needs to be structured to make KM work

13.a.i. Knowledge needs to be structured to make KM work -- Comment

13.b. Time is needed to make KM work

13.b.i. Time is needed to make KM work -- Comment

13.c. People are required to make KM work

13.c.i. People are required to make KM work -- Comment

13.d. Technology is required to make KM work

13.d.i. Technology is required to make KM work -- Comment

13.e. Funding is needed to make KM work

13.e.i. Funding is needed to make KM work -- Comment

13.f. Testing of processes is needed to make KM work

13.f.i. Testing of processes is needed to make KM work – Comment

13.g. Physical spaces for interaction contribute to the success of KM

13.g.i. Physical spaces for interaction contribute to the success of KM -- Comment

13.h. Virtual spaces for interaction contribute to the success of KM

13.h.i. Virtual spaces for interaction contribute to the success of KM -- Comment

13.i. Knowledge must be communicable for KM to work

13.i.i. Knowledge must be communicable for KM to work – Comment

13.j. Motivation is needed for people to engage with KM work

13.j.i. Motivation is needed for people to engage with KM work -- Comment

13.k. Combining existing knowledge to create new knowledge is a part of KM

13.k.i. Combining existing knowledge to create new knowledge is a part of KM -- Comment

13.l. Extending existing knowledge to create new knowledge is a part of KM

13.l.i. Extending existing knowledge to create new knowledge is a part of KM -- Comment

13.m. Artefacts of existing knowledge are needed to make KM work

13.m.i. Artefacts of existing knowledge are needed to make KM work -- Comment

13.n. The culture of the environment directly affects the workings of KM

13.n.i. The culture of the environment directly affects the workings of KM -- Comment

13.o. The working structure that people are placed in effects the way in which KM works

13.o.i. The working structure that people are placed in effects the way in which KM works -- Comment

14. Do you believe anything has been missed from the list above?

14.a. If you answered 'yes', what do you believe is missing?

15. Did you feel comfortable with this survey format?

15.a. If you answered 'no', what were you not comfortable with?

16. Please feel free to comment on the survey or issues of KM in general

17. Would you like to be informed of the findings of this survey?

17.a. If yes, please provide your email address

18. If needed, would you be willing to be contacted to clarify your answers?

18.a. If yes, please provide your email address

Appendix 5: Survey protocol

The KM Survey has been designed to examine KM activity across countries and sectors. Your responses will contribute to the contextualisation of current KM practice and underlying satisfaction or dissatisfaction in performance.

All participants who fully complete the survey will receive an extended Executive Summary by email, detailing top-level findings. The report will present anonymous data and all responses kept confidential, please see our data protection statement for further details.

Thank you for taking the time to participate in this project and we hope the intelligence gathered will bring added value to your KM activities. The survey should take approximately 25-30 minutes to compete.
Once you have completed the survey, you will be provided with the opportunity to print off your responses. You may choose to do this as a method of monitoring your KM responses within the organisation; this facility is only available for 15 minutes after the completion of the survey.

Data Protection and Confidentiality

• I understand that the general purpose of this study is to examine current KM activity across countries and sectors.
• I understand my responses will contribute to the understanding of current KM practices and levels of satisfaction with existing tools and approaches.
• I understand that my participation in this study voluntary and I may end participation at any time.
• I understand that the researchers will gladly answer any questions regarding the procedures in this study.
• I understand that if I have any concerns about this project I can contact d.a.griffiths@ed.ac.uk
• I understand that aggregate data may be retained to benchmark future surveys.
• I understand that the research team will keep all responses confidential, anonymous, and secure.
• I understand that cookies, personal data stored by your Web browser, are not used in this survey.

Appendix 6: K-Core PIAT examples (Maturity Model/Feedback chart/Question Sample)

[1.1]CS-CON	V. An organisational strategy exists for the collection and storage of Knowledge-Based resources from: a. Internal sources b. External sources VI. Strategy is transposed into a. Divisional plans b. Departmental plans c. Influence is evident in operational plans VII. Divisional and departmental feedback is evident in the development of context setting documents VIII. Strategy documents clearly identify the drivers for collection and storage initiatives and demonstrates responsiveness to: a. Internal feedback b. External feedback IX. An organisational strategy exists for the collection and storage of Knowledge-Based resources, possibly considering internal and external sources. However, there is evidence that some divisions or departments have not incorporated that strategy. X. There is some evidence of strategic influence upon operational plans. Strategy documents identify need, but doesn't clearly identify the drivers for collection and storage activities. XI. Strategy sets the context, but it fails to demonstrate responsiveness to internal and external feedback.	[2.1]/[3.1]/ [4.1]/[2.1A]/ [3.1A]/[4.1A]	[1.1i] *Documentation* (Strategic documents/ operational plans) *Engagement* (Levels 1/2, 3) [1.1A] *Documentation*

	XII. There is little or no evidence of strategic planning for the collecting and storing of knowledge-based resources, either internally or externally. XIII. There is little or no evidence of influence upon operational work programmes. *A. Staff are able to explain the relationship between strategy and their:* *a. Internal knowledge-based collection and storage activities.* *b. External knowledge-based collection and storage activities.* *B. They are able to synthesise the needs of the organisation and their work activities.* *C. They are able to communicate the importance of their activities in relation to organisational planning and this importance is reflected by the presence of collecting and storing activities in work programmes.* *D. Staff are able to articulate an understanding of:* *a. Internal drivers that affect their work* *b. External drivers that affect their work* *E. Staff are able to discuss how their activities feedback into:* *a. Departmental plans* *b. Divisional plans* *c. Organisational strategy* *F. Staff speak of:* *a. Formal processes and can*		(Work programmes) *Engagement* (Levels 3, 4, 5) *Observation* (Levels 3, 4, 5)

	demonstrate their participation in those processes b. *Informal feedback processes* XIV. *Staff are able to link some of the relationships between their knowledge-based work and the organisation strategy for collecting and storing knowledge. However there may appear to be gaps in understanding of external collection.* XV. *They make some links between the needs of the organisation and their work. There is some evidence of the storage and collecting of knowledge resources in their work programmes.* XVI. *Some staff are able to articulate an understanding of the internal and external drivers that affect their work activities and there is some evidence that feedback effects departmental, Divisional and/or organisational strategy.* XVII. *Some staff speak of formal and informal feedback processes and can demonstrate their participation in those processes.* XVIII. *Staff in the main are not able to communicate their understanding of organisational requirements for the collecting and storage of knowledge.* XIX. *There appears to be a gap in understanding of the need for the collection and storage of external knowledge resources. There is little or no evidence of activities relating to the collecting or storage of knowledge in their work*		

	programmes. *XX. Staff find it difficult to relate their work activities to internal or external drivers and there is little or no evidence that feedback effects Departmental, Divisional and/or organisational strategy.* *XXI. Staff find it difficult to give examples of the existence and/or their participation in formal or informal feedback processes.*		

KPI	Enq	Descriptor	D3	D2	D1	DF		I3	I2	I3	IF		O1	O2	O3	OF
1.1Ia		An organisational strategy exists for the collection and storage of Knowledge-Based resources from internal sources														
1.1Ib		An organisational strategy exists for the collection and storage of Knowledge-Based resources from external sources														
1.1IIa		Strategy is transposed into Divisional plans														
1.1IIb		Strategy is transposed into Departmental plans														
1.1IIc		Strategic influence is evident in operational plans														
1.1III		Divisional and departmental feedback is evident in the														

1.1IVa		Strategy documents clearly identify the drivers for collection and storage initiatives and demonstrates responsiveness to internal feedback														
1.1IVb		Strategy documents clearly identify the drivers for collection and storage initiatives and demonstrates responsiveness to external feedback														
1.1Aa		*Staff are able to explain the relationship between strategy and their internal knowledge-based collection and storage activities.*														
1.1Ab		*Staff are able to explain the relationship between strategy and their external knowledge-based collection and storage activities.*														
1.1B		*Staff are able to synthesise the needs of the organisation and their work activities.*														
1.1C		*Staff are able to communicate the importance of*														
1.1C		*Staff are able to communicate the importance of their activities in relation to organisational planning and*														

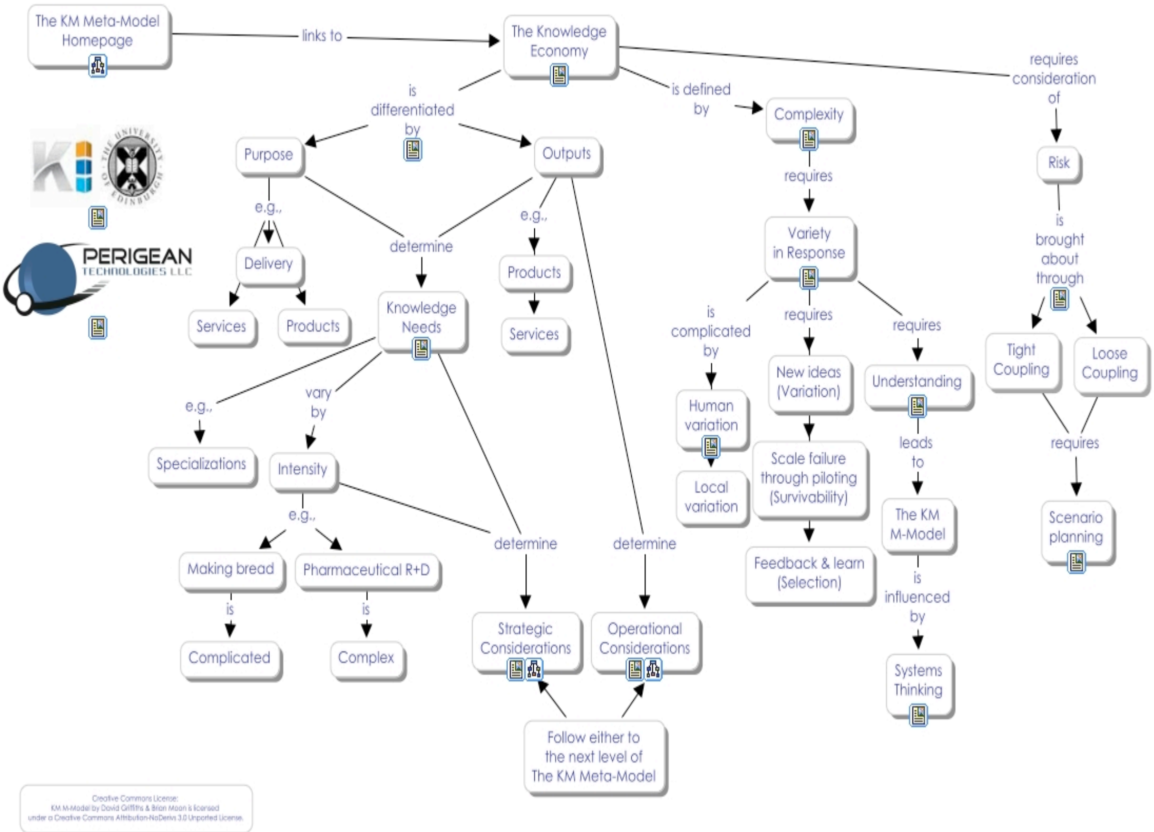
1.1Da		*Staff are able to articulate an understanding of internal drivers that affect their work*														
1.1Db		*Staff are able to articulate an understanding of external drivers that affect their work*														
1.1Ea		*Staff are able to discuss how their activities feedback into Departmental plans*														
1.1Eb		*Staff are able to discuss how their activities feedback into Divisional plans*														
1.1Ec		*Staff are able to discuss how their activities feedback into organisational strategy*														
1.1Fa		*Staff speak of formal processes and can demonstrate their participation in those processes*														
1.1Fb		*Staff speak of informal processes and can demonstrate their participation in those processes*														

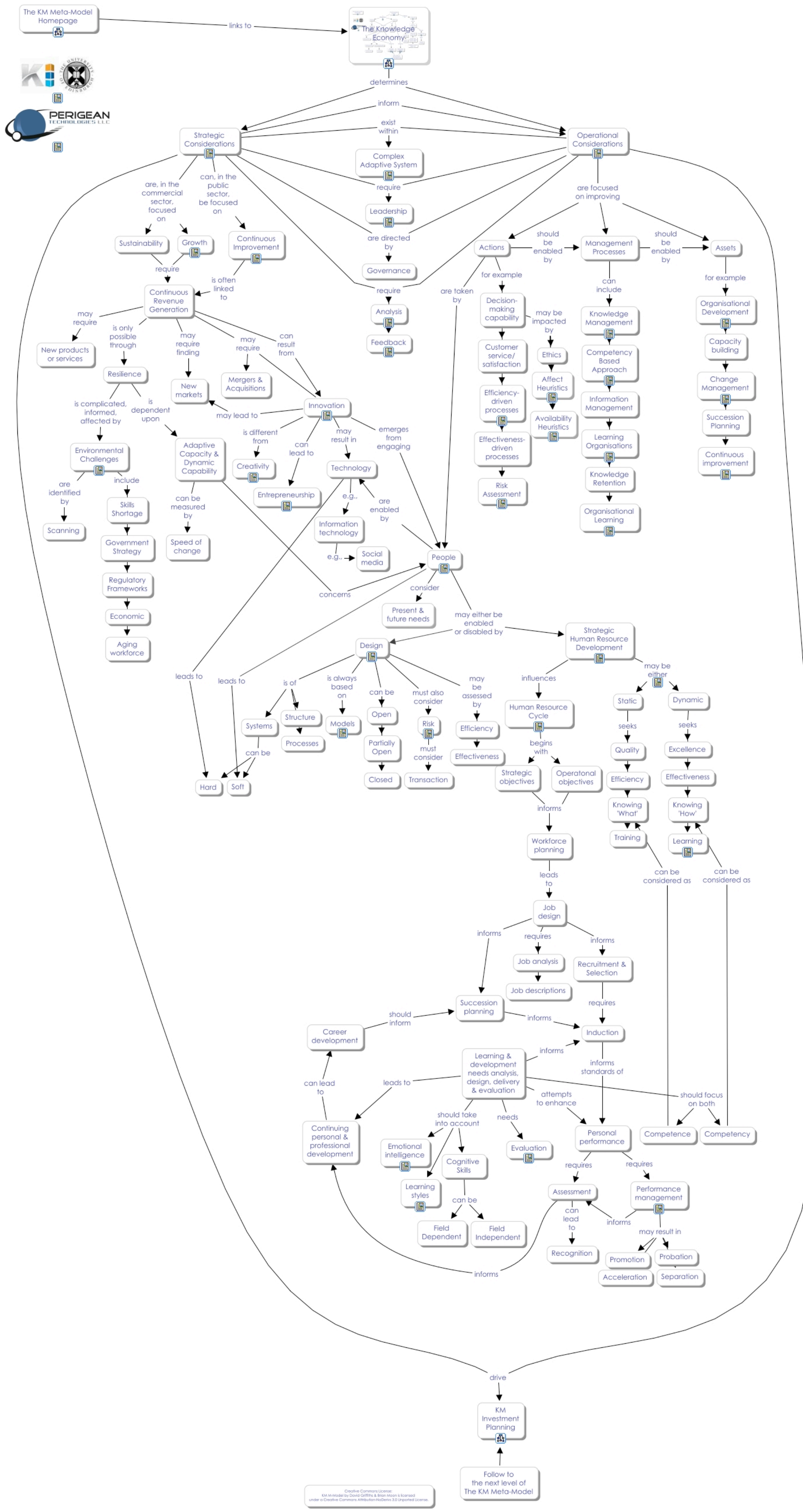
Performance Indicator	Cross Reference	Enquiry Level	Enquiry Options	Selection
E1.1I		1 2 3	How would you explain the aims	

DA1.1I E1.1II DA1.1II E1.1.III *E1.1A* *E1.1B* *E1.1C* *E1.1D*		 1 2 3 1 2 3 3 4 5 3 4 5 3 4 5 3 4 5	and objectives of your strategy for the collection and storage of knowledge-based resources? Strategic plans (Organisation/Division/Department) What are the external and internal drivers that influence strategy development? Operational plans (Division/Department) Where has internal or external feedback influenced changes to strategic direction? *Why does the organisation need you to collect and store knowledge-based resources?* *How does that translate to your day-to-day work activities?* *What are the differences in the needs of internal and external stakeholders?* *Do you feedback into strategic and operational planning processes?*	

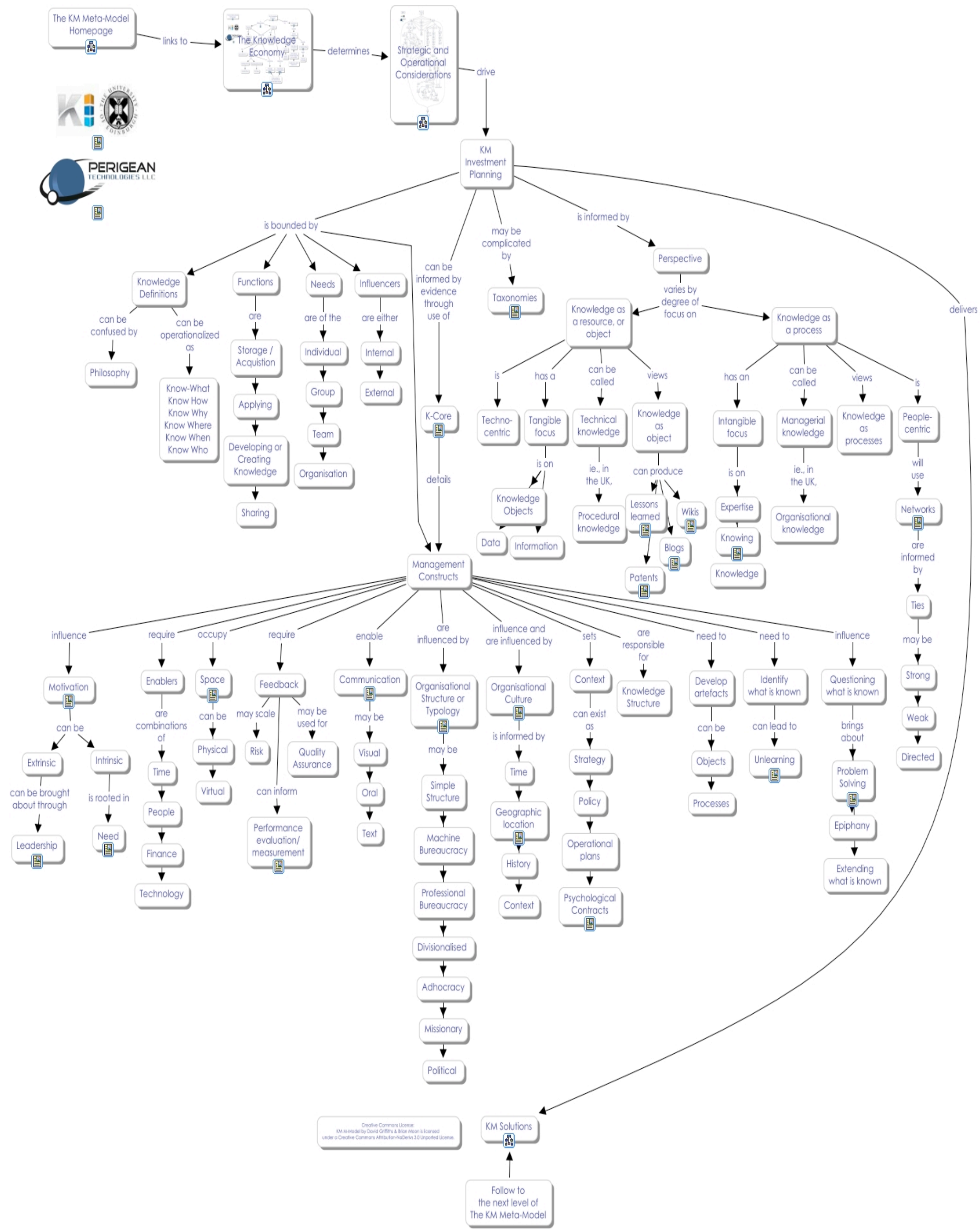
Appendix 7: C-Map overview of underpinning knowledge and understanding informing K-Core ™ PIAT design

Web based version available http://www.perigeantechnologies.com/The_KM_Meta-Model.php





The KM Meta-Model Homepage
links to
The Knowledge Economy
PERIGEAN TECHNOLOGIES LLC
determines
inform
exist within
Strategic Considerations
Operational Considerations
Complex Adaptive System
require
Leadership
are directed by
Governance
require
Analysis
Feedback
are, in the commercial sector, focused on
can, in the public sector, be focused on
Sustainability
Growth
Continuous Improvement
require
is often linked to
Continuous Revenue Generation
may require
New products or services
is only possible through
Resilience
may require finding
New markets
may require
Mergers & Acquisitions
can result from
may lead to
Innovation
is complicated, informed, affected by
is dependent upon
Environmental Challenges
Adaptive Capacity & Dynamic Capability
is different from
Creativity
can lead to
Entrepreneurship
may result in
Technology
emerges from engaging
include
are identified by
Scanning
Skills Shortage
Government Strategy
Regulatory Frameworks
Economic
Aging workforce
can be measured by
Speed of change
e.g.
Information technology
are enabled by
e.g.
Social media
People
concerns
consider
Present & future needs
may either be enabled or disabled by
Strategic Human Resource Development
Design
leads to
leads to
is of
Systems
Structure
Processes
is always based on
Models
can be
Open
Partially Open
Closed
must also consider
Risk
must consider
Transaction
may be assessed by
Efficiency
Effectiveness
can be
Hard
Soft
influences
Human Resource Cycle
begins with
Strategic objectives
Operational objectives
informs
Workforce planning
leads to
Job design
may be either
Static
seeks
Quality
Efficiency
Knowing 'What'
Training
Dynamic
seeks
Excellence
Effectiveness
Knowing 'How'
Learning
can be considered as
can be considered as
are focused on improving
Actions
should be enabled by
Management Processes
should be enabled by
Assets
for example
Decision-making capability
may be impacted by
Ethics
Affect Heuristics
Availability Heuristics
Customer service/ satisfaction
Efficiency-driven processes
Effectiveness-driven processes
Risk Assessment
are taken by
can include
Knowledge Management
Competency Based Approach
Information Management
Learning Organisations
Knowledge Retention
Organisational Learning
for example
Organisational Development
Capacity building
Change Management
Succession Planning
Continuous improvement
informs
requires
informs
Job analysis
Job descriptions
Recruitment & Selection
requires
Succession planning
should inform
Career development
informs
Induction
informs
Learning & development needs analysis, design, delivery & evaluation
informs standards of
can lead to
leads to
Continuing personal & professional development
should take into account
Emotional intelligence
Learning styles
Cognitive Skills
can be
Field Dependent
Field Independent
needs
Evaluation
attempts to enhance
Personal performance
should focus on both
Competence
Competency
requires
requires
Assessment
can lead to
Recognition
informs
Performance management
may result in
Promotion
Acceleration
Probation
Separation
informs
drive
KM Investment Planning
Follow to the next level of The KM Meta-Model


The KM Meta-Model Homepage
links to
The Knowledge Economy
determines
Strategic and Operational Considerations
drive
KM Investment Planning
is bounded by
may be complicated by
Taxonomies
can be informed by evidence through use of
K-Core
details
is informed by
Perspective
delivers
Knowledge Definitions
can be confused by
Philosophy
can be operationalized as
Know-What
Know How
Know Why
Know Where
Know When
Know Who
Functions
are
Storage / Acquistion
Applying
Developing or Creating Knowledge
Sharing
Needs
are of the
Individual
Group
Team
Organisation
Influencers
are either
Internal
External
varies by degree of focus on
Knowledge as a resource, or object
is
Techno-centric
has a
Tangible focus
is on
Knowledge Objects
Data
Information
can be called
Technical knowledge
ie., in the UK,
Procedural knowledge
views
Knowledge as object
can produce
Lessons learned
Wikis
Blogs
Patents
Knowledge as a process
has an
Intangible focus
is on
Expertise
Knowing
Knowledge
can be called
Managerial knowledge
ie., in the UK,
Organisational knowledge
views
Knowledge as processes
is
People-centric
will use
Networks
are informed by
Ties
may be
Strong
Weak
Directed
Management Constructs
influence
Motivation
can be
Extrinsic
can be brought about through
Leadership
Intrinsic
is rooted in
Need
require
Enablers
are combinations of
Time
People
Finance
Technology
occupy
Space
can be
Physical
Virtual
require
Feedback
may scale
Risk
may be used for
Quality Assurance
can inform
Performance evaluation/ measurement
enable
Communication
may be
Visual
Oral
Text
are influenced by
Organisational Structure or Typology
may be
Simple Structure
Machine Bureaucracy
Professional Bureaucracy
Divisionalised
Adhocracy
Missionary
Political
influence and are influenced by
Organisational Culture
is informed by
Time
Geographic location
History
Context
sets
Context
can exist as
Strategy
Policy
Operational plans
Psychological Contracts
are responsible for
Knowledge Structure
need to
Develop artefacts
can be
Objects
Processes
need to
Identify what is known
can lead to
Unlearning
influence
Questioning what is known
brings about
Problem Solving
Epiphany
Extending what is known
KM Solutions
Follow to the next level of The KM Meta-Model
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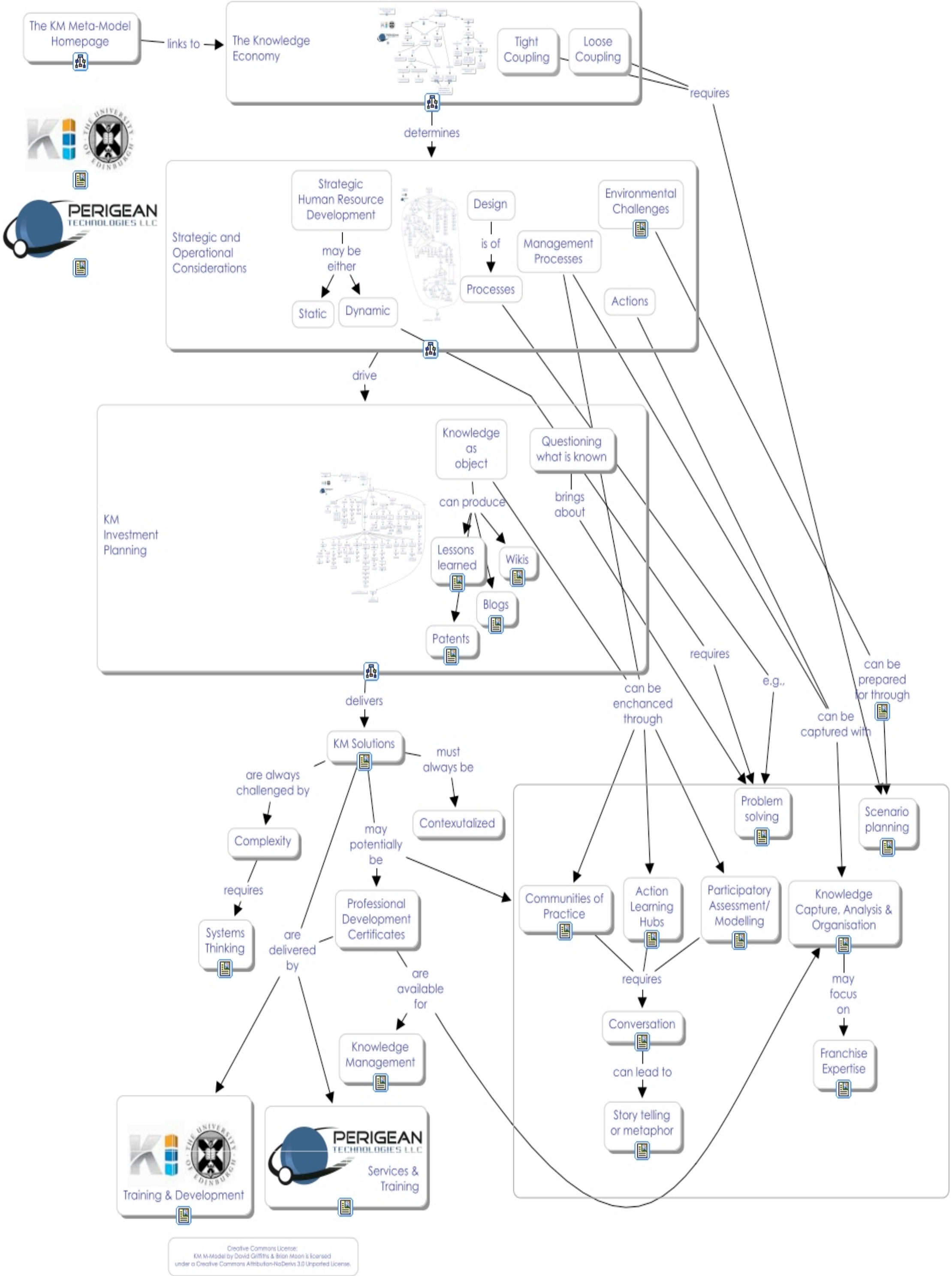
The KM Meta-Model Homepage
links to
The Knowledge Economy
Tight Coupling
Loose Coupling
requires
determines
Strategic and Operational Considerations
Strategic Human Resource Development
may be either
Static
Dynamic
Design
is of
Processes
Management Processes
Environmental Challenges
Actions
PERIGEAN TECHNOLOGIES LLC
drive
KM Investment Planning
Knowledge as object
can produce
Lessons learned
Wikis
Blogs
Patents
Questioning what is known
brings about
requires
e.g.,
can be enchanced through
can be captured with
can be prepared for through
delivers
KM Solutions
are always challenged by
Complexity
requires
Systems Thinking
must always be
Contextualized
may potentially be
Professional Development Certificates
are delivered by
are available for
Knowledge Management
Problem solving
Scenario planning
Communities of Practice
Action Learning Hubs
Participatory Assessment/ Modelling
Knowledge Capture, Analysis & Organisation
requires
Conversation
can lead to
Story telling or metaphor
may focus on
Franchise Expertise
Training & Development
PERIGEAN TECHNOLOGIES LLC
Services & Training

Appendix 8: Lower level meta-analysis findings

Analysis	**Discipline Synthesis**						**Totals**
Discipline	**Computer Science**						
Period	**Pre-1960**	**1960-1969**	**1970-1979**	**1980-1989**	**1990-1999**	**2000-2008**	
No. of articles	1	1	1	2	16	23	44
PR Journals		1	1	2	12	13	29 – 66%
Conference Proc.					2	2	4 – 9%
Books							0 – 0%
Other	1				2	8	11 – 25%
Research type							
Narrative	1	1	1	2	12	15	22 – 50%
Case Study					2	7	9 – 20%
Meta synthesis							0 – 0%
Qualitative					2	1	3 – 7%
Quantitative							0 – 0%
Epist. View							
HR	1						1 – 2%
Interactionist			1		9	14	24 – 55%
Techno		1		2	7	9	19 – 43%
CSF							
Resources	1	1	1	1	16	21	41 – 93%
Creating		1			10	12	23 – 52%
Pre Existing K	1	1		2	15	15	34 – 77%
Extending K	1	1	1	2	14	14	33 – 75%
Reflection	1	1		2	4	6	14 – 32%
Context			1	2	11	13	27 – 61%
Application	1	1	1		11	15	29 – 66%
Motivation	1				3	6	10 – 23%
Social Extension			1		11	18	30 – 68%
Culture				1	4	8	13 – 30%
Structure					6	7	13 – 30%
Space					5	6	11 – 25%
Storing	1	1		2	16	21	41 – 93%
Transmitting	1	1	1	1	15	20	39 – 89%
Artefacts	1	1		2	15	19	38 – 86%
K Structure		1		2	14	14	31 – 70%
Av. CSFs /Article	9	10	9	8	10	9	10 – 62%
High/Low/No.w/all	0	0	0	0	1	1	2 – 5%

Analysis	Discipline Synthesis						Totals
Discipline	Engineering						
Period	Pre-1960	1960-1969	1970-1979	1980-1989	1990-1999	2000-2008	
No. of articles	3	1		2	1	43	50
PR Journals		1		2	1	15	19 – 38%
Conference Proc.						7	7 – 14%
Books						2	2 – 4%
Other	3					19	22 – 44%
Research type							
Narrative	3	1		1		17	22 – 44%
Case Study				1	1	16	18 – 36%
Meta synthesis							0 – 0%
Qualitative						9	9 – 18%
Quantitative						1	1 – 2%
Epist. View							
HR	3	1				10	14 – 28%
Interactionist				2	1	24	27 – 54%
Techno						9	9 – 18%
CSF							
Resources	2	1		2	1	43	49 – 98%
Creating						24	24 – 48%
Pre Existing K	3	1		1		37	42 – 84%
Extending K	2	1		2	1	29	35 – 70%
Reflection	1	1				21	23 – 46%
Context	1			1	1	27	30 – 60%
Application	3			2		31	36 – 72%
Motivation	1					20	21 – 42%
Social Extension	2	1		1	1	35	40 – 80%
Culture	1				1	23	25 – 50%
Structure	1			1		17	19 – 38%
Space	1			1		11	13 – 13%
Storing	3	1				41	45 – 45%
Transmitting	3	1		1		36	41 – 82%
Artefacts	3	1		2		38	43 – 86%
K Structure	2					19	21 – 42%
Av. CSFs /Article	10	8		7	5	10	10 – 62%
No.w/all	0	0		0	0	3	3 – 6%

Analysis	**Discipline Synthesis**						**Totals**
Discipline	**Decision Science**						
Period	**Pre-1960**	**1960-1969**	**1970-1979**	**1980-1989**	**1990-1999**	**2000-2008**	
No. of articles			1	5	6	33	45
PR Journals			1	5	3	14	23 – 51%
Conference Proc.						5	5 – 11%
Books							0 – 0%
Other					3	14	17 – 38%
Research type							
Narrative			1	4	6	15	26 – 58%
Case Study				1		4	5 – 11%
Meta synthesis						1	1 – 2%
Qualitative						7	7 – 16%
Quantitative						6	6 – 13%
Epist. View							
HR			1			13	14 – 31%
Interactionist				1	3	13	17 – 38%
Techno				4	3	7	14 – 31%
CSF							
Resources			1	5	6	32	44 – 98%
Creating				2	4	24	30 – 67%
Pre Existing K				5	5	27	37 – 82%
Extending K				4	3	26	33 – 73%
Reflection				3	5	17	25 – 56%
Context			1	2	3	20	26 – 58%
Application				3	4	23	30 – 67%
Motivation				1		15	16 – 36%
Social Extension				1	4	27	32 – 71%
Culture			1		2	19	22 – 49%
Structure			1		2	14	17 – 38%
Space						6	6 – 13%
Storing			1	5	6	26	38 – 84%
Transmitting			1	3	3	27	34 – 76%
Artefacts			1	5	4	25	35 – 78%
K Structure				5	4	15	24 – 53%
Av. CSFs /Article			7	8	9	10	10 – 62%
High/Low/No.w/all			0	0	0	1	1 – 2%

Analysis	Discipline Synthesis						Totals
Discipline	Business&Management						
Period	Pre-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2008	
No. of articles		1	3	2	25	27	58
PR Journals			3	2	19	12	36 - 62%
Conference Proc.						6	6 - 10%
Books							0 - 0%
Other		1			6	9	16 - 28%
Research type							
Narrative		1		2	11	15	29 - 50%
Case Study			1		10	3	14 - 24%
Meta synthesis							0 - 0%
Qualitative			1		4	7	12 - 21%
Quantitative			1			2	3 - 5%
Epist. View							
HR		1	3	2	14	17	37 - 69%
Interactionist					9	3	18 - 26%
Techno					2	1	3 - 5%
CSF							
Catalysts		1	1	2	24	23	51 - 88%
Creating K			2		11	20	33 - 57%
What is known		1	3	1	16	20	41 - 71%
Extending Wik		1	3		15	18	37 - 64%
Reflection		1	1	1	10	19	32 - 55%
Context		1	3	1	15	19	39 - 67%
Using K		1	2	2	14	16	35 - 60%
Motivation		1	2	1	18	18	41 - 71%
Interacting		1	3		23	27	54 - 93%
Culture			2	1	18	20	41 - 71%
Org. Structure			1		16	12	29 - 50%
Space			1		3	7	11 - 19%
Storing				1	17	19	37 - 64%
Transmitting		1	3	2	20	21	47 - 81%
Artefacts		1	2	1	22	20	46 - 79%
K Structure			1	1	8	9	19 - 33%
Av. CSFs /Article		10	10	7	10	11	10 - 62%
No. including all		0	0	0	1	1	2 - 3%

Analysis	Discipline Synthesis						Totals
Discipline	Medicine&Health						
Period	Pre-1960	1960-1969	1970-1979	1980-1989	1990-1999	2000-2008	
No. of articles	1	1			7	36	45
PR Journals		1			5	18	24 – 53%
Conference Proc.						4	4 – 9%
Books							0 – 0%
Other	1				2	14	17 – 38%
Research type							
Narrative	1	1			6	26	34 – 76%
Case Study					1	7	8 – 18%
Meta synthesis						1	1 – 2%
Qualitative						1	1 – 2%
Quantitative						1	1 – 2%
Epist. View							
HR	1	1				7	9 – 20%
Interactionist					2	18	20 – 44%
Techno					5	11	16 – 36%
CSF							
Catalysts	1	1			7	36	45-100%
Creating K		1			3	15	19 – 42%
What is known	1	1			6	29	37 – 82%
Extending Wik	1	1			3	23	28 – 62%
Reflection	1				2	23	26 – 58%
Context	1				3	30	34 – 76%
Using K	1	1			5	21	28 – 62%
Motivation					2	10	12 – 27%
Interaction	1	1			1	29	32 – 71%
Culture	1				1	15	17 – 38%
Org. Structure		1			2	11	14 – 31%
Space	1	1				5	7 – 16%
Storing	1	1			5	27	34 – 76%
Transmitting	1	1			6	29	37 – 82%
Artefacts	1	1			6	33	41 – 91%
K Structure	1				4	22	27 – 60%
Av. CSFs /Article	13	11			8	9	10 – 62%
High/Low/No.w/all	0	0			0	0	0 – 0%

Analysis	Discipline Synthesis						Totals
Discipline	Social Science						
Period	Pre-1960	1960-1969	1970-1979	1980-1989	1990-1999	2000-2008	
No. of articles	2	4	7	3	15	14	45
PR Journals	2	3	6	2	12	8	33 – 73%
Conference Proc.			1		2	2	5 – 11%
Books				1		1	2 – 4%
Other		1			1	3	5 – 11%
Research type							
Narrative	2	2	6	3	11	11	35 – 78%
Case Study					2	1	3 – 7%
Meta synthesis		1					1 – 2%
Qualitative					1	2	3 – 7%
Quantitative		1	1		1		3 – 7%
Epist. View							
HR	2	3	6	2	4	3	20 – 44%
Interactionist			1	1	11	11	24 – 53%
Techno		1					1 – 2%
CSF							
Resources	1	3	7	2	13	12	38 – 84%
Creating	2	3	2	1	11	10	29 – 64%
Pre Existing K	2	4	3	3	12	13	37 – 82%
Extending K	1	1	4	3	10	11	30 – 67%
Reflection		1	2	1	5	7	16 – 36%
Context		3	4	3	10	10	30 – 67%
Application	1	3	4	3	10	9	30 – 67%
Motivation	2	2	2		8	9	23 – 51%
Social Extension	1	3	4	2	13	11	34 – 76%
Culture	1	3	3	3	11	9	30 – 67%
Structure	1	2	6	2	5	6	22 – 49%
Space		1			4	4	9 – 20%
Storing	2	3	2	1	11	13	32 – 71%
Transmitting	2	4	6	2	14	13	41 – 91%
Artefacts	1	4	2	2	15	11	35 – 78%
K Structure	1	2	4	2	9	8	26 – 58%
Av. CSFs /Article	9	10	9	10	10	10	10 – 62%
No.w/all	0	1	0	0	1	0	2 – 4%

Appendix 9: Meta-Analysis: Models analysed

Author	Model	Year
Martin-Castilla, JI; Rodriguez-Ruiz, O	EFQM Model	2008 9(1) 133-156
Garcia, R	Pratt+Whitney	2006
Roy, R; del Rey, FM; v. Wegen, R; Steele, A	Performance Indicators in KM	2000
Hasan, H; Al-hawari, M	A Knowledge space framework	2003 7(4)15-28
Carrillo, PM; Robinson, HS; Anumba, CJ; Bouchlaghem, NM	A knowledge transfer framework	2006 24(Oct) 1045-1056
de Lusignan, S; Pritchard, K; Chan, T	KM model for clinical practice	2002 48 297-303
Mariam, H	ACT-R	2001
Hubert, C; Lemons, D	APQC's Maturity Model	2008 6/25
Boom, D	Asian development Bank KM Framework	2005 1(2) 69-75
Daghfous, A	KM Core capability framework	2003 (Oct)
Maier, R; Remus, U	Process Oriented framework	2003 7(4) 62-74
Carrillo, PM; Robinson, HS; Anumba, CJ; Al-Ghassani, AM	IMPaKT	2003 1(1) 1-12
Rosenberg, D; Devlin, K	Information based model	2007 1/11
Hung, Y-H; Chou, S-CT	KMM Pyramid Model	2005 1-6
Brassington, J; Hartropp, D	Parachute Consulting Model	2008 (Jul)
Probst, GJB	A practical KM Model	1998 2nd ed.
Mones, A; Ortega, F; Roquemi, N; Mesa, JM; Alvarez, JV	KM4SME An interactive web-based model for knowledge	2003 (Dec)
Hebenstreit, K	D-Development Model	2008 (March 19th)
Holsapple, CW; Singh, M	Knowledge Chain Model	2001 20 77-98
Durrant-Law, G	The STEEP Framework	2008 (April)
Grant, KA; Grant, CT	A composite model for NGKM	2008 (5) 571-590
Remus, U; Schub, S	Blueprint for process-oriented KM	2003 10(4) 237-253
Know-Net.Org	The Know-Net Framework	Not Known
Sureephong, P; Chakpitak, N; Ouzrout, Y; Neubert, G; Bouras, A	Industry Custer KM system	2007 (Dec)
McElroy, M	Knowledge Life Cycle (KLC) Model	2003
Small, CT; Tatalias, J	MITRE KM Model	2000 4(1) 1-5
Diakoulakis, IE; Georgopoulos, NB; Koulouristis, DE; Emiris, DM	A holistic KM model	2004 8(1) 32-46
Zuber-Skerritt, O	Personal KM Model	2005 17(1/2) 49-64
Xu, J; Quaddus, M	Six Stage Model	2005 24(4) 362-373
Lustri, D; Miura, I; Takahashi, S	KMS conceptual model	2007 14(2) 186-202
Long, I; Lai, A	Conceptual model for Chinese medicine	2005 13(3) 244-255
Jambehar, AB; Pelc, KI	A model of Knowledge processes	2006 17(3) 315-331
Wang, C; Luxhoj, JT; Johansen, J	A model for manufacturing vision development	2004 104(9) 735-743
Lee, CC; Yang , J	Knowledge Value Chain Model	2000 19(9) 783-793
Sotirakou, T; Zeppou, M	The MATE model	2004 42(1) 69-88
Ju, TL; Li, C-Y; Lee, T-S	A contingency model	2006 106(6) 855-877
Leonard, A	The viable system model and KM	2000 29(5/6) 710-715
Abou-Zeid, E-S	A KM reference model	2002 6(5) 486-499
v. Beveren, J	Knowledge acquisition model	2002 6(1)18-22
Chen, SS; Yang, CCandLin, WT; Yeh, TM; Lu, YS	Key model for KM systems	2007 18(5) 576-598

Xie, X; Zhang, W; Xu, L	A description model	2006
Li, Z; Xi, Y; Ge, J	Business process model	2008 562-569
Cano, AR; perez-Baslamante, G	A framework model for KM	2006 243-255
Wu, Y-L; Pang, J-J	A framework model for application	2008
Lai, H; Chu, T-H	KM Framework: A synthesis of models	2000
d. Santos, IC; Neto, JA	High technology industry model	2007 1019-1031
Luo, T; Xiong, Z; Fang, Y	Framework for mass customisation	2008 461-466
Collison, C	Collison and Parcell model	2001
MG Taylor Corporation	10 Step KM	1996 November 1st
Aw, KK	KM performance model	2005
Chantarasombat, C; Srisa-ard, B	Model for self-reliant communities	2007 180-189
Sarawanawong, J; Thumask, K; Vongprasert, C; Khiwyoo, J	KM strategic model	2008 Dec
Snowden, D	The ASHEN Model	2000 3(7)
Orzano, JA; McInerney, CRandScharf, D; Tallia, AF; Crabtree, BF	A KM Model	2008 59(3) 489-505
Mohanty, K; Chand, M	5iKM3 Maturity Model	2005
HCI	KM Development Model	2001
Wisdom Source	Maturity Model	2007 2(1) Aug 15th
XCD Limited	Integrated KM Model	Not known
Kok, JA	McKinsey Management Consultants 7S Model	2002 June
Liipfert, CE	BP Process Model	2005
CEN (European committee for standardisation)	European KM framework	2004 March
Lau, F	Conceptual framework	2004 1(8)
Mostert, JC; Snyman, MMM	KM Framework	2007 9(2) June
KolaCo Inc	The Lotus KM Framework	2009
Kerschberg, L	A service oriented framework	2004 March
Lacher, SM; Koch, M	Agent-based framework	2000
Tortorella, F; St. John, C	A model for focused KM	1997
Selamat, MH: Abdullah, R; Paul, JC	Technology support framework	2006 6(8) 101-109
Rabenstine, J	APQC Framework	2002 May
Epistree	KSS KM Framework	2008
Newman, BD; Conrad, KW	Characterisation framework	2000 Oct

Appendix 10: Meta-Analysis literature and coding sample

Author(s)	Year/Vol/Iss	CSF
Carter, LF	1967 October	Ap/P/Q/Rs/T/Rf/Ar/Sc/Mo/Cx
Duncan, JW	1972 15(3) 273-287	T/Sc/Q/P/Ap/Ar/Cx/Mo/Cg
Duncan, JN	1973 11(1) 3-14	Cg/Ap/T/Q/P/Cx/Cu/Sc
Goldner, FH; Ritti, R; Ference, TP	1977 42(4) 539-551	Mo/St/Cu/Cx?t/Ar/Sc/Q/Rf/P/Sp/Rs
v.Mesdag, M	1984 2(1) 53-61	Rs/Ap/T/Mm/Cx/P/Cu
Levitt, T	1989 67(3) p. 8	Ar/Ap/Rf/T/Rs/Mo
Nonaka, I	1991 69(6) 96-104	Cg/T/Ar/Rs/Q/Rf/Ap/Cx/Sc/St/Mo/Cu
Hedlund, G	1994 15(special summer issue) 73-90	Ar/Q/Mm/Rf/T/Ap/P/Sc/St/Cu
Davis, S; Botkin, J	1994 72(5) 165-170	Rs/Ap/Ar/T/Cx
Coulson-Thomas, CJ	1997 1(1) 15-26	St/Sc/Q/P/Cx/Ap/Mm/Rs/Rf/Cu/Ar/Mo
Skyrme, D; Amidon, D	1997 1(1) 27-37	Cu/Rs/Sc/Ar/St/Mm/Cx/P/Q/T/P
Johnson, C	1997 1(1) 50-55	Rs/Sc/Mo/P/T/Rf/Cu/Q/Cg/Ar/Rf/Mm/cx
Chase, RL	1997 1(1) 83-92	Sc/Cu/St/Q/Cg/T/Ap/Rs/Rf/Mo/P/Sp
Newman, V	1997 1(2) 123-128	Q/P/Mo/P/Rs/T/Cx/Ap
Demaresti, M	1997 30(3) 374-84	Cg/P/T/Q/Rs/St/Ap/Ar/Rf/Mm/Cx/Cu/Sc/Mo/St/Sp
Davenport TM	1997 4(3) 187-208	Mm/Rs/Sc/T/Cu/P/Q
Kim, CW; Marborgne, R	1997 75(4) 65-75	Cg/Sc/Q/Cu/Mo/St/Q/Rs
De-Jager, M	1998 - June	Rs/Sc/Mo/Cu/Cx/Mm/T/Ar
Takeuchi, H	1998 - June	P/Cg/Q/Rs/Mm/Sc/T/Cx/St
Bukowitz, W	1998 1(3) 215-224	Sc/P/Rs/Cx/Rf/Ar/Cu/Mo/T
Brand, A	1998 2(1) 17-22	Q/St/Rs/Mm/Sc/Mo/Cx/Cu
Gumbley, H	1998 47(5) 175-177	Rs/Sc/Mm/Ar/Mo/Cu/St/Ap
Baladi, P	1999 10(4) 20-28	Sc/Rs/Mo/St/Cx/Rf/T/Cu/Cg/Ap
Nonaka, I; Reinmoeller, P; Senoo, D	1999 27(10/11) 458-459	P/Q/Mo/Sc/T/Ar/Rs/Mm/Rf/Ap
Cook, P	1999 31(3) 101-5	Cu/St/Rs/Sc/Mo/Ar/T
Cunninham, P	1999 43(6)	Ar/Rs/Ap/Mm/St/Cx
Flanagan, RJ	1999 44(11) 54-55	Mm/T/St/Mo/P/Ap/Rs/Sc
Hansen, MT; Nohria, N; Tierney, T	1999 77(2) 106-116	Mo/Rs/Mm/T/Ar/Sc/P/Q/Cx/Sp
Hansen, MT; Nohria, N; Tierney, T	1999 November 23rd	Ar/Mm/P/T/Rs/Sc/Q/Cu?Mo
Donoghue, LP; Harris, JG; Weitzman, BA	1999 Number 1	St/Cu/Rs/Mm/Ar/Sc
Skyrme, JD	1999(?) 31(2) 84-90	P/Rs/T/Rf/Ar/Mm/Sc/St/Mo
Sveiby, KE	2001 November	Cg/P/Q/T/Rs/Sc/Ap/Cu/Mo/Cx
Alvesson, M; karreman, D; Swan, J	2002 16(2) 282-291	Cg/Mm/Sc/Ap/P/Ar/Rs/T/Mo
Choi,B; Lee, H	2002 23(3) 173-187	P/Q/Cg/Sc/Mm/Rs
Oxbrow, N	2002 April	T/Rs
Oxbrow, N (Ed)	2002 April	Cg/Sc/Rs/Ar/Cu/Mm/Ap/P/Cx/Mo/T/St/Q/Rf
Braun, P	2002 Spring	Rs/P/Mm?Cg/Sc/Ar/Q/Cu/Mo/T
Smith, PAC	2003 (-)	Mo/Sc/Mm/Ar/Rs/Cu
Iftikhar, Z; Eriksson, IV; Dickson, G	2003 1(1) 55-62	R/Sc/Cx/Cu/Mo/St/P/Ap
Sharkie, R	2003 7(1) 20-31	Cu/Mo/Rf/Cg/Mm/Sc/P/Cx/T/Ar
Chou, S-W; He, M-Y	2004 (-)	Cg/Cx/Cu/Sc/P/Ar/T/Q

Yu, s-h; Kim, y-g; Kim, m-y	2004 (-)	Rs/Cu/St/P/Ap/Sc/Cx/Cg/Mo/Mm/Sp
Steinlin, M	2005 1(2) 108-112	Sp/Sc/Rs
Wong, KY	2005 105(3) 261-279	Cu/Rs/Mo/Cx/St/Sc/Mo/Q/Ap
Hung, Y-H; Chou, S-CT	2005 1-6	Rs/St/Cu/Mm/Ap/T/Sc/Cg/St/Cx
Chua, AandLam, W	2005 9(3) 6-17	Rs/Mo/Cu/Sc/Rf/St/P
Supyuengong, V;Islam, N	2006 1210-1219	Rs/Cu/Cx/P/Ar/T/Cg/Mm/Ap/Q/Sc/St
Khalil, O; Claudis, A; Saliem, A	2006 71(3) 34-44	Cg/T/Mm/P/Rs/Ar/Ap/Q/Sc/Sp/Mo/Cu
Evetts, I	2007 (-)	Mo/Rs/Mm/Sc/Ap/Cg/T/Ar/Q
Zhai, Y-K; Cao, X; Dong, Q-Q	2007 1530-1535	Sc/Q/T/P/Cg/Mm/Ap/Ar/Mo/Cx
Bhalla, AandLampel, J	2007 45(7) 1069-82	Sc/Cx/Mo/Ar
Deyong, X; Zhang, X; Zhao, Q	2007 5860-5863	Q/P/Cx/Sc/Mo/Cu/Rs
Johnston, S; Paladim, A	2007 March/April	Q/Cg/P/T/Mm/Rs/Cx/Sc/Ar/St
St. Clair, G; Stanley, D	2007 Oct/Dec	Ap/T/Cx/Q/Rs/Cu/Mo/Sc/Ar/P
Brassington, J; Hartropp, D	2008 - July	Rs/Sc/Cx/St/Ar/Mm/P/Cg/Ap/Q
Moballeghi, M; Galyani Moghaddam, G	2008 6(1) 45-54	Mm/T/Sc/Ar/Rs/P/Cg/Q/Cx/Cu/Ap
Druce, L	2008 April 2nd	Sp/Rs
Bush, V	1945 July	T/Ar/Q/Cg/Rf/P/Rs/Mm/Ap
Maxwell, R	1968 4(2) 87-90	Rs/T/Ap/Q/Rf/P/Ar/Mm/Mo
Hillman, DJ	1977 1(1) 23-30	T/Sc/Cx/Rs/Q/Ap
Levesque, H	1986 (1) 255-87	Ar/Q/P/Rf/Cx/Mm
Applegate, M; Chen, TT, Konoyiski, BR: Nunamaker, JF	1987 3(4) 20-38	Rs/Sc/Q/P/Rf/Mm/Ar/T/Ap
Holsapple, CW; Whinston, AB	1989 2(1) 37-48	Mm/Cu/P/Q/Rs/Ar/Rf/Cx
Nebel, B (Siekmann, J ed)	1990 422 1-33	P/Ap/Ar/Q/T/Rs/Cx/Mm
Sandhal, K; Eriksson, H; Padron-McCarthy, T; Sokolnicki, T; Osterlund, B	1991 3(2) 259-267	Mm/Rs/Ap/Cx/P/Q
Mattos, N	1991 474 127-152	Mm/T/Q/P/Rs
Skuce, D; Lethbridge, TC	1995 42 413-451	Mm/T?Sc?Rs/Ar/P/Sp/Cx
Gundry, J; Metes, G	1996 December	Rs/Sc/Mm/P/Ar/T/Cx/Q/Ap
Henninger, S	1997 4(3) 319-	Rf/Mo/Rs/Mm/Sc/Q/T/P/Ar/Cx/Cg/P/St/Q/Ap
Gaines, BR	1997 9(3) 227-298	P/Q/St/Mm/Sc/Rs/Ap
Boy, G	1997 Aug 1st	Cx/Mm/Rs/Ar/P/T/Sc/Q/Ap
Leibowitz, J	1998 27(2) 170-175	Cg/Mm/T/Sc/Ar/Rf/Rs/P/Ap/Q
O'Leary, DE	1998 March 54-61	Mm/Cu/P/Ar/Rs/Q/Cg/T/Ap/Cx
Alavi, N; Leidner, D	1999 (-)	T/Rs/Cg/Mm/Ar/Cx/Rf/Q/P/Sc/Cu/Mo/St/Ap
Sage, AP; Rouse, WB	1999 1(3) 205-219	Mm/Ar/T/Rs/St/Cg/Cx/Mo/P/Q
Shadbolt, NR; Milton, N	1999 10(4) 309-322	Cg/Rs/Ar/t
Jurisica, I; Mylopoulos, J; Yu, E	1999 101-134	Ar/Mm/Cg/Ap/Q/T/Rs/Cx/Sp/St
Vasconcelos, J; Kimble, C; Gouveia, F; Kudeiko, D	2000 - October	Rs/Mm/T/P/Cx/Sc/Ar/Ap/Rf/St
Piccoli, G; Ahmad, R; Ives, B	2000 1(4) 229-245	Cg/Mm/Ap/Rs/Sc/Mo/Ar/Cu/P
Tochtermann, K; Maurer, H	2000 6(5) 517-536	Rs/Mm/Sc/Ap/Cu/St/T/P/Cg/Cx/Ar/Rf/Q
Rubenfeld, J	2001 (-)	Mm/T/Q/Rs/Sc/Sp/Ar/Ap/St
Walsham, G	2001 19(6) 599-608	Rs/T/Ap/Mm/Cg/Sc/Ar/Q/Mo/Cx/St/P/Cu

Dueck, G	2001 40(4) 885-888	Rs/T/Mm/Sc/Cu
Fahey, L; Srivasta, R; Sharon, JS; Smith, DE	2001 40(4) 889-907	Rs/P/Q/Mm/Cg/Sc/Ap/Cx/T
Tomek, I	2001 7(6) 458-471	Mm/Rs/Sp/T/Cx/Ar/Sc
Kirkland, J	2002 (-)	Rs/Cu/T/Sc/mm/Ar/Mo/P
Chau,KW; Chuntian, C; Li, CW	2002 22(4) 321-330	Ap/Rs/P/Mm/Q
Brzezowski, PE	2002 April	Ar/Rs/Mm/Mo/T/Cx/Ap
Rinhus, A; Johnson-Thorpe, KA; Zhang, J	2003 559-563	Rs/Mm/T/Sc/Q/Ar/Sp
Schutt, P	2003 9(6) 451-462	Rs/Sc/Ar/mm/Mo/Cu/T/Ap/Cx/Sp/St/P
Hori, K; Kakakaji, K; Yamamoto, Y; Ostwald, J	2004 10(3) 252-261	Cg/Sc/Ar/Q/P/T/Mm
Maliappis, MT; Sideridis, AB	2004 21(3) 149-156	Ar/Cx/Mm/Q/Ap/P/Cg
Loebbecke, C; Angehrn, A	2004 490-500	Sc/Cx/Ar/T/Rs/Cg/St/Q/P/Mm/Mo/Cu/Ap/P/Rf
Fallows, J	2004 April 18th	Q/Rs/Mm/Ar
Walsham, G	2005 1(1) 6-18	Cx/Rs/Sc/Ar/Ap/Rf/T/Cg/St/Cu
Avery, JP	2008 December	Cg/Ar/T/P/Rs/Mm/Sc
Association for the advancement of artificial intelligence	2008 Sept 3rd	Mm/P/Sc/Ap/Rs/T/Ar/Cg/Q
Milton, N	2008 Vol 3 02-26 p.1-137	Rs/Mm/P/Cx/Q/Ar/Ap/T/Sc
Johanson, J; Vahlne, J	1977 8(1) 23-32	Sp/Cu/Mm/Rs/Ar/T/Cx
Wiederhold, G	1984 1(1)63	Rs/Cg/P/Cx/Mm/Ar
Shen S	1987 3(1) 1-11	Rs/Q/P/Mm/T/Ar
Peppard, J; Henry, PL	1988 26(6) 42-46	Rs/Cx/Mm/Ap/Ar/Q/Rf
Greenes, RA; Tarabar, DB; Krauss, M; Anderson, G; Wolnick, WJ, Cope, L; Slosser, E; Hersh, W	1989 22(2) 113-135	Rs/Q/P/Ar/Cx/T/Rf/Ap/Mm/Mo
Wilson, LT; Snyder, CA; Daugherty, PS	1998 (-)	Rf/Rs/Mm/Sc/Cu/Ap/p
Nissen, ME	1999 27(1-2) 47-65	Rs/Mm/Ap/Ar/Cg/P/Q/Cx/Sc/Rf
Macintosh, A	1999 51(3) 549-566	P/Mm/Ar/Rs/Sc/Cg/T/Cu/Cx/St
Dieng, R; Corby, O; Giboin, A; Ribiere, M	1999 51(3) 567-598	Cg/T/Mm/Ar/P/Q/Ap/Rf/Rs
Ubogu, FU	2001 (September0	Ap/Rs/Mm/Cg/T/Sc/Cx/Q/Cu/Ar/Q/P
Cortes, U; Sandez-Marie, M; Sanguesa, R; Comas, J; Roda, IR; Poch, M; Riano, D	2001 14(1) 3-12	Ar/Cx/Cg/T/Sc/Mm/Q/Rs/Rf/P/Ap
Courtney, JF	2001 31 (-) 17-38	Rs/Ap/Cu/Sc/Ar/T/Cg/Mm/P/St/Cx/Q/St/Mo/Kst/Rf
Handzic, M	2001 9(1) 16-22	Cg/Sc/Ar/Mm/Ap/Q/Rs/Mo/Cu/Rf/Cx/P
Lipicnik, B	2002 (June)	p/Q/Rf/Cx
Martz, B; Shepherd, MM	2003 1(1) 41-56	Rs/Sc/AP/Q/P/Ar/T/Cg/Mm
Sabherwal, Rajiv; Becerra-Fernandez, Irma	2003 34(2) 225-260	Sc/P/Q/Ar/T/Cx/Ap
Teigland, R; Wasko, MM	2003 34(2) 261-286	Sc/St/Cu/Mo/P/Sp
Morgan, NA; Shaoming, Z; Vorhies, DW, Katsikeas, CS	2003 34(2) 287-321	P/Q/Mm/Sc/St/R/Ar/T
Garcia, R; Calantone, R; Levine, R	2003 34(2) 323-349	P/Rs/Ar/Mo/Cu/St/Q
Janz, BD; Prasarnphanich, P	2003 34(2) 351-84	Cg/Mm/T/Sc/Ap/Cu/Mo/P
Brockman, BK; Morgan, RM	2003 34(2) 385-419	P/Q/Cx/Cu/Rs
Hellstrom, T; Jacob, M	2003 9(55) 55-72	Rs/P/Q/Ap/Sc/Cg/Cx/Cu/Rf
Deshpande, S	2003 June 12th	Cx/Ap/Rs/Ar/St/T
Zngier, S; Burstein, F; McKay, J	2004 (-)	St/Mm/T/Ap/Cg/Q/Rs/Mo/Cu/Sc/Ar/P
Kim, SK; Lim, S; Mitchell, RB	2004 August	P/Mm/T/Sc/Rf/Rs/Cg/Ap/Cx
Chuan, t-Z; Cheng, P-L; Tsai, CT; Cheng, Y-P	2005 31(4) 283-291	Cg/Mm/Q/Sc/Ar/Mo/Cu/Rs/P/Ap/Cx/T

Fu, PP; Tsui, AS; Dess, GG	2006 - July	St/Sc/Rs/Q/Ar/T/Cg/P/Mm/Mo/Cu/Ap
Qureshi, S; Briggs, RO; Hlupic, V	2006 15(3) 197-220	Cg/Ar/Mm/T/Ap/Q/Rs/Sc/Sp/Cu/St/Cx/P
Jones, K	2006 Summer	p/Q/Rf/Cx/Ap/Sc/Mm/Ar/Cg/Mo/Rs/Cu/Sp
Zhang, N; Lu, WF	2007 1 517-522	Cg/Rs/Ap/Mm/Ar/Sc/T/St/Cu
Kedaitiene, A	2008 - April	Rs/Cg/T/St/Sc/Ar/Rf/Mm/Ap/Q/Mo
Federal Ministry of education and research	2008 (estimated - current acess)	Cg/Ap/T/Cx/Rf/Sc/Mo/St/Rs
Holsapple, CW; Wu, J	2008 (-)	Q/Ap/P/Cg/Mm/Rs/Ar/T/Mo/Rf/Cu/Sc
Diez, UI; Urbistondo, AI	2003 (September)	Rs/Cx/Ar/Rf/Mm/Ap/P/T
Edmondson, AC; Winslow, AB; Bohmer,RMJ, Pisano, GP	2003 34(2) 197-223	Cx/Mm/Ar/T/Sc/Q/P/Ap/Rs
Yang, L; Frize, M; Eng, P; Walker, RC; Calley, C	2004 2 3420-3423	Rs/Sc/Q/T/Ar/Rf/Mm
Saint Elizabeth Healthcare	2006 (5)	Cu/P/Ap/Mm/Cg/Rs/St/T/Sc/Sp/Q
The science newsletter	1940 38(3) 47	Ap/Q/Mm/Ar/P/T
Lusty, I	1942 14(7) 201-202	Mm/Ap/Mo/Cx/P/St/Ar/Rf/Rs/T/Sc/Cu/Sp/Q
Aslib	1952 170 (4330) 698-699	T/Ap/Ar/Rs/P/Sc/Mm
Abelson, PH	1968 159(3815) 585	Mm/Ar/Rs/Sc/Q/Rf/T/P
Amidon Rogers, DM	1987 11(2) 75-79	Q/Sc/St/Rs/T/Ap/Ar/Sp
Scmoldt, DL	1989 25(2) 150-165	Ap/Rs/P/Q/Ar/Cx
McConnachie, G	1997 1(1) 56-62	Cx/Rs/Mm/P/St/Cu/Cg/Sc/Ap
Leitjen, E; Maas, G; Vastert, E	1998 1454 449-454	Ar/P/Mm/Rs/T/Ap
Siemens, WD	1998 Oct 30th	Cx?Rs/P/T/Ar/Q/Sc/Rf
Klamma, R; Matthias, J	1999 - September	Cx/T/Rs/Mm/Cg/Ap/Ar/Sc/P/Q/Ap
Clevland Jr, AB	1999 15(28) 28	Rs/Cu/Cx/Q/Sc
Stewart, TA	1999 July 7th	Rs/Sc/Mm/P/St/Mo/Cx/Rf/Ar
Hicks, C; Braiden, PM	2000 - March	St/Ap/Mm/Rs/Q/P/Ar/T/Cg/Cx
Azarian, A; Bueno, R; Aizaga, A	2001 (-)	P/Q/Rs/Mm/T/Ar
Henriksen, LB	2001 21(9) 595-603	Rs/Sc/P/Q/Ap
Lieder, S	2001 77-81	P/T/Ar/Mm/Sc/Mo/Cu/Cx/Rf/Ap/Q/Cg
Hall, WP; Jones, M; Zhou, M; Anticev, J; Zhing, J; Mo, J; Nemes, L	2002 - December	Ar/Cx/T/P/Sc/Mm/Q/Rs/Rf
Voraus, ES	2002 - December	Mo/Cx/Rs/Cg/Ap/T/Rf/Ar
Kamara, JM; Augenbroe, G; Anumba, CJ, Carillo, PM	2002 2(1) 53-67	Cx/P/Cu/Ar/St/Mm/T/Rs
Ellis, S; Rumizan, M	2002 5(1) 12-15	Rs/Q/Mm/Cu/Ap/Ar/Rf
Egbu, Co; Botterill, K	2002 7 125-136	Rs/Cg/mm/Sc/Ap/P/Ar/Cu/Cx/T/Mo/St/Q
Al-Ghassanii, AM; Kamara, JM; Anumba, CJ; Carrillo, PM	2002 7 69-82	Cg/Mm/Sc/Ap/T/P/Cx/mo/Rs/Cu
KCO Agip	2003 (September)	Mm/T/Cx/Mo/P/Rf/Sc/Ap/Ar/Rs
Barnard, Y; Blok, I	2003 339-346	P/Ap/Mm/Rs/Ar/Rf/Cx/Sp/Cg/Q
Barnard, Y; Rothe, A	2003 931-938	Ar/Cx/P/Ap/Mm/Rs/T/Rf/Sc/Mo/Q
Verton, D	2003 August 27th	T/Cu/St/Sc/Rs/Mm/Rf
Desouza, KC	2004 (jan-Feb)	Cg/T/Mm/Ap/Ar/Rs/P/Sc
Barnard, Y; Poyrp, P	2004 112-119	P/RS/AR/CX/Q/AP/CG/SC/T/MM/SP/MO/RF
McMahon, C; Lowe, A; Culley, C	2004 15(4) 307-325	Cg/Sc/Rs/Ap/Ar/P/Mm/Cu/St/Sp
Gagarinski, A	2004 153/3/o/02	T/Rs/Q/Mo/Cx/Ar/Sc/Mm/P

Chen, Y-M; Chen, Y-J; Wang, C-B	2004 170-174	Mm/P/Cg/Q/Ar/T/Rs
Eybu, C; Hayles, C; Quintas, P; Hutchinson, V; Anumba, C; Ruikar, K	2004 July	Cg/Ar/Mm/T/Sc/Ap/Rf/Rs/P/Q/Cx/Mo/Cu/St(full report part 4)
Wallace, I	2005 (-)	Rs/P/Mm/T/Sc/Ar/Sp/St
Denning, S	2005 (estimated)	Q/Ap/Mm/Sc
Dignan, L	2005 08-04	Ar/P/Mm/Rs/T/Sc/Cu
Wang, C-B; Chen, Y-J; Chen, Y-M; Chu, H-C	2005 13(1) 43-56	Ap/P/Mm/Cx/Cg/T/Ar/Rs/Q/Sc
Knudsen, JS	2005 15892) 101-105	St/Sc/Ar/Mm/T/P/Ap/Cx/Rs/Mm/Q/Sp/Cu/Mo
Metaxistis, K; Engazakis, K; Psarras, J	2005 9(2) 6-18	Mm/Sc/Ap/T/Cg/P/Ar/Q/Rs/Sc/Cu/St
Denkena, B; Woelk, PO; Apilz, R	2005 July	Cx/Ar/T/Rs/Cg/Rf/Q/P
Dow, RM; Bobrinsky, N; Pallaschke, S; Spada, M; Warhaut, M	2006 10(2) 22-35	T/St/Q/mm/Ap/Rs/Sc/Sr/Rf/Sp/Cu/P/Cg/Mo/Cx
Wall, C	2006 2(3) 111-122	P/Cu/Sc/Rs/Ar/Q/Cg/Mm/Cx/Ap/Mo
Carillo, P; Chonowsky, P	2006 22(2) 2-10	Rs/Mm/P/Mo/Cg/Ap/Cx/T/Cu/Ar/Sc/Rf/St
Lou, S-J; Tseng, K-H	2006 5(1) 77-82	Rs/Cg/Sc/St/Cu/Mm/Q/T/Ap/Mo/Ar/P
El-Tayeh, A; Gil, N	2007 133(6) 462-473	P/Ar/Q/Sc/Cx/St/Rs/Mm/T/Sp
Grundspenkis, J	2007 18(4) 451-457	St/Rs/P/Mm/Cg/Q/Cu/Sc/T/Sp
Michiko, Y	2007 November	T/Rs/St/Sc/Mm/Ap/P/Rf/Sp/Ar/Cg/Cu
Takahashi, T	2007 Oct 25th	T/Ar/Ap/P/Mm/Rf/Rs/Q
Lindberg, T; Vargesko, AM	2007 Oct/Dec	Rs/Sc/Ar
Tweitmeyer, GA; Lyth, DM; Mallak, LA; Aller, BM	2008 - March	Mm/T/Ar/Rs/Q/Cu/P/Sc/Ap/Mo
Chen, YJ, Chen, YM, Chu, HC	2008 59(4) 395-409	Rs/Mm/T/Sc/P/Cx/Cu/Q/Rf/Ap/Ar
Flores, R; Bissonnette, C; Jones, M; Wagner, M	2008 April/June	Rs/Mm/Ar/T/Rf/P/Ap/Cx
Khota, IA; Pretorius, L	2008 May	Cu/Q/Cg/Rs/Mm/Sc/Cx/Mo/P
Murphy, K; Holm, J	2008 Nov 5th	Cg/Sc/Ap/Ar/Rs/mm/T/Cx/Cu/Mo/P/Q/Sp/Rf/St
Umemoto, K	2002 463-476	Cg/P/Cx/Ar/Mo/Sc/T/Rs/mm/Q/Ap/Sp/Rf/Cu
The Lancet	1908 171(4401) 33-34	T/Mm/Rf/Q/Sc/Cx/P/Ap/Cu/Sp/Ar/Rs
Christman, L	1966 66(9) 2027-2029	Ar/P/Mm/Q/Sp/T/Ap/Cg/St/Sc/Rs
Henry, JB	1990 21(10) 998-1002	RS/Cg/P/Q/Ap/Ar/T/Mm
Cerny, K	1994 72(5) 165-170	Mo/Sc/St/T/Cu/Rs/Cx
Matheson, NW	1995 2(2) 73-78	Rs/Mm/T/Ar/Cg/P/Mo/St
Doyle, MD; Cheong, SA; Martin, DC, Noe, A	1996 20(6) 423-431	T/Ar/Rs/Mm/Cg/P/Q/Kst/Rf/Ap
Bergeron, B	1998 1(6)	Rs/Ar/P/Rf/Ap
Koretz, S; Lee, G	1998 2(2) 53-58	Ap/P/Rs/Mm/Q/Cx/Ar/T
Heathfield, H; Louw, G	1999 5(2) 67-73	T/Rs/Ar/Mm/Ap/P/Cx
Jadad, Ar; Haynes, RB; Hunt, D; Browman, GP	2000 162(3)	Rs/Cg/Sc/Rf/P/Mm/Ar
Davies, HTO; Nutley, SM	2000 320(April 8th) 998-1001	Cu/Q/P/Mm/Cu/Rf/Ar/Cx/Mo/Sc
McColl, A; Roland, M	2000 321(7265) 871-874	P/Ap/Q/Cg/Cx/Rf/Mm/Rs/Ar/Sc
Burns, APCG	2001 356(1412) 1187-1208	Cx/Rs/Ar/P/Sc/Rf/Q/T
McNulty, T	2002 33(4) 439-458	Cg/Ap/Cx/P/St/Rs/Q/Sc
de Lusignan, S; Pritchard, K; Chan, T	2002 48 297-303	Rs/T/Mm/Ar/Cx/Cg/Cu/Q/Sc/Ap
Sensky, T	2002 8 387-395	P/Q/Rs/T/Cu/Mm/Mo/Ap/Cx/Rf/Cg/Ar
Tkach, D	2003 (July 24th)	Sc/Cx/Ar/T/Mm/P/Rs

Bose, R	2003 24(1) 59-71	Sc/T/Ap/Rs/Cx/P/Mm/Cg/Ar
Jiefeng, X; Chen, H; Wu, Z	2003 3 2477-2482	T/Sc/P/Rs/Ar/Sc/Q
Nimmagadda, MRK; Prasad, BVLS	2003 4(2) 257-269	Mm/Ar/Rs/Sc/P/Rf/Cg/Ap/Q/St
Dotan, D	2003 August 24th	Ar/Rs/Cx/T/Rf
Abidi, SSR; Finley, A; Milios, E; Shepherd, M; Zitner, D	2004 (-)	P/Ar/Mm/Q/Cg/T/Rs/Cx/Sc/Ap
Lobodzinski, SM; Criley, M	2004 (-)	Ap/Cx/Rs/Ar/Q/P/Mm/T/Rf
Della Mea, V; Pittaro, M; Roberto, V	2004 136-146	Mm/Cg/Sc/Q/P/Rf/Rs
Hughes, J	2005 (estimated)	Rs/Mm/Cu/Ar/T/Sc/Rf/Cx/Ap/P/Cg/Q
Rowley, M	2005 (estimated)	Mm/Rs/Ap/Sp/Ar/Sc/T
Association of state and territorial health officials	2005 (January)	Mo/Rf/Cx/Sc/Rs/Ap/P/Q/Cu/T/Mm/St/Ar
Barret, M; Fryatt, B; Walsham, G; Joshi, S	2005 1(2) 31-46	Mm/Ar/Cg/Rs/Ap/Rf/T/Cx/Sc/P/St/Cu/Q/Mo
Abidi, SSR	2005 208-213	Ar/Cx/Q/P/Ap/T/Rf/Rs/Mm
Bali, KR; Wickramsingle, N	2006 (Oct)	Rs/Mo/Cx/P/Cu/St/T/Ar
CSIP (knowledge services team)	2006 1(May)	Sc/Cg/Rs/Ap/T/P/Mm/Cx
Peleg, M; Tu, S	2006 72-80	Rs/St/Ar/Sc/Cx/Q/T/Cg/Mm/Rf
Papsupathy, K	2006 July	Rs/Mm/T/Rf/Ar/Cx
Peter S. Dayan, MD, MSc, Martin Osmond, MD, CM, Nathan Kuppermann, MD, MPH, Eddy Lang, MD, Terry Klassen, MD, MSc, David Johnson, MD, Sharon Strauss, MD, Erik Hess, MD, Sandra Schneider, MD, Marc Afilalo, MD, Martin Pusic, MD, MA	2007 14(11) 978-83	Cu/Sc/Rs/P/St
Tokosumi, A; Malsumoto, n; Murai, H	2007 487-490	T/Mm/Rs/Ar/Ap/Sc/Cx
Galvez, C	2008 (-)	Ap/Mm/Ar/Cg/Rs/Q/P/T/Rf/Cx
Sharon, A	2008 12(2)	Rs/Ar/Sc/Cu/Mo
Caldwell, L; Davies, S; Stewart, F; Thain, Aand Wales, A	2008 25(2) 125-134	Rs/Ar/T/Sc/Sp/P/Q/Cx/Mo/Rf
Krishnam, N	2008 November	Cg/Rf/Mm/Q/Sc/Ap/T/P/Ar/Rs/Mo/Sp/Cx/Cu
Mistry, B	2008 (june)	Rs/Mm/Sc/Mo/P/St/Cx/T/Ar/Sp/Cu
Nutting, PG	1918 6(5) 406-416	Ap/Q/T/P/Rs/St/Cu/Sc/Mm/Cg/Mo
Williams, SR	1931 2(8) 415-419	Mm/Cg/Ar/T/P/Mo/Q
Boulding, KE	1966 14(6) 4-7	P/Ar/Cu/T/Mm/Cg/P/Rs
Willis, RE	1966 February	T/Cx/P/Ap/Ar
Havelock, RG; Guskin, MF; Havelock, MH; Hider, J	1969 - July	Q/T/Ap/Sc/Rs/Cu/St/Mo/Sp/Cx/Mm/Ar/P/Rf/Cg
McGuire, J	1969 12(3) 31-38	Ar/T/Cg/Ap/Rs/St/Mo/Mm/Cx/P/Sc/Cu
Farradance, JEL	1970 22(12) 607-616	Cx/Q/Mm/T/Ar/Rs/P/Rf
Henry, NL	1974 34(3) 189-196	Rs/Cg/Ap/T/St/P/Q
Freeman, LD	1974 45(2) 81-97	Cu/T/St/Q/Rf/Cx
Caldwell KC - Carroll, JD; Nenry N (eds)	1975 35(6) 567-572	Cu/Mo/Sc/St/Ap/Mm/P/Q/Rs/Ar
Henry, N	1975 35(6) 572-578	Rs/Sc
Gates, LB - Carroll, JD; Nenry N (eds)	1975 35(6) 581-588	Rs/St/Cx/Cu/Sc/T
Goerl, FG	1975 35(6) 581-588	Cg/Ap/Rs/Mo/T/St/Sc
Freeman, RR	1977 1(3) 215-229	Ap/Cx/Rs/T/St
Bates, R	1983 3rd Ed 54-73	Sc/Ar/Cx/St/T/Cu/Rs/Q/Ap/P
Duncan, JW	1986 5(5) 391-400	Ap/Q/P/Rf/Cg/Sc/Cx/Cu/St
Sinding-Larsen, H	1987 1(2) 93-101	Mm/Rs/Ar/P/Ap/Q/Cx/Cu/T

Falquot, S	1992 23(1) 30-43	T/Cu/Sc/Ap/St/Ar/P/Sc/Mm/Rf/Q/Cx
Nonaka, I	1994 5(1) 14-37	Cu/Cg/Sc/Q/Mo/Ap/T/Cx/P/Rf/Mm/St/Ar/Rs
harrison, S	1995 11(5) 10-14	Cu/Sc/T
Wigg, KM	1997 1(1) 6-14	Rs/T/Ap/Q/Mm/P/Mo
Shariq, SZ	1997 1(1) 75-82	Rs/Ar
Finerty, T	1997 1(2) 98-104	q/Rf/Mo/Cg/T/Mm/Rs/Cx/P/Ap/Ar/Sp/Sc
Ives, W; Torrey, B; Gordon, C	1998 1(4) 269-274	Ar/Rs/T/Sc/Cx/P
Shrivastava, P	1998 11-0	Rs/Cg/Ar/Mm/Sc/Cu/Sp
Corrall, S	1998 18(ISSN: 1361-3200)	Ar/Cg/T/Ap/Cx/Rf/P/Sc/Ap/Mm/Q/Rs/Cu/St/Mo
Petrovic, O; Kailer, N; Scheff, J; Vogel, D	1998 22(7) 277-288	Rs/Cg/T/P/Q/Cx/Sc/Ar/Mo/St/Sp/Cu
Cook, SDNand Brown, JS	1999 10(4) 381-400	Sc/Ap/Cx/Q/Mo/Ar
Mackenzie Owen, J	1999 19(4-5)	Rs/Ar/Mm/Sc/T/Q/Cu/P/Sc
Seonghee, K	1999 20-28	Sc/Q/Cx/Ar/Rs/Cu/Mo/P/T/Mm/Cg/Ap
Hull, R	1999 6(3) 405-428	Ar/Rs/Mm/Cg/T/Ap/Rf/Cx/P/Mo
Koganuramath, MM; Anagadi, M; Hiremath, CV; Bandi, A	2000 76-94	Rs/P/Mm/Ar/T/Cg/Ap
Thomas, JB; Sussman, SW; Henderson, JC	2001 12(3) 331-345	St/Ap/Mm/T/Cu/Cg/Cx/Q/P/Rf/Rs/Ar
J. C. Thomas, W. A. Kellogg, and T. Erickson	2001 40(4)	Cg/Mm/Q/Rf/Cu/P/Cx/T/Ar/Sp/Sc/Mo/Rs
Igonor, A	2002 June	Rs/Cx/P/T/Ap/Rf/Mo/Mm
AmidonandDavis	2004 8(2)	Sp/Sc/Mo/St/Ct/R
Bhojaraju, G	2005 10(2) 37-50	Ar/T/Q/Ap/Rs/Sc/Cu/Mo/Mm/Sp/P/Cg
Antonacopoulou EP	2006 (-)	P/Q/Cu/Cx/Mo/Rf/Sc/Mm
Underdown, A; Blusom, M	2007 (38) December	Rf/Mm/P/Sc/St/Ar/Cx
Kamal Kumar, C	2007 1(1)	Ap/P/Cx/Rs/Mm/Ar/Cg/Sc/Mo/Q/T
de Rezende, JL; de Souza, JM	2007 681-686	Cg/T/Ap/Sc/Mm/P/Ar/Q/Rf/Cx
Parise, S	2007 9(3) 359-383	Q/Mm/Rs/Sc/Mo/Cu/Ar/Cx/St/T/P/sp
Gupta, KS	2008 15(3) 186-195	Cg/Mo/Rs/Sc/Ap/Cx
Clark, G; Kelly, L	2005 (-)	T/Sc/mm/Rs/P/Ap/Q/Cu/Cg/Ar
Vaught, C; Mallett, L; Brnich, Jr; Reinke, D; Kowalski-Trakofler, KM; Cole, HP	2006 3(2/3) 178-191	Rf/P/Mm/Ap/Kst/Ar/Sc/T/Cu/Cx/Cg/Q/Rs

Appendix 11: Chiva and Alegre (2005) – Summary of points of convergence between the concepts of knowledge and learning

Organisational Learning	Organisational Knowledge	Points of convergence
Mainly studied by academics in the area of Human Resources	Mainly studied by academics in the area of Strategic Management	
Two main perspectives: • Cognitive – Based on psychology and individual learning. Seen as rationalist. • Social – Based on sociology and social learning. Seen as relational.	Two main perspectives: • Knowledge as perceptive and as a commodity. Something people possess. • Knowledge is socially constructed with focus being on the process.	Two areas of convergence: • Cognitive-possession Both areas declare a detachment of Learning and Knowledge processes • Social-process
Fails to examine the psychosocial view of learning – seen as the tension between the needs of the individual and those of the organisation: 'some research…shows that individual and organisational goals are rarely the same' (p. 53)		'An organisation learns if any of its units acquires knowledge' (Huber, cited in Chiva & Alegre, 2005, p.52). 'Organisational knowledge is a key component of organisational learning…' (Duncan & Weiss, cited in Chiva & Alegre, 2005, p.52)
Cognitive-possession perspective • Social - Many authors focus on the how individuals learn within an organisation or how individual learning can translate to organisational learning through 3 main theories. Behaviourist Cognitivist Humanist All focus on 'the individual as a self-directed and individually autonomous' (p. 52) • Cognitive – This approach has two schools of thought: Individual learning as a model for organisational action. Proposes that organisations can learn as they have similar capacities as individuals. Organisational learning as individual learning in an organisational context. Organisational learning is seen as a gestalt of individual learning, with acknowledgement of the role of the individual. The cognitive perspective sees organisational learning to be a process that responds to information of a mainly explicit nature. Authors in this area tend to identify learning processes without accounting for the context in which they were developed.	***Cognitive-possession perspective*** • Positivist - Derived from the work of Grant, Nelson & Winter and Nonaka in developing knowledge as perceptive and a commodity. 'Reality is taken as fact, and consequently can be disclosed through attentive perception' (p. 53). Knowledge is seen as existing in people's minds and is capable of being codified and transmitted to others. • Connectionist – This process is a variant suggested by Kogut & Zander and expanded by Venzin who suggests that knowledge is the generated in networks and relationships and is removed from the individual. • Three approaches as cited by the authors: Grant – The creation of knowledge is grounded in the individual. Spender – Knowledge is moulded by organisation culture. Nonaka – Knowledge is generated by the individual, but moulded by the organisation.	***Cognitive-possession perspective*** • Individual knowledge shared throughout the organisation • Embedded within the culture of the organisation • Individuals generate and contribute to overall organisational knowledge
Social-process perspective • Bandura - Learning can take place through the observation of behaviour and its consequences • Lave & Wenger - Model of 'situated learning', seen as forms of knowledge acquired in social relationships • Huysman – organisational learning is generated through social interactions within the workplace • The process is founded on the premise that learning is achieved through 'active participation, not based on the individual, bit on the social practice of organisational life, which is constantly being modified and, consequently, this perspective is based on change, not order and regulation' (p. 56).	***Social-process perspective*** • Focus is directed toward the process or development of knowledge. • Spender – Knowledge is socially constructed • Durand and Van Krogh acknowledge two approaches to knowledge: Perceptive or cognitive Constructionist or social • Blackler, Spender and Gherardi & Nicolini acknowledge two approaches to the nature of knowledge: Something people possess Something people create Both approaches are seen as being related. • Van Krogh – discusses systems theory and social construction theory in proposing that 'reality is socially constructed or conceived' (p. 57) and is dependent on context	***Social-process perspective*** • Social, beliefs developed through social interaction between individuals and groups. • Knowledge is a process

Appendix 12: Research Outputs

Awards

Emerald Literati Network Awards for Excellence 2012 – Highly commended award: Griffiths, D.A and Evans. P.E. (2011) Scaling the fractal plain: Towards a general view of Knowledge Management, *Journal of European Industrial Training,* 35(8), 779-807

Conference Papers

Griffiths, D.A. and Morse, S.M. (2009) A paper on Knowledge Management, *University Forum for Human Resource Development, 10th International conference – June 09,* Newcastle

Griffiths, D.A. and Morse, S.M. (2009) Knowledge Management: Towards overcoming dissatisfaction in the field, *World Academy of Science Engineering and Technology – June 09,* 54, 724-735

Griffiths, D.A. (2009) A model to challenge the Knowledge Management Field, *10th International Conference on KM,* Hong Kong

Griffiths, D.A. and Evans, P.E. (2010) Scaling the fractal plain, *University Forum for Human Resource Development, 11th International Conference – June 10,* Pecs

Griffiths, D.A. and Koukpaki, S. (2010) The problem with Knowledge Management, *University Forum for Human Resource Development, 11th International Conference – June 10,* Pecs

Griffiths, D.A., Hughes, A. and Maraghi, F. (2011) Taking the lead: The role of Higher education in Societal KM, *10th OECD conference on the theme of Entrepreneurship and Society: "Creating Social, Economic, Cultural and Personal Value*, January 2011

Academic Publications

Griffiths, D.A., Koukpaki, S. and Martin, B. (2010) The Knowledge Core: A new model to challenge the Knowledge Management field, *Journal of Knowledge Systems Science,* 1(1), 3-17

Griffiths, D.A., Koukpaki, S. (2010) Are we stuck with Knowledge Management: A case for Strategic Human resource Development, *Journal of Knowledge Systems Science,* 1 (4), 41-60

Griffiths, D.A and Evans. P.E. (2011) Scaling the fractal plain: Towards a general view of Knowledge Management, *Journal of European Industrial Training,* 35(8), 779-807

Griffiths, D.A. (2011) Knowledge and learning at the new frontier: A case study in an emerging market, *Journal of KM Practice,* 12(1), electronic journal

Griffiths, D.A., Maraghi, F. and Evans, P. (2012) Taking the lead: The role of Higher Education Institutions in Societal HRD, *Advances in Human Resource Development,* Societal HRD special edition, forthcoming

Professional Publications (Reports)

Griffiths, D. A (2011) *Knowledge Management: New principles for better practice,* London: Ark Publications

Professional Publications (Case Studies)

Griffiths, D. A (2011) *The Unichem Case Study,* CIPD Case Study Club

Professional Publications (Articles)

Griffiths, D.A. and Moffat, D. (2011) Protecting the value of what you know, *Policing Today,* online www.policingtoday.co.uk

Griffiths, D.A. (2011) I say tomato, *Inside Knowledge,* 14(7), 26-29

Griffiths, D.A. (2011) KM is dead! Long live knowledge!, *Inside Knowledge,* 14(9), 5-7

Griffiths, D.A. (2011) KM Fairy Tales, *Managing Partner,* June/July, 60-63

Griffiths, D.A. (2011) Reaping growth through KM, *Managing Partner,* October, 60-61

Griffiths, D.A. and Moon, B. (2011) The state of Knowledge Management, *KM World,* 20(10), 16-17 and 28

Griffiths, D.A. (2012) Building for a future: Creating KM strategies to take your organisation forward, *InPerspective (CPA Magazine),* winter, 30-31

Griffiths, D.A. (2012) Leadership, tomorrow belongs to knowledge, *InPerspective (CPA Magazine),* spring, 34-36

Book Chapters

Griffiths, D.A., Koukpaki, S. and Martin, B. (2012) The Knowledge Core: A new model to challenge the Knowledge Management field, IN KLINGER, K (Ed.), *Organisational learning and knowledge: Concepts, tools and applications,* London: Information Science Reference 1-21

Griffiths, D.A., Koukpaki, S. (2012) Are we stuck with Knowledge Management: A case for Strategic Human resource Development, IN KLINGER, K (Ed.), *Organisational learning and knowledge: Concepts, tools and applications,* London: Information Science Reference 525-539

Keynote or Plenary Presentations

Griffiths, D.A. (2010) The critical factors in managing knowledge, *presented at KM Russia,* Moscow

Griffiths, D.A. (2010) How to manage knowledge, *presented at KM Asia,* Singapore

Griffiths, D.A. (2011) The critical factors in managing knowledge, *presented at the University of Dublin LINK Seminar Series,* Dublin

Griffiths, D.A. (2011) A strategy for KM, *presented at KM Asia,* Singapore

Griffiths, D.A. (2011) The future of KM, *presented at Vision 2030,* Bahrain

Griffiths, D.A. (2011) What drives KM, *presented at K-Net 2011,* Edinburgh

Griffiths, D.A. (2011) Strategy and tactics for KM, *presented at the European Training Foundation Living Knowledge Seminar,* Turin

Griffiths, D.A. (2012) The cost of relearning what you already know, *presented at KM Kuwait,* Kuwait

Griffiths, D.A. (2012) The future is dynamic, the future is knowledge, *presented at Niveus Performance Improvement seminar,* Finland

Griffiths, D.A. (2012) KM and Organisational Learning, *presented at the University of Henley KM Conference,* Henley