How could Knowledge Management support Innovation in Small to Medium-sized Enterprises in the UK Energy Sector?

by

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Abstract

How could Knowledge Management (KM) support Innovation in Small to Medium-sized Enterprises (SMEs) in the UK Energy Sector?

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The knowledge management process is crucial in fostering and sustaining competitive innovation processes that create economic and social value through the generation, development and implementation of ideas. These new ideas are behind the production of new or significantly improved products and processes. The organisations which have readily adopted and implemented KM are found to be the larger, well financed and better resourced organisations. There are many success stories of KM in large organisations, but these have not been replicated in Small to Medium-sized Enterprises (SMEs).

This study explores how KM could be used in SMEs to support innovation. The research question was further divided into three *research objectives:* What are the KM goals of SMEs? What are the Innovation goals of SMEs? What association is their between KM and Innovation in SMEs which could be further explored? The research design for the project is based on a deductive research approach composed by an extensive literature review, to express an informed conceptual model, and a sector wide questionnaire survey, to identify issues emerging from practice. The questionnaire uses a purposively theoretical/conceptual model (KMOLI Cycle) deduced from the literature review. The model was improved by mapping it against KM-Innovation activities. The questionnaire tests aims to identify issues or discrepancies between the theoretical/conceptualisation and actual KM-Innovation activities. This deductive approach questioned a universe of 400 UK SMEs from the UK Energy Sector. This report presents the findings of the questionnaire as well as the findings of research project as a whole. It was found that SMEs are surprisingly innovation and KM active but lack a strategic perspective for both KM and innovation. The questionnaire highlighted a number of discrepancies for further exploration.

Acknowledgements

This research project has been a thoroughly enjoyable experience for me. Having experienced over 6 years of laboratory based scientific experiments it was a real opening experience to learn about the field of social sciences. I've always considered the "people element" of experiments to be important but was unable to pursue this line of inquiry in my original setting.

I thank God for providing me with this opportunity to draw closer to him and develop my skills and expertise with this research project. I'd also like to thank my mother and father for their endless encouragement to pursue and complete this project. Thank you also to my wife without whom I could not have completed this. Thank you also to my friends and family for providing me with the financial support to compensate for the lack of direction in the initial stages of this project.

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Chapter 1: Introduction

Knowledge is a valuable asset which can enhance organisation competitiveness. Subsequently, knowledge is acknowledged as an important organisational asset that needs to be appropriately managed to realise its value. This knowledge management process is crucial in fostering and sustaining competitive innovation processes that create economic and social value through the generation, development and implementation of ideas. These new ideas are behind the production of new or significantly improved products and processes. Hence, the global interest in Knowledge Management (KM) and the consensus that KM is an ideal vehicle to enable innovation. However, the organisations which have readily adopted and implemented KM are found to be the larger, well financed and better resourced organisations. There are several success stories of KM in large organisations, but these have not been replicated to the same extent in Small to Medium-sized Enterprises (SMEs). Although most SME managers acknowledge the importance of knowledge as a competitive factor for its organisation, there are many obstacles in the successful implementation of KM in SMEs, mainly finance and resource constraints.

This study endeavours to further investigate this phenomenon to elucidate and contribute to this field of learning. The following sections will explain the research question and objectives; and the layout of the thesis.

1.1 Research Question and Objectives

As mentioned above and explained in the following sections, the organisations which have readily adopted and implemented KM are found to be the larger, well financed organisations. Generally, SMEs face a different set of challenges, compared to larger organisations, which are mainly associated with finance and resource limitations. Consequently, these issues have a knock-on effect on what strategies and systems SMEs can adopt to realise its strategic ambitions.

Nevertheless, there is a growing interest in KM amongst the academic and business communities, including SMEs, as the KM discipline matures. The interest follows some of the successful results obtained by the larger organisations. Therefore, the use of KM in SMEs is an area which requires

further investigation in order to replicate the achievements of KM with the larger organisations.

The overarching research question guiding this project was formulated as follows:

"How could Knowledge Management (KM) be used to support Innovation in Small to Medium-sized Enterprises (SMEs) based in the UK Energy sector?"

This question is further explicated into the following sub-questions for the purpose of this study:

- What are the KM goals of SMEs based in the UK Energy sector?
- What are the innovation goals of SMEs based in the UK Energy sector?
- What are the relationships, processes, practices and understandings between KM and innovation in SMEs based in the UK Energy sector?

1.2 Layout of Thesis

This thesis is divided into the following chapters:

Chapter 1 (Introduction) provides a brief overview of the whole thesis including the research question and objectives; and structure of the thesis;

Chapter 2 (Research Methodology) explains the research philosophy, methods and techniques driving this study to help understand the research question and objectives. In short, the study was originally intended to implement an inductive triangulation approach to investigate how KM could be used to support innovation in SMEs based in the UK Energy sector. The literature review was used to express an informed conceptual model of KM and Innovation in SMEs called the Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle. A sector wide questionnaire survey, comprising of 30 questions, was designed and implemented to verify the conceptual model and identify discrepancies between the model and reality. It was then intended to explore the issues, which could not be explained by the questionnaire, via an exploratory case study analysis. Participants for the case study were identified and an interview script was designed to explore the issues, identified from the questionnaire survey, using a semi-structured interview approach. Consequently, after the analysis of the qualitative data from the case study analysis, it was intended to review the original KMOLI Cycle and suggest modifications and further improvements. However, due to

unforeseen circumstances, this study could not go further and explore the issues identified by the questionnaire by implementing the case studies.

Chapter 3, 4 and 5 are part of the literature review. Chapter 3 provides an overview of the UK Energy sector and the challenges which the organisations in this sector are currently facing; and presents KM as a possible solution to help these organisations meet these challenges. Chapter 4 presents an overview of innovation and how it relates to the research question including information on innovation in SMEs. Chapter 5 provides an outline of the relationship between KM and innovation using the available literature; and then presents the KMOLI Cycle and explains how it was formulated.

Chapter 6 (Questionnaire Survey), presents the key findings and some discussion from the questionnaire survey. This chapter is subdivided into a further two sections: Part 1 "Descriptive Statistics"; and Part 2 "Exploratory Statistics". Part 1 identifies the key findings for each of the 30 questions from the questionnaire and includes some discussion of these findings and subsequently identifies further queries. Descriptive statistics, including bar charts and pie-charts were used to illustrate the key findings from the questionnaire survey. In Part 2, 22 relationships were identified from Part 1, which were considered by the researcher to help understand the research question and objectives. Part 2 is further divided into three sections: KM relationships; Innovation relationships; and KM and Innovation relationships. KM relationships comprise of key relationships, identified by the researcher, which help understand the KM goals in SMEs based in the UK Energy sector. The Innovation relationships include key relationships which help understand the innovation process in SMEs. Finally, the KM and Innovation relationship comprise of key relationships, identified by the researcher, which provide an understanding of how SMEs could use KM to support innovation. These relationships were explored using Chi-square and Fishers Exact Tests using the software package Statistical Processing for Social Scientists (SPSS) to ascertain the statistical significance of these 22 relationships.

Chapter 7 (Discussion Summary) provides a summary of the key discussion points from the previous chapter and discusses how these relate to the research question and objectives.

Chapter 8 (Conclusions and Future Work) presents a synthesis of the discussions from Chapter 6 and Chapter 7 in the form of conclusions. Key discrepancies between the KMOLI cycle and questionnaire findings are

presented for further exploration. Practical implications are also suggested for SMEs to use KM to support innovation in the UK Energy sector.

Chapter 2: Research Methodology

2.1 Introduction

This chapter explains the research methodology adopted for this study and is divided into the following sections:

The first section identifies the key theoretical propositions derived from the literature review. The second section provides some general background to the research process and philosophy. The second section explores the general research strategy. The third and final section explains the actual research approach and strategy adopted for this study.

The study was originally intended to implement an inductive triangulation approach to investigate how KM could be used to support innovation in SMEs based in the UK Energy sector. The literature review was used to express an informed conceptual model of KM and Innovation in SMEs called the Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle. A sector wide questionnaire survey, comprising of 30 questions, was designed and implemented to verify the conceptual model and identify discrepancies between the model and reality. It was then intended to explore the issues, which could not be explained by the questionnaire, via an exploratory case study analysis. Participants for the case study were identified and an interview script was designed to explore the issues, identified from the questionnaire survey, using a semi-structured interview approach. Consequently, after the analysis of the qualitative data from the case study analysis, it was intended to review the original KMOLI Cycle and suggest modifications and further improvements. However, due to unforeseen circumstances, this study could not go further and explore the issues identified by the questionnaire by implementing the case studies.

Furthermore, a number of conference papers were successfully submitted and presented at various conferences explaining the original approach (see Appendix 4 for more details). An invitation was sent to the researcher to submit in the special issue on "Using Technology for Innovation and Knowledge Sharing in SMEs: Socio-technical Approaches" for The International Journal of Knowledge Management Studies (IJKMS). As a result, this study could be continued study to explore the issues identified from the questionnaire.

2.1.1 Theoretical Propositions

This section highlights the key theoretical propositions derived from the literature review. These theoretical propositions are divided into three areas: 'KM'; 'Innovation'; and 'KM and Innovation'. However, the theoretical propositions for 'KM and Innovation' were formulated after the analysis and discussion of the 'KM' and 'Innovation' propositions, consequently these 'KM and Innovation' propositions are identified and discussed in Chapter 4 (Part 2).

Nevertheless, the following two tables identify the key theoretical propositions for 'KM' and 'Innovation' and the appropriate question(s) where the proposition was operationalised.

Theoretical Proposition - Knowledge Management	Questionnaire Reference
KM Awareness: The majority of SMEs have heard of KM.	Q7
Knowledge as a competitive factor: The majority of SMEs acknowledge that knowledge is one of their most competitive factors.	Q8
Level of KM implementation: The majority of SMEs realise significant benefits from developing a knowledge-conscious style of management and specific knowledge actions.	Q9
KM Strategy: The majority of SMEs have a formal KM strategy.	Q11
Continuous Identification and Mapping of knowledge: The majority of SMEs continuously identify and map knowledge within its organisation.	Q14
Organisation facilitation of Employees' acquisition of Information and Expertise: The majority of SMEs facilitate employees to acquire information and expertise.	Q22
Awareness of relevant Information and Expertise availability: The majority of SMEs make their employees aware of information and expertise available for current projects and activities.	Q26
Encouragement of Information and Expertise dissemination and sharing: The majority of SMEs encourage their employees to share and disseminate expertise and information which may help other employees within the organisation.	Q27
Knowledge Acquisition activities and instruments: The majority of SMEs use all 10 Knowledge Acquisition activities and Instruments.	Q21-Q30
Knowledge Development activities and instruments: The majority of SMEs use all 19 Knowledge Development activities and instruments.	Q21-Q30
Knowledge Embodiment activities and instruments: The majority of SMEs use all 17 Knowledge Embodiment activities and instruments.	Q21-Q30
Knowledge Sharing and Dissemination activities and instruments: The majority of SMEs use all 25 Knowledge Sharing and Dissemination activities and instruments.	Q21-Q30
Knowledge Use and Revision: The majority of SMEs use all 17 Knowledge Use and Revision activities and instruments.	Q21-Q30

Table 1: Key Theoretical Propositions for Knowledge Management

Theoretical Proposition - Innovation	Questionnaire Reference
Allocation of resources to KM activities: The majority of SMEs allocate resources to KM activities.	Q12
Innovation Strategy: The majority of SMEs have a formal innovation strategy.	Q15
Allocation of resources to innovation activities: The majority of SMEs allocate resources to innovation activities.	Q16
Systems and Processes to facilitate ideas from discovery to implementation: The majority of SMEs 'agree' and 'strongly agree' that they have systems and processes in place to facilitate ideas from discovery to implementation.	Q17
Improvements in Strategy, Marketing, Organisation Structure, Operations and Management: The majority of SMEs have made improvements in strategy, marketing, organisation structure, operations, and management.	Q18
Introduction of improved and/or new products and/or services to the market: The majority of SMEs introduce new and/or improved products or services to the market; and develop these on their own.	Q19 & Q20
Idea activities and instruments: The majority of SMEs use all 11 'Idea' related activities and instruments.	Q21-Q30
Tacit Knowledge activities and instruments: The majority of SMEs use all 11 'Expertise' related activities and instruments.	Q21-Q30
Explicit Knowledge activities and instruments: The majority of SMEs use all 14 'Information' related activities and processes.	Q21-Q30

Table 2: Key Theoretical Propositions for Innovation

The following section discusses the research process and approach taken to test the above theoretical propositions.

2.2 The Research Process

Saunders et al., (2003) define research as something that people undertake in order to find out things in a systematic way, thereby increasing their knowledge. Nevertheless, there appears to be no consensus with regards to a definition of 'research'. Buckley et al. (1975) suggest that an operational definition of research requires the satisfaction of the conditions that:

- it be an orderly investigation of a defined problem;
- appropriate scientific methods be used;
- adequate and representative evidence be gathered;
- logical reasoning, uncoloured by bias, be employed in drawing conclusions on the basis of the evidence;
- the researcher be able to demonstrate or prove the validity or reasonableness of their conclusions;
- the cumulative results of research in a given area yield general principles or laws that may be applied with confidence under similar conditions in the future.

Then (1996) explains that research relies on facts, experience and data, concepts and constructs, hypotheses and conjectures, and principles and laws and is conducted in the spirit of scientific inquiry. Furthermore, Then (1996) illustrates how together these concepts of research form a symbolic and rational system of inquiry as illustrated in Figure 1 below.

Before the guidelines for the research project are suggested, it is useful to define the basic elements of the research process. Crotty (1998) suggests that the basic elements of any research process include methods, methodology, theoretical perspective(s) and epistemology. Hence, it is essential for any rigorous research attempt to clarify and explore the answers to the following questions:

- What methods (techniques, procedures, i.e. interviews, observations, etc.) are to be used?
- What methodology (strategy, plan of activity, process of design, i.e. ethnography, action research, etc.) governs our choice of methods?

- What are the theoretical (philosophical) perspective(s) of looking at the world and making sense of it (i.e. systemic thinking, complexity theory, theory of language, etc.) that influence our logic and criteria and provide context for applying the methodology?
- What epistemology grounds the theoretical perspective(s)?

Laws	Verified hypotheses; used to assert a predictable association among variables; can be empirical or theoretical
Principles	A principle is a law or general truth which provides a guide to thought or action
Hypotheses	Formal propositions which, though untested, are amenable to testing; usually expressed in causal terms
Conjectures	Informal propositions which are not stated in a testable form, nor is a causal relationship known or even necessarily implied
Concepts and constructs	Concepts are inventions of the human mind to provide a means for organising and understanding observations; they perform a number of functions, all of which are designed to form logical and systematic relationships among data
Facts	Something that exists, a phenomenon that is true or generally held to be true
Data	The collection of facts, achieved either through direct observations or through garnering from records; observation is the process by which facts become data

Figure 1: Basic elements of Scientific Research Methodology (Then, 1996)

These questions are mutually associated and require a clear understanding of the research process to enable the most effective research strategy for any research question. Furthermore, as Remenyi et al., (1998) explain that there are many factors to be considered when choosing an appropriate research methodology, with the topic to be researched and the specific research question being primary drivers.

The starting point in any research project is to focus clearly on the fact that the ultimate purpose is to add something of value to the body of existing knowledge guided by a research question or objective. In this study, in short, an unanswered or partially answered question or unsolved problem is ascertained and explored and consequently the researcher endeavours to construct an appropriate response to the question.

This study investigates how SMEs use KM to support innovation using social survey methods, as De Vaus (2002) explains that research in the social sciences is both descriptive (what is going on) and explanatory (why is it going on). The following section explores the philosophy of the research process in general before providing the research approach adopted by the researcher.

2.2.1 Research Philosophy

Philosophers of science have been engaged in a long-standing debate about how best to perform research. Thomas Kuhn (1962) popularized the idea of a paradigm. Paradigm is a general concept that includes a group of researchers having a common education and an agreement on "exemplars" of high quality research or thinking (Kuhn, 1977). Consequently, and most recently, Onwuegbuzie and Leech (2005), amongst others, argue that there is now a trilogy of major research paradigms: qualitative research, quantitative research, and mixed methods research. This debate has centred on the relative value of two fundamentally dissimilar and competing schools of thought or paradigms.

That is, quantitative purists (also called positivists) believe that social observations should be treated as entities in much the same way that physical scientists treat physical phenomena. Further, they contend that the observer is separate from the entities that are subject to observation (Onwuegbuzie and Leech, 2005). The emphasis on objectivity in social science inquiry is asserted by quantitative purists. That is, time- and context-free generalizations (Nagel, 1986) are desirable and possible, and real causes of social scientific outcomes can be determined reliably and validly. Then (1996) illustrates some of the widely acknowledged strengths and weaknesses of this approach in Figure 3.

On the other hand, Qualitative purists (also called constructivists and interpretivists) reject what they call positivism. They argue for the superiority of constructivism, idealism, relativism, humanism, hermeneutics, and, sometimes, postmodernism (Guba & Lincoln, 1989; Lincoln & Guba, 2000; Schwandt, 2000; Smith, 1983, 1984). This approach tries to understand and explain a phenomenon, rather than search for external causes or fundamental laws (Easterby-Smith, 1991). These purists contend that multiple-constructed realities abound, that time- and context-free generalizations are neither desirable nor possible, that research is value-bound, that it is impossible to differentiate fully causes and effects, that logic flows from specific to general (e.g., explanations are generated inductively from the data), and that knower and known cannot be separated because the subjective knower is the only source of reality (Guba, 1990). Silverman (1998) illustrates these two approached in Figure 2 below. Furthermore, Then (1996) illustrates some of the strengths and weaknesses associated with the qualitative approach in Figure 3.

Theme	Strengths	Weaknesses
Positivist (quantitative paradigm)	They can provide wide coverage of the range of situations They can be fast and economical Where statistics are aggregated from large samples, they may be of considerable relevance to policy decisions	The methods used tend to be rather inflexible and artificial They are not very effective in understanding processes or the significance that people attach to actions They are not very helpful in generating theories Because they focus on what is, or what has been recently, they make it hard for policy makers to infer what changes and actions should take place in the future
Phenomenological (qualitative paradigm)	Data-gathering methods seen more as natural than artificial Ability to look at change processes over time Ability to understand people's meaning Ability to adjust to new issues and ideas as they emerge Contribute to theory generation	Data collection can be tedious and require more resources Analysis and interpretation of data may be more difficult Harder to control the pace, progress and end-points of research process Policy makers may give low credibility to results from qualitative approach

Figure 2: Two Schools of Science (Silverman, 1998)

Specifically, these camps have comprised positivists on one side and interpretivists on the other side. Interestingly, as noted by Sechrest and Sidani (1995), it is only in the social and behavioural sciences that the merits of both research paradigms are so intensely debated. Nevertheless, as Onwuegbuzie and Leech (2005) explain that both sets of purists view their paradigms as the ideal for research, and, implicitly if not explicitly, they advocate the incompatibility thesis (Howe, 1988), which posits that qualitative and quantitative research paradigms, including their associated methods, cannot and should not be mixed.

Theme	Strengths	Weaknesses
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Phenomenological (qualitative paradigm)	Data-gathering methods seen more as natural than artificial Ability to look at change processes over time Ability to understand people's meaning Ability to adjust to new issues and ideas as they emerge Contribute to theory generation	Data collection can be tedious and require more resources Analysis and interpretation of data may be more difficult Harder to control the pace, progress and end-points of research process Policy makers may give low credibility to results from qualitative approach

Figure 3: Comparison of Quantitative and Qualitative Strengths and Weaknesses (Then, 1996)

As Creswell (1994) explains that the purpose of mixed methods research is not to substitute either of these approaches but rather to draw from the strengths and curtail the weaknesses of both in single research studies and across studies. Furthermore, as Onwuegbuzie and Leech (2005) illustrate that if you visualize a continuum with qualitative research anchored at one pole and quantitative research anchored at the other, mixed methods research covers the large set of points in the middle area. If one prefers to think categorically, mixed methods research sits in a new third chair, with qualitative research sitting on the left side and quantitative research sitting on the right side.

Methodological work on the mixed methods research paradigm can be seen in several recent books (Brewer & Hunter, 1989; Creswell, 2003; Greene, Caracelli, & Graham, 1989; Johnson & Christensen, 2004; Newman & Benz, 1998; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003). As Creswell (2003) explains much work remains to be undertaken in the area of mixed methods research regarding its philosophical positions, designs, data analysis, validity strategies, mixing and integration procedures, and rationales, among other things. Nevertheless, mixed methods research presents a great opportunity for researchers in practice who would like to see methodologists explain and develop techniques that are nearer to what

researchers in point of fact use in practice. Mixed methods research as the third research paradigm can also help bridge the schism between quantitative and qualitative research (Tashakkori & Teddlie, 1998, 2003; Creswell, 2003; Onwuegbuzie & Leech, 2004). Figure 4 below provides a summary of the strengths and weaknesses of this approach.

Strengths and Weaknesses of Mixed Research

Strengths

- Words, pictures, and narrative can be used to add meaning to numbers.
- Numbers can be used to add precision to words, pictures, and narrative.
- Can provide quantitative and qualitative research strengths (i.e., see strengths listed in Tables 3 and 4).
- Researcher can generate and test a grounded theory.
- Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach.
- The specific mixed *research designs* discussed in this article have specific strengths and weaknesses that should be considered (e.g., in a two-stage sequential design, the Stage 1 results can be used to develop and inform the purpose and design of the Stage 2 component).
- A researcher can use the strengths of an additional method to overcome the weaknesses in another method by using both in a research study.
- Can provide stronger evidence for a conclusion through convergence and corroboration of findings.
- Can add insights and understanding that might be missed when only a single method is used.
- Can be used to increase the generalizability of the results.
- Qualitative and quantitative research used together produce more complete knowledge necessary to inform theory and practice.

Weaknesses

- Can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently; it may require a research team.
- Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
- Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.
- More expensive.
- More time consuming.
- Some of the details of mixed research remain to be worked out fully by research methodologists (e.g., problems of paradigm mixing, how to qualitatively analyze quantitative data, how to interpret conflicting results).

Figure 4: Strengths and Weaknesses of Mixed Research (Onwuegubuzie and Leech, 2004)

As Then (1996) explains, in research design, therefore, the issue then becomes not whether one has uniformly adhered to prescribed canons of either logical positivism or phenomenology but whether one has made sensible methods decisions, given the purpose of the study, the questions being investigated, and the resources available. Therefore it is critical to know about the methodological paradigms debate in order to appreciate why methods decisions can be highly controversial. The paradigm of choices recognises that different methods are appropriate for different situations and the epistemology does not dictate which specific data collection analytical methods should be used by researchers (Saunders et al., 2003; Creswell 2003).

The following section discusses the general purpose behind the research strategy to explain and explore to research question.

2.3 Research Strategy

From the discussion under schools of thought, it is apparent that both qualitative and quantitative methods involve differing strengths and weaknesses. McGrath (1982) in his study of research strategies makes it clear that there are no ideal solutions, only a series of compromises. Similarly, according to Yin (1994), research strategy should be chosen as a function of the research situation. Each research strategy has its own unique approach to gather and analyse empirical data, and therefore each strategy has its own advantages and disadvantages. Although each strategy has its own characteristics, there are overlapping areas, which bring complexity to the process of strategy selection. In order to avoid gross misfits between the desired outcome and the chosen strategy, Yin (1994) stresses that the type of question posed; the control over actual behavioural elements; and the degree of focus on historical or contemporary events; are the conditions which should provide the grounds for strategy choice. Figure 5 depicts the outcome of the intersection between most common research strategies and the three conditions identified below.

Furthermore, Galliers (1992) provides a list of approaches or tactics Figure 6 summarises this list according to the general philosophical base underpinning the different research tactics and shows that some research tactics can be used, at least to some extent, as either positivistic (quantitative) or interpretavist (qualitative) devices. The following sections will describe more about research techniques before which an overview of reliability and validity in terms of the research process are discussed.

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	How, why	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

Source: Yin (1994)

Figure 5: Research Strategies versus Characteristics (Yin, 1994)

Research approaches	Positivistic (quantitative)	Phenomenological (qualitative)
Action research		Strictly interpretive
Case studies	Have scope to be either	Have scope to be either
Ethnographic		Strictly interpretivist
Field experiments	Have scope to be either	Have scope to be either
Focus groups		Mostly interpretivist
Forecasting research	Strictly positivistic with some room for interpretation	
Futures research	Have scope to be either	Have scope to be either
Game or role playing		Strictly interpretivist
In-depth surveys		Mostly interpretivist
Laboratory experiments	Strictly positivistic with some room for interpretation	
Large-scale surveys	Strictly positivistic with some room for interpretation	
Participant observer		Strictly interpretivist
Scenario research		Mostly interpretivist
Simulation and stochastic modelling	Strictly positivistic with some room for interpretation	

Figure 6: Research Tactics and Philosophical Bases (Galliers, 1992)

2.3.1 Deductive and Inductive

Another set of terms commonly used in the research process are deductive and inductive. As Yu (2002) explains, the deductive logic has a long-standing association with positivism but what is a deductive approach? This is an approach which develops a theory and hypothesis (or hypotheses) and subsequently involves designing a research strategy to test the hypothesis (Saunders et al., 2003). On the other hand, the inductive approach is to collect data and develop theory as a result of the data analysis (Saunders et al., 2003; Creswell 2003).

As emphasised by Knox (2005), again this could provide a seemingly either or dilemma for the researcher as it could infer that the research approach of induction or deduction are in fact mutually exclusive. Nevertheless, the mixed method research approach accommodates for the use of both deductive and inductive approaches within any one study (Tashakkori & Teddlie, 1998, 2003; Creswell, 2003).

Nevertheless, given that this study will adopt the positivist philosophy – as explained and justified in the following sections – the following sections will elaborate more on quantitative research and explain briefly the reliability and validity of evidence.

2.3.2 Quantitative research

As Horna (1994) explains that quantitative research designs are characterised by the assumption that human behaviour can be explained by what may be termed "social facts" which can be investigated by methodologies that utilise

"the deductive logic of the natural sciences". More specifically, as Nau (1995) explains that quantitative investigations look for "distinguishing characteristics, elemental properties and empirical boundaries" and tend to measure "how much" or "how often".

This process is directed towards the development of testable hypotheses and theory which are generalisable across settings. Chalmers (1976) describes that, in general, quantitative philosophy could be defined as an extreme of empiricism according to which theories are not only to be justified by the extent to which they can be verified but also by an application to facts acquired. He further explains that it is a branch of thought which tried to find out the origins, justifications and progress of knowledge through observation, but is considered to have meanings only in so far as they can be derived.

Furthermore, Easterby-Smith (1991), explains the strengths of quantitative methodologies:

- comparison and replication are allowable;
- independence of the observer from the subject being observed;
- subject under analysis is measured through objective methods rather than being inferred subjectively through sensation, reflection or intuition;
- reliability and validity may be determined more objectively than qualitative techniques;
- strong in measuring descriptive aspects;
- emphasises the need to formulate hypothesis for subsequent verification;
- helps to search for causal explanations and fundamental laws, and generally reduces the whole to the simplest possible elements in order to facilitate analysis

Nonetheless, these strengths are not the sole prerogative of quantitative designs. Indeed, amongst the arguments for the use of quantitative research, especially in an academic environment where resources are limited, have pragmatic origins in terms of allowing large-scale data collection and analysis at a reasonable cost and effort, as well as providing statistical "proof".

On the other hand, the weaknesses of such quantitative research designs lie mainly in their failure to ascertain deeper underlying meanings and explanations, even when significant, reliable and valid. Quantitative research is strong in measuring variables and, if this measurement is one of the focuses

of the research, then a quantitative approach may be justified. However, factors such as physiological factors, motivating factors, employees' *capability, etc. are important in most research settings associated with KM.* Although quantitative methods can be used to measure such factors, their appropriateness in explaining them in depth is more limited. A further weakness in quantitative approaches lies in their tendencies to take a "snapshot" of a situation and so measure variables at a specific moment in time. This could be an issue, given that KM related aspects may be more likely be affected by temporal changes which cannot always be identified within a single quantitative study.

The following sections will explain the valuation of the research process.

2.3.3 Reliability and Validity

As Then (1996) explains, in many respects an evaluation is often focused on measures to counteract the weaknesses inherent in the particular research strategy chosen to carry out a particular piece of research. The technical language of such research evaluation includes terms such as validity, reliability and generalisability. The debate is rooted in philosophical differences about the nature of reality and takes the form of qualitative versus quantitative methods, as described earlier. In general, as DeVaus (2002) explains, the value of any research stems from the validity of its results and the extent of its contribution to the body of knowledge. Research into KM is no exception. These results are the outcomes from the collection, interpretation, analysis and the evaluation of data.

Validity

More specifically, as Then (1996) explains, for a given problem, validity is one of the concepts used to determine how good is an answer provided by research. Further, as Dillman (2002) explains it means in essence that a theory, model, concept, or category describes reality with a good fit. A valid measure is one which measures what it is intended to measure. In fact, it is not the measure that is valid or invalid but the use to which the measure is put "... the validity of a measure then depends on how we have defined the concept it is designed to measure" (De Vaus, 1991).

In research methodology literature, the measure of validity is often considered under either internal or external validity (Yin, 1994; Gill and Johnson, 1991). Internal validity refers to whether or not what are identified as the causes actually produce what has been interpreted as the "effect" or "responses" and

checks whether the right cause-and-effect relationships have been established. Thus internal validity is the issue of establishing theoretical territory that goes with the defined construct and ensuring consistency between it and other recognised constructs. External validity criterion refers to the extent to which any research findings can be generalised beyond the immediate research sample or setting in which the research took place; thus the extent to which findings drawn from studying one group are applicable to other groups or settings (the applicability of findings beyond the group). External validity could be achieved from theoretical relationships.

On the other hand, as Creswell (1994) explains it is worth noting that there is a different perspective on validity when viewed within the context of qualitative research. Qualitative research identifies the presence or absence of a given feature in a given problem or situation, as opposed to quantitative research which measures the degree of presence of the feature itself.

Reliability

Reliability is the extent to which a test or procedure produces similar results under constant conditions on all occasions (Yin, 1994). Another definition by Simon and Burstein (1985) states that "... reliability is essentially repeatability – a measurement procedure is highly reliable, if it comes up with the same result in the same circumstances time after time, even employed by different people". So, the goal of reliability is to minimise the errors and biases in a study. The object is to ensure that, if a later investigator followed exactly the same procedures, the same findings and conclusions would result.

Then (1996) provides a useful comparison between reliability and validity, that the basic difference between reliability and internal validity is that reliability deals with the data collection process to ensure consistency of results, while internal validity focuses more on the way such results support conclusions. It should also be noted that the above deliberation refers very much to the traditional evaluation criteria of validity and reliability that are governed by the convention of the quantitative research paradigm. Although early qualitative researchers felt compelled to relate traditional notions of validity and reliability to procedures in qualitative research, later writers (Miles and Huberman, 1994; Yin, 1994; Easterby-Smith, 1991) developed their own language to describe the quality criteria in a qualitative research paradigm. Miles and Huberman (1994) concentrate on improved and rigorous techniques for data gathering and analysis as the best way to enhance credibility and acceptance.

Finally, Then (1996) provide five essential steps as the requirements to ensure the assurance of quality research and the achievement of reliability and validity:

- Knowledge stems from observations which take place through a definable searching process.
- The research problem is defined, which means answering the questions why the research is being done and what it is supposed to achieve.
- A research plan must be formulated. The purpose of the plan should be directed towards the testing of a hypothesis (deduction) or evaluation of evidence in terms of constructing a hypothesis (induction).
- The outcome of the enquiry is stated in explicit terms, which may result in the support or refutation of an existing hypothesis (deduction) or a proposed one (induction).
- The conclusions are documented with sufficient support and clarity to establish what was done, what was found, and what significance the findings may have. The researcher is also careful to separate their work from that of others, and to show how their methodology or findings mesh with other efforts within the same field of inquiry.

2.4 Overview of Research Approach for the Study

2.4.1 Research Question and Objectives

The research question of the project was formulated as follows:

How could Knowledge Management (KM) be used to support Innovation in Small to Medium-sized Enterprises (SMEs) based in the UK Energy sector?

This question could be further explicated by the following sub-questions:

- What are the KM objectives of SMEs based in the UK energy sector?
- What are the innovation objectives of SMEs based in the UK energy sector?
- What are the relationships, processes, practices and understandings between KM and innovation in SMEs based in the UK energy sector?

2.4.2 Research approach

This research project adopts an approach or framework developed by Galliers (1992) who formulated this approach following an extensive review of existing research approaches in the field of information systems. As Creswell (2003) explains, Galliers (1992) research approach has been extensively used in research projects from various disciplines including Business and Management. The original proposition from Galliers (1992) has been adapted to suite this study as shown in Figure 7 below.

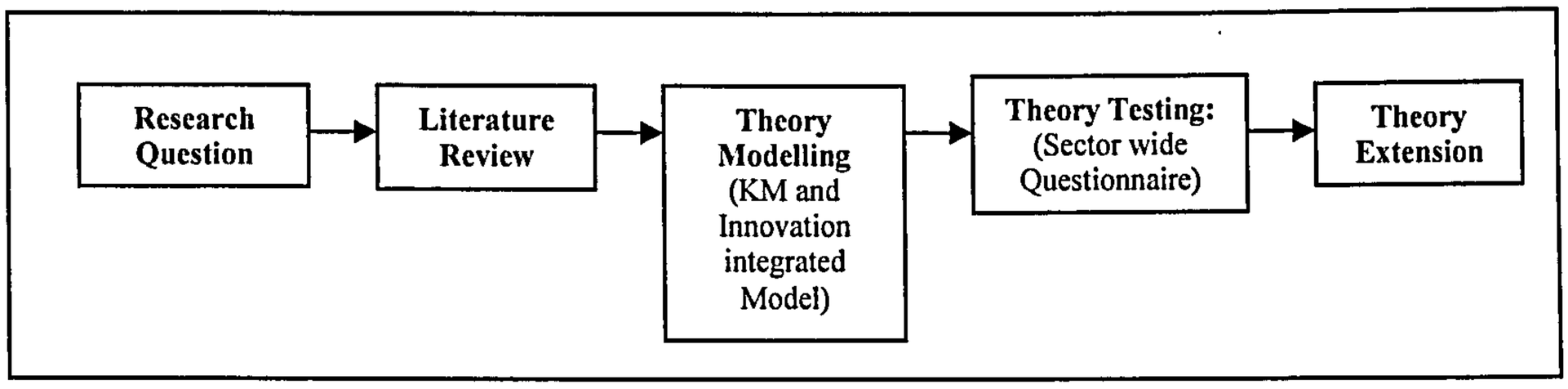

Figure 7 Research Design based on Galliers (1992).

The first stage of the approach is to develop a research question (as discussed above). Secondly, review the literature related to the research question. Thirdly, build a theory or model from the literature review. Fourthly, design and implement the study based on a social survey method to test and evaluate the proposed theory or model. Finally, review the findings, and modify the model if necessary. The following sections will briefly discuss each stage of this research framework.

Why did you do start with a literature review?

The purpose of the literature review was to review the existing literature to formulate assumptions for the theoretical models; verify the gap in understanding with regards to how KM could support innovation in SMEs based in the UK energy sector; review KM and innovation models for applicability to SMEs.

The literature review revealed the scarcity of research done into the relationship between KM and innovation, more specifically in relation to SMEs based in the UK energy sector. Furthermore, a variety of models depicting the KM and Innovation processes were identified and used as a platform to formulate the KMOLI cycle.

Why did you do a questionnaire survey?

The survey questionnaire approach was selected for the following reasons:

The complexity of the UK energy sector and the convolution of its operational frameworks, as discussed in the literature review chapter, would make it difficult to identify SMEs. Consequently, it was decided that this difficulty would impede the identification of SMEs from the onset for interview and case study participation.

Given the widely acknowledged time and resource constraints which SMEs encounter it was decided that this would hinder SMEs to participate in interviews and case studies.

Also, the data collection and analysis for qualitative techniques and mixed methodology is acknowledged to require more resources (time and money) compared to quantitative techniques hence it was decided to opt for a less costly and economic research technique.

Furthermore, given the relatively new focus on the UK energy sector and scarcity of literature focusing on this area it was decided that qualitative methods may provide an issue with generalising the findings for the UK energy sector. Therefore, it was decided that the quantitative approach through the questionnaire survey would provide more useful results which could be generalised for the UK energy sector.

In addition, given the influence of quantitative research on government policies compared to qualitative and the plethora of schemes by which the UK government affords assistance to SMEs, it was decided that conclusions and recommendations from the questionnaire survey could provide a broader impact and more value.

2.4.3 Literature Review

The purpose of the literature review in this study was to review the current knowledge in the field, related to the research question, in order to form a cohesive and coherent argument to support the research project. Hence the literature review was the source of the theoretical propositions, which form the basis of the conceptual/theoretical models.

The literature review is divided into the following specific areas: Knowledge Management; Innovation; SMEs; UK Energy Sector; KM in SMEs; Innovation in SMEs; KM and Innovation.

2.4.4 Theoretical or Conceptual Model

Following an in-depth review of the literature models for KM and Innovation in SMEs were reviewed and then used to formulate the Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle, as discussed previously.

2.4.5 Theory Testing

Theory testing of the study consisted of a sector wide questionnaire survey. This is a very well accepted method in business and management research. Saunders et al. (2003) argue that surveys allow the collection of a large amount of data from a sizeable population in a highly economical way. Often obtained by using a questionnaire, these data are standardised, allowing easy comparison. In addition, the survey strategy is perceived as authoritative by people in general, this is because it uses quantitative methods of analysis and is easily understood as data collection method. Furthermore, the purpose of the questionnaire in this study is exploratory i.e. to identify discrepancies or issues between the KMOLI Cycle and subsequent KM and innovation activities in SMEs.

There are various definitions of the term 'questionnaire' (Oppenheim, 2000). The greatest use of questionnaires is made by the survey strategy. Some authors, such as Kervin (1999), reserve it exclusively for surveys where the person answering the question actually records their own answers. Others, such as Bell (1999), use it as a more general term to include interviews that are administered either face to face or telephone. Saunders et al, (2003) and deVaus (2002) use the term in a more precise way, to include all techniques of data collection in which a person is asked to respond to the same set of questions in a predetermined order. It therefore includes structured interviews and telephone questionnaires as well as those in which the questions are answered without an interviewer being present. The survey undertaken by this research aimed basically at obtaining a 'snap-shot' of the current way of "doing things" in KM and Innovation. Hence the study adopted a cross-sectional approach as supported by Easterby-Smith et al, (2002) and Robson (2002).

There are a number of different ways questionnaires can be delivered. In this survey, a postal questionnaire approach was used due to the difficulties in finding up-to-date and accurate SME information (i.e. email addresses). SMEs tend to have high personnel turnovers and be more dynamic in terms of

changes of individuals in the company. It was acknowledged that this type of questionnaire has some known disadvantages. The type of questionnaire dictates the reliability of responses. Even if the postal questionnaire is addressed to a company manager by name, there is no way of ensuring that she or he will be the respondent. Her or his assistant or someone else could complete it! Email questionnaires offer greater control because most users read and respond to their own mail at their personal computer (Witmer et al, 1999). Any contamination of respondents' answers will reduce data's reliability. Additionally, if respondents have insufficient knowledge or experience they may sometimes deliberately guess at the answer, a tendency known as uninformed response. Respondents may also discuss their answers with others, thereby also contaminating their response. However, these later contamination problems are common to all types of questionnaire survey and therefore were deemed to be acceptable.

This survey is seen as an exploratory study and aims to explore and identify issues and discrepancies between the conceptual or theoretical models and the actual KM and innovation practices being carried out by the SMEs. The following sections explain the questionnaire administration and analysis approaches respectively.

Selecting SMEs for the survey

In total, 400 SMEs were identified using the KOMPASS™ Business Directory. The aforementioned directory was used to identify products and services; and verify that the number of employees did not exceed 250, which is the criterion for a SME according to the DTI (1999). In total, 64 products and services associated with the UK energy sector were identified using the Institute of Energy Yearbook and Directory 2003 and the KOMPASS™ Business Directory with collaboration of a panel of experts from the Chemical and Process Engineering Department at the University – see Appendix 1 for Products and Services.

Questionnaire Design and Pilot

In order to maximise the response rates and ensure validity and reliability of the questionnaire, spearman's rho and factor analysis were considered. However, due to the complexity of these tests and initial plan to supplement the questionnaire with an in-depth qualitative analysis, the following design guidelines were implemented (Saunders et al, 2003):

- Clear layout of the questionnaire form;

- Careful design of individual questions;
- Pilot testing;
- Lucid (clear and easily understood) explanation of the purpose of the questionnaire;
- Carefully planned and executed administration.

The actual questionnaire was 3 pages of A4 divided into the following three sections: Organisation Characterisation; Strategic Components; and Organisation Systems and Processes. A variety of question types were used determined by the data which needed collecting for analysis. This is common practice as discussed by Youngman (1986; cited in Bell, 1999) - see Appendix 2 for Questionnaire used in the study.

Following deVaus (2002) a unique identification or reference number was inserted on each document to identify the respondent to facilitate the analysis of feedback and responses.

The questionnaire was pilot-tested on 5 SMEs. They were provided with a draft version of the questionnaire with the aim of employing their comments to improve the main questionnaire. The main outcome of the pilot was that the questionnaire was too long – the final questionnaire was improved on this basis. In short, Part 3 of the questionnaire was condensed to reduce the number of activities and instruments. The explanation of the purpose of the questionnaire and the administration are discussed in the following section.

Data Collection using Questionnaire

Questionnaires, formulated from the theoretical/conceptual models, were disseminated to 400 SMEs. In total, there were 56 survey respondents. This represents a 14.0% response rate, which is within typical response rates from SMEs (Macdonald et al, 2001). Issues and discrepancies between the conceptual/theoretical models and actual KM and innovation practices were identified as discussed in the final chapter.

The questionnaire distribution consisted of two main phases:

The initial contact consisted of sending the questionnaire with a cover letter and proforma (see Appendix 3). The purpose of the proforma was to collect details of the respondent including contact information. Pre-paid envelopes were enclosed with each questionnaire during the whole survey for the purpose of minimising costs for the SME and hence increasing the response rate.

The second contact was a reminder. This consisted of sending a follow-up letter (see Appendix 4) with the original content and in addition reminding the SME that a response was expected. SMEs which were no longer in operation or had changed address without a redirection address were identified at this stage. Royal Mail returned questionnaires from the initial contact phase where either the employee had left the organisation or the organisation was no longer at that address. In total, 25 questionnaires were returned by Royal Mail.

The highest number of responses was received after initial contact (34). Even so, a further 22 responses were received after the first reminder. A third contact, i.e. a second reminder; and telephone-interviews with SMEs which did not respond were considered, but due to typical constraints of time limited research project, were abandoned. Once the data was collected the analysis of the responses was implemented as described below.

Data Analysis

The data analysis was broken down into three areas: descriptive statistics findings; exploratory statistics findings; and integration of findings. Descriptive statistics were used to analyse data in order to identify areas to explore using exploratory statistics, an approach discussed by Tukey (1977). In total, 24 relationships were identified using descriptive statistics and these were further divided into the following three categories: KM relationships in UK Energy sector SMEs; Innovation relationships in UK Energy sector SMEs; and KM and Innovation relationships in UK Energy sector SMEs. The relationships were selected by the researcher on the basis of relevancy to the research question and objectives. Nonetheless, there is scope for a number of further relationships to be explored although not directly relevant to the research question

Subsequently, these relationships were then analysed using exploratory statistics. Saunders et al., (2003) provide a useful table to select the most relevant statistical techniques according to data type, see Figure 8. Given the 'categorical' nature of the data type obtained from the survey questionnaire Chi-square test was considered to be the most relevant technique to ascertain if two variables were associated; and Phi-coefficient was used to determine the strength of association where applicable. The Chi-square test is a technique which only establishes if there is an association or not between any two qualitative variables. However, in most cases the Fisher's Exact Test (FET) was used due to the relevant number of samples (<25), as discussed in

the following chapter. However, regression and multiple regression techniques were considered but were found to be inapplicable due to the predominant categorical data type usage in the questionnaire for exploratory analysis as illustrated in the table below.

The findings in this paper focus on the relationship between KM and Innovation in UK Energy sector SMEs. This study is, as far as the researchers are aware, the first to systematically determine the aforementioned relationship. As a result, literature directly relevant to this study was difficult to find.

The theory extension component of the research approach, as discussed above, is considered in the final chapter. The following chapter presents the key findings from the questionnaire survey.

	Categorical		**Quantifiable**	
	Descriptive	*Ranked*	*Continuous*	*Discrete*
To test whether two variables are associated	Chi square (data may need grouping)		Chi square if variables grouped into discrete classes	
To test whether two groups (categories) are different	Kolmogrov-Smirnov (data may need grouping)		Independent t-test or paired t-test (often used to test for changes over time)	
To test whether three or more groups (categories) are different			Analysis of Variance (ANOVA)	
To assess the strength of relationship between two variables		Spearman's rank correlation coefficient	Pearson's product moment correlation coefiicient (PMCC)	
To assess the strength of relationship between one dependent and one or more independent variables			Regression coefficient	
To predict the value of a dependent variable from one or more independent variables			Regression equation	
To compare relative changes over time			Index numbers	
To determine the trend over time of a series of data			Time series: moving averages; Regression equation	

Figure 8 Statistics to examine relationships, differences and trends by data type: a summary (Saunders et al., 2003).

The following chapters will discuss the concepts behind the research question and objectives in order to review the current knowledge in this field and provide theoretical insights for the KMOLI model.

2.6 Summary:

This study was originally intended to take an inductive triangulation approach to investigate how KM could be used to support innovation in SMEs. The literature review was used to express an informed conceptual model of KM and Innovation in SMEs called the Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle. A sector wide questionnaire survey, comprising of 30 questions, was designed and implemented to verify the conceptual model and identify discrepancies between the model and reality. It was then intended to explore the issues, which could not be explained by the questionnaire, via an exploratory case study analysis.

Nevertheless, the quantitative and deductive approach presented in this chapter provided a wide coverage of 400 SMEs in the UK Energy sector in a fast and economical approach to identify the KM and innovation goals of SMEs; and identify issues between the KMOLI Cycle and the reality of SMEs in the UK Energy sector. However, a further exploratory study to investigate why these issues happen could be valuable and provide further insights into the KM and innovation process in SMEs.

Chapter 3: Knowledge Management and Knowledge Management in Small to Medium-sized Enterprises in the UK Energy Sector

3.1 Introduction

This chapter reviews the background to this study with regards to the UK Energy sector and the challenges which organisations based in this sector are currently facing. A definition of the UK Energy sector is presented which was subsequently used to guide the selection of organisations for this study. Furthermore, Knowledge Management is presented as a possible solution for the organisations in the UK Energy sector.

The concept and practice of Knowledge Management is discussed including its origins. Furthermore, previous studies into Knowledge Management in SMEs are highlighted and discussed.

3.2 The UK Energy Sector

3.2.1 What is the UK energy sector?

Energy is essential to a modern economy like the UK. Akin to all nations, the UK needs energy to heat and light its homes, to facilitate travel and to power businesses. The DTI (2002) explain that energy industries in the UK play a central role in the economy by producing, transforming and supplying energy in its various forms to all sectors. They are also a major contributor to the UK's Balance of Payments through the export of crude oil, oil products and power equipment. This contribution by the energy industries is summarised by the statistics below:

- 5% of GDP
- 7% of total investment
- 31% of industrial investment
- 6% of annual business expenditure on research and development (R&D)

The UK energy sector is a complex environment, incorporating a variety of organisations, operational frameworks, and internal and external pressures. However, today, the sector is facing a number of challenges that could well count among the toughest it has ever encountered. As Gillett and Espenhahn (2000) note that the UK energy sector has had to respond to important economic and market changes over the last two decades, which still influence its structure, business drivers and research needs, including:

- a downward trend in overall employment, most notably in coal production;
- decreasing energy consumption by industry, but increased energy use in transport;
- increasing electricity consumption by the services sector;
- a switch from coal to gas (and an increased role for nuclear) as primary energy for electricity generation since the early1990s;
- the introduction and demand of innovative renewable energy and Combined Heat and Power (CHP) facilities;
- sector reform, deregulation, privatisation and increased competition in the market;
- heightened environmental concerns, particularly over emissions control;

Furthermore, the UK energy sector includes a wide range of industries and companies, both large and small which are experiencing these challenges of increased competition. As Price (1997) explains that the main energy suppliers in the UK have been privatised, many are now owned by overseas concerns, and the process of globalisation seems set to continue. As a result, the previous service-based industries have become profit-motivated companies with an increasing emphasis on achieving shareholder value. Consequently, the organisations are now operating in a highly competitive environment which commands the need, for organisations to increase productivity and innovation. This study explores how Knowledge Management (KM) and innovation could help these organisations meet their strategic goals and objectives under these unique challenges.

3.2.2 UK Energy Policy

The Department of Trade and Industry (DTI) initiated the 'Energy White Paper' (DTI, 2004) to address the challenges in the sector and direct the energy policy for the UK. The paper categorises the challenges into three and explores in detail how each challenge will be tackled. "We need to address the threat of climate change. We must deal with the implications of reduced UK oil, gas and coal production, which will make us a net energy importer instead of an energy exporter. And over the next twenty years or so we will need to replace or update much of our energy infrastructure" (DTI, 2003). All these challenges present their own specific operational difficulties for the organisations absorbed in the sector.

Furthermore, the paper addresses these three challenges by identifying four goals for the UK energy policy:

1. To put ourselves on a path to cut the UK's carbon dioxide emissions - the main contributor to global warming - by some 60% by about 2050, as recommended by the RCEP, with real progress by 2020;
2. To maintain the reliability of energy supplies;
3. To promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
4. To ensure that every home is adequately and affordably heated.

Furthermore, it is well recognised that efficient energy utilisation and the mitigation of environmental impact are important economic factors. Energy policy objectives are essentially twofold: to eliminate the economic impact of

energy profligacy and to develop and exploit new technologies in the energy/ environment sector. Energy efficiency and clean technologies (e.g. renewable energy conversion) can be expected to undergo rapid developments in the near future (DETR 1998, EPSRC 1996). This further emphasises the need for the sector to innovate to develop existing and new technologies to help the nation deliver the energy policy requirements.

3.2.3 Knowledge worker crisis

Given the unique challenges which organisations based in the sector are currently facing, Lelic (2004) argues that at the same time, the sector urgently needs to address the impending knowledge-worker crisis: by 2010, up to 50 per cent of the industry's workforce will simply walk out of the door, leaving behind a shortfall in expertise of immense proportions. This is due to the dramatic operational framework changes that are happening and the increased demand and competition of knowledge workers from other sectors. As David Lecore from Schlumberger, quoted by Lelic (2004), points out that "[...] it is those companies that are addressing this problem of impending knowledge-crisis right now that will emerge as industry leaders further down the line. Knowledge management may not be a magic bullet, but it can certainly offer energy firms a means of dealing with this issue, and indeed many of the other challenges they are facing, in a coherent, effectual way". The rapid changes happening to the operational framework of the sector, given its economic importance and sensitivity to geo-political factors, are the root cause for these changes.

3.2.4 Is KM a solution to these challenges?

In addition, Lelic (2004) argues that downsizing is one of the many tactics which the UK energy sector organisations are using to enhance productivity. Di Mattia and Oder (1997) strongly defend that there is a relationship between the trend to downsize in a sector and the increasing need for KM strategies that retain organisational knowledge.

Perhaps unsurprisingly, therefore, some of the biggest players in the energy sector were among the earliest adopters of KM, notably oil and gas giants Shell and BP. In fact, there is a convincing argument to suggest that these firms have given as much to the knowledge-management world as KM has to them; the KM Magazine online archive, for instance, is full of case studies detailing examples of good practice from the energy industry.

In essence, as the researcher will elaborate further in the following sections, organisations from both the private and public sectors associated with the sector will need to respond positively to these changes to remain in operation. These organisations could adopt a number of tools and techniques from the Business and Management domain to realise their goals and objectives in line with the changes to the sector. More specifically, as is the focus of this thesis, KM tools and techniques could benefit these organisations by helping them understand the complex environments in which they operate.

For this project, a definition of the "UK Energy Sector" was adopted from Gillett and Espenhahn (2000) which include organisations involved with the extraction of energy resources, energy production, distribution and consumption, plant operators (including the electricity supply industry), equipment manufacturers and service providers (including energy distribution utilities, consultants and research organisations). Each of the main energy sources is also included: coal, oil, gas, nuclear and renewables. This definition will guide the sampling of organisations for the questionnaire survey as discussed in Chapter 3.

In summary, given the potential benefits of KM, namely improving productivity and increasing innovation, as mentioned earlier, organisations in the UK energy sector could utilize KM to enhance their competitiveness and meet the tough challenges which they encounter in this dynamic business environment. Furthermore, given the circumstances that these organisations find themselves there is now an increased interest from the academic community which plan to launch the Journal of Energy Sector Management in 2007, exploring how KM amongst other management tools could facilitate the successful operation of these organisations. Subsequently, this raises the question, how would organisations in the UK energy sector use KM to meet their strategic goals and objectives? The purpose of this thesis is to shed light on this pertinent subject.

3.3 Knowledge Management

3.3.1 Is Knowledge Important?

The knowledge-based society is a vision of a possible future and a consequence of the knowledge economy's growth (David and Foray, 2002). The accumulation of knowledge over the centuries has resulted in a change in society, from a random (agrarian) society to an knowledge society where knowledge is built on knowledge (Al -Hawamdeh, 2002). Thus, as we enter the knowledge society, ownership of knowledge and information as a source of competitive advantage is becoming increasingly important (Johannessen et al, 1999). The terms information society and knowledge society are often used interchangeably in the KM literature due to the confusion between the terms knowledge and information which is rife in the literature (Wilson, 2002).

Al-Hawamdeh (2002) argues that the key to economic success is linked to advances in knowledge creation; ability of a nation to translate knowledge to products and services. Knowledge creation is, in fact, a process of value addition to previous knowledge through innovation (Duffy, 1999; Naryanan, 2001). This statement implies that more knowledge enables knowledge creation and dissemination.

It is only recently that people have identified that knowledge is a factor of production. Many scholars have recognised that knowledge is the only meaningful economic resource in the knowledge society (Foray & Lundvall, 1996; Johnston & Rolf, 1998). Knowledge creates knowledge and in the process brings competitive advantage and leads to wealth creation (Al-Hawamdeh, 2002). However, as Dove (1999) explains, knowledge has no value until it is applied. When new knowledge is applied, it introduces a change into the environment, which generates a value. Change that comes from the application of new knowledge is called innovation when the value is positive. The relationship between knowledge and innovation is explored further in Section 6.

Since the majority of individuals and organisations understand the benefit of knowledge today, the next question is how do we manage knowledge to create value?

3.3.2 What is knowledge?

The question of the nature of knowledge is extremely challenging (Martensson, 2000). Allee (1997) defines knowledge using 12 qualities, knowledge is: messy; self-organising; seeks community; travels on language; slippery; likes looseness; experiments; does not grow forever; social phenomenon; evolves organically; multi-modal; multi-dimensional.

Although philosophers have been discussing the issue of defining knowledge for several hundred years, the search for a formal definition continues (Emery, 1997). Wilson (2002) defines knowledge as 'what we know', this involves: mental processes of comprehension; understanding and learning which takes place in the mind only (regardless of how much outside interaction that takes place). Given that KM is hard to define precisely and simply, the definition of KM also leapfrogs the task of defining "knowledge" itself!

Nonetheless, when one wants to express what he or she knows one must utter 'messages', these 'messages' take the following forms: oral; written; graphic; gestural; and body language.

In short, the word knowledge itself is also context-specific and generates different meanings in different fields of application. Hence this emphasises the importance of defining 'knowledge' for any knowledge-related project so to avoid confusion and misinterpretation.

3.3.3 Types of knowledge

Knowledge is described using a variety of terms by both researchers and practitioners: the terms formal and informal knowledge are used by Conklin (1996); the focus on knowledge in an organisation is used by Rulke, Zaheer and Anderson (1998) in terms of transactive and resource knowledge; Kogut and Zander (1992) differentiate between information and 'know-how'; a distinction between 'know-what' and 'know-how' is made by Brown & Duguid (1998: 91) "The organisational knowledge that constitutes 'core-competency' is more than 'know-what' explicit knowledge which may be shared by several. A core competency requires the more elusive 'know-how' –the particular ability to put know-what into practice"; Leonard & Sensiper (1998: 113) describe knowledge not as a dichotomy but as a continuum. In short, this further highlights the variety of definitions of knowledge in the literature and emphasises the need to define knowledge and KM in the organisational context for purposes of clarity and affectivity of any organisation's KM endeavour.

by Choo (1998a); personal, proprietary, public knowledge and common sense have been identified by Boisot (1998), this by no means an exhaustive list.

Implicit knowledge

Wilson (2002) highlights the following points regarding implicit knowledge:

- previously unexpressed but expressible knowledge may be termed implicit knowledge;
- implicit knowledge is what we take for granted in our actions, and can be shared with others via common experience or culture;
- implicit knowledge is expressible but tacit knowledge is not.

Data and information

Wilson (2002) suggests that everything outside the mind which can be used is classified as data, including information. Ash (1998) argues that information has little value and will not become knowledge until it is processed by the human mind, and Kirchner (1997) suggests that knowledge involves the processing, creation, or use of information in the mind of the individual.

Infield (1997) depicts the information to the knowledge process. The process begins with facts and data, which are organised and structured to produce general information. The next stage involves organising and filtering this information to meet the requirements of a specific community of users, producing contextual information. Next, individuals assimilate the contextual information and transform it into knowledge. This transformation process is affected by individual's experiences, attitudes, and the context in which they work. The final stage of the continuum is behaviour; unless information and knowledge lead to an informed decision or action, the whole process becomes invalidated.

3.3.6 What is Knowledge Management?

Kakabadse et al., (2003) explain how a variety of disciplines have influenced the field of KM including the effect of philosophy in defining knowledge; social science in understanding the motivation, people, culture and environment. Consequently, there are is a plethora of KM definitions in both academic and business communities. Nevertheless, the literature underlines that organizations can generate a key source of competitive advantage, embrace innovation, and improve bottom-line results by developing capabilities for KM (Wang and Ahmed, 2003; Armstrong and Foley, 2003;

Bierly et al., 2000; Davis and Botkin, 1994; Drucker, 1997; Easterby-Smith and Araujo, 1999; Nonaka, 1991; Quinn, 1992).

While KM has a concrete and tangible side characterised by people, physical systems and processes, there is a great deal of scope for interpretation as what actually constitutes this management approach. In fact, KM practices are highly subjective in nature and subject to various interpretations. There is no shortage of definitions of KM (Liebowitz, 1999; Gloet and Terziovski, 2004). The KM literature shows a proliferation of definitions mainly due to the increasing interest in KM amongst both the academics and practitioners. Many of these definitions are narrow and mechanistic, "Knowledge Management is the activity which is concerned with strategy and tactics to manage human-centred assets" (Brooking, 1997). Due to the often conflicting, contradicting and mechanistic definitions of KM in the literature the need to identify and adopt a holistic and clear definition of KM for any KM related assignment is paramount.

Consequently, in this thesis the researcher has decided to adopt the definition proposed by Beckman (1999): "KM concerns the formalisation of and access to experience, knowledge, and expertise that create new capabilities, enable superior performance, encourage innovation, and enhance customer value." According to this definition, KM deals with the management of knowledge related activities (Wiig, 1997; Civi, 2000; Wong and Aspinwall, 2004) such as creating, organising, sharing and using knowledge in order to create value for an organisation.

Although having emerged as a field of study in its own right, KM has been critiqued as being a misnomer and an oxymoron (Coleman, 1999) or for being "fuzzy" and imprecise (McCune, 1999) and most notably for being a fad and a re-packaged form of information management (Wilson, 2002). However, Jashapara (2005) identifies a number of valid shortcomings in the methodology and analysis of this most notable critique of KM:

- As information and knowledge were considered synonymous, the analysis showed that information and knowledge management were one and the same.
- There was no attempt at philosophical introspection or examination of epistemological assumptions.

- The citation analysis adopted in the critique failed to engage in the depth and complexity of the KM literature and the sampling frame adopted was contentious.
- Finally, the 'convenience' sampling of consultancy and business school websites lacked any scientific rigour.

Furthermore, Alvesson and Karreman (2001) suggest that KM is "not merely some passing fad, but is in the process of establishing itself as a new aspect of management and organisation and as a new form of expertise." Accordingly, the researcher acknowledges the potential of KM to enable organisations to face the complexities and changes enveloping them in the knowledge-based economy today.

KM and Intellectual Capital

The field of KM can be seen as an integral part of the broader concept of intellectual capital (Roos et al, 1997). Guthrie (2000) makes the following distinction between KM and intellectual capital "KM is about the management of the intellectual capital controlled by the company". Roos et al. (1997) suggest that intellectual capital can be traced to two streams of thought: strategy and measurement. Within the strategic area, the focus is on studying the creation and use of knowledge and the relationship between knowledge and success or value creation. Measurement focuses on the need to develop new information systems, measuring non-financial data alongside the traditional financial ones.

KM Measurement

When something is to be managed many people feel that in order to do this it must be quantified, counted, organised and measured (Glazer, 1998). It must be able to be built, owned and controlled if its value is to be maximised (Allee, 1997). So, as a result many approaches to KM have focused on the capture and control of knowledge (Hildreth & Kimble, 2002).

There are many interpretations of KM in the business literature; as many as eighteen different definitions of KM have been identified by Hlupic et al.(2002). KM is considered differently by different people: some say it's the "emperors new clothes" (Martensson, 2000; Gourlay, 2000; and Beckman, 1999) and present it as an emerging discipline; some say that information professionals and organisations have been practising KM related activities for years (Broadbent, 1998; Streatfield & Wilson, 1999); some researchers still

view the capture of knowledge as the main challenge for KM (Alavi & Leidner, 1997).

KM encompasses broader issues and, in particular, creation of processes and creation of behaviours that allow people to transform information into the organisation and create and share knowledge (Kakabadse et al., 2001) to further enhance the competitiveness of the organisation in realising its strategic goals and objectives. Knowledge is a key asset to enhance an organisation's competitiveness and to understand the nature of knowledge could only facilitate the realisation of any KM initiative.

3.3.7 The Origins of Knowledge Management

The literature shows that a range of disciplines has added to the emergence of KM. As Wong and Aspinwall (2005) explain, Kelly (2000) discussed its origin from the knowledge-based theory of the firm, which in turn was built upon a number of streams of research such as resource-based theory (April, 2002; Grant, 1991; Wernerfelt, 1984), organisational learning (Huber, 1991) and core competence (Prahalad & Hamel, 1990). Grover and Davenport (2001) on the other hand, traced its emergence from the evolution of information technologies. According to Liebowitz (2000), KM is a consolidation of 'knowledge-based systems, artificial intelligence, software engineering, business process improvement, human resources management and organisational behaviour concepts'. Even though the theoretical insights into the management of knowledge are available from a variety of perspectives (Earl, 2001), this study primarily acknowledges the view that knowledge is a critical resource for organisations today, and subsequently explores how knowledge could be managed to support innovation in SMEs.

Acknowledging the importance of knowledge as a critical resource of the organisation today this study addresses the research question through the knowledge-based view which is a consequence of the resource based view. Here, knowledge is perceived as both tangible and intangible assets. Furthermore, elements of organisational learning will also be considered – as explained in the following chapters. The researcher hopes that this view will provide a more holistic perspective of knowledge and how it could support innovations in SMEs based in the UK Energy sector as the alternative view from the information technology perspective, as described above, may induce a mechanistic and codified view of knowledge.

Furthermore, Di Mattia and Oder (1997) argue that the emergence of KM is a result of downsizing and technological development as explained below.

Downsizing

During the 1980s, downsizing was the accepted strategy to reduce overheads and increase profits. However, the drawback to being "lean and mean" soon became evident (Forbes, 1997). The downsizing strategy resulted in a loss of important knowledge, as employees left and took the knowledge that they had accumulated over the years with them (Piggot, 1997). With time, organisations had come to recognise that they had lost years of valuable information and expertise and were now determined to protect themselves against a recurrence (Di Mattia and Oder, 1997).

This led management to undertake a "knowledge management" strategy in an effort to store and retain employee knowledge for the future benefit of the company (Forbes, 1997). Organisations are now trying to use technology and systems to capture the knowledge residing in the minds of their employees, so it can be easily shared within the organisation. When stored, it becomes a reusable resource that can provide a wealth of competitive advantages, including enhanced organisational capacities, facilitating output, and lowering costs (Forbes, 1997).

Technology development

The technological development has heightened the interest in KM through two main sources: the explosive growth of information resources such as the internet and the accelerating pace of technological change (Hibbard, 1997; Mayo, 1998). The recent IT development has affected both the lives of people and organisations (Mayo, 1998). The continual flow of information leaves us feeling disquietude (Hibbard, 1997). Di Mattia and Oder (1997) postulate that KM is an attempt to cope with the explosion of information and to capitalise on increased knowledge in the workplace (Martensson, 2000).

The emerging technological development enables global sharing of information across platforms and continents (DiMattia and Oder, 1997) and can serve as a tool within an organisation to use knowledge more effectively (Martensson, 2000). Capturing a company's collective expertise in databases can help organisations to "know what they actually know", and then marshal and exploit this knowledge in a systematic way (Blake, 1998).

3.3.8 What are the benefits of Knowledge Management?

The key prospective benefits of adopting KM are well documented in the literature (Bouthillier & Shearer, 2002; Jarrar, 2002; Al-Hawamdeh, 2002; KPMG, 1998; Skyrme & Amidon, 1997; uit Beijerse, 1999). Bouthillier & Shearer (2002) identified the following potential benefits of KM which range from: improving productivity; decision making; customer service; and innovation (MacMarrow, 2001). Furthermore, Al-Hawamdeh (2002) highlighted the following benefits: focusing on people to manage their tacit knowledge; enhancing the capability of the people by improving: communication; information transfer; and collaboration.

Nevertheless, KM signifies an attractive initiative for organisations to undertake, but in order to develop a robust system, certain key issues that require the attention of researchers and practitioners are (Desouza, 2004):

1. How to organise or structure a knowledge repository (a layout problem);
2. The best mechanism for knowledge transfer from an employee to another, and from a system to an employee, or vice versa (a transportation or logistics problem);
3. Maintaining a KM system (a maintenance problem).
4. Making a KM system user friendly (a human factor or ergonomics problem).

KM System

Knowledge management systems are defined as systems designed and developed to give decision makers/users in organizations the knowledge they need to make their decisions and perform their tasks (Davenport, 1998). Oppong et al., (2005) argue that the KM market is highly competitive, and it has developed considerable uncertainty and risk because of the contradictory nature of its enabling technologies and the inherent organizational and cultural difficulties embedded in its applications. According to a recent Merrill Lynch report, the market for technologies that facilitate KM systems is expected to appreciate at a 30% compounded annual growth rate, having skyrocketed from $97 million in 1999 to over $500 million at the end of 2004. This clearly reinforces the fact that KM is perhaps 95% focused on people, processes, and culture, rather than on technology, since the majority of technology growth is in information management (i.e. business content

management) and classification systems. Nevertheless, the focus of this study is not on KM Systems but they could play a role in helping deliver the KM strategy of the organisation.

3.3.9 KM Strategy

KM has become increasingly critical for the success of companies in today's dynamic and highly competitive business environment. As business activities increasingly shift to the web, the challenge facing corporate management is maintaining competitive advantage by building strong relations with employees, customers, suppliers and partners. A good KM strategy can help achieve this goal. Furthermore, the effective use of knowledge is a key component in every successful organization no matter what field or business function they may be in or what services the organization provides.

In this climate of competition creativity for innovation is given great strategic emphasis (Mintzberg, 2001; Pfeffer et al., 1995), and consequently employee skills and expertise are deemed the most valuable resources. As a result, the management of any organisation should capitalise on these resources by developing a KM strategy appropriate to the organisation (Allee, 1997; Duffy, 2001; Ahanotu, 1998).

Hansen et al., (1999) suggests two strategies for managing an organisation's knowledge: codification strategy and the personalisation strategy. Both of these strategies must be aligned with the organisations overall business strategy. The codification strategy is designed to coordinate knowledge-related activities for storing explicit knowledge in databases and other forms of information storage devices in order to make this accessible to employees and individuals. The personalisation strategy coordinates knowledge-related activities to share tacit knowledge between employees and individuals. Both of these strategies must be present in the organisation to some extent, depending on the organisational context, in order to achieve competitive advantage

Furthermore, Choi and Lee (2002) argue that the fit between KM processes and KM strategies is imperative in improving corporate performance. It is essential to identify which knowledge processes represent unique and valuable capabilities for effective KM (Holsapple and Singh, 2001). However, implementing knowledge processes within a firm can be very costly and fragile (Soliman & Spooner, 2000). Therefore, knowledge processes should be guided by appropriate knowledge strategies. KM strategies that firms take

have a significant influence on KM processes (Zack, 1999). Furthermore, given the financial constraints of SMEs it is even more important for such organisations to effectively manage their knowledge processes through the formulation of an effective KM strategy.

Nevertheless, Burke and Jarett, (2004) argue that whilst the process of general business strategy definition to guide business growth in large corporations has been extensively debated (Chakravarthy, 1997; Hamel and Prahalad, 1994; Stalk et al., 1992), the process of formulating and defining strategy in the SME has not been as easily described or understood by business researchers. This shows that the area of strategy in the SME-context is not very well understood by researchers and requires further exploration. Consequently, this could have a knock-on effect on the possibility of formulating an effective KM strategy for the SME.

Given the importance of a KM strategy, Uit Biejerse's (2000) study into Dutch SMEs showed that SMEs show no explicit KM strategy or policy to coordinate their knowledge related activities. However, SMEs did show the acknowledgement of the importance of knowledge as a competitive factor and in addition allocate resources towards knowledge-related activities. Furthermore, Burke and Jarett (2004) argue that strategy in the SME is highly contextual and dynamic and does not operate similar to that of larger organisations. In order to implement an appropriate KM strategy in SMEs, cultural, behavioural, and organisational issues need to be tackled before even considering technical issues (Nunes et al., 2006). Nevertheless, Handzic (2006) argue that the success of any KM initiative in a SME is determined by its impact on the organization; and a critical starting point for a successful KM initiative is a clear KM vision which is aligned with the overall business strategy. Together with an appropriate understanding of KM this will serve as a basis for designing and applying the most appropriate KM interventions that will achieve the right balance between developing new knowledge and utilizing existing knowledge, to ensure the organization's long-term competitive-ness and success. In addition, Handzic (2006) argues that the recent SME case studies from Australia (Hall, 2003) suggest a relatively strong level of interest and sophistication in the KM strategies and in the practices pursued by some SMEs. In general, the issues reported were no different than those encountered by larger organizations.

In short, the literature shows a variety of findings with regards to KM strategy in SMEs thus indicating that this field is presently not very well understood.

The purpose of this study is to further contribute to the understanding of this phenomenon.

However, due to a change in circumstances, this study was plainly able to ascertain if SMEs acknowledged the use of a formal KM strategy. This study was primarily intended to use case studies and explore how SMEs use KM to support innovation. Subsequently, it was intended to ascertain if SMEs acknowledge and use the formal KM strategy to coordinate their KM activities with regards to both the knowledge codification and personalisation strategies as discussed by Hansen et al., (1999).

It was intended to ask SMEs whether or not SMEs in the UK energy sector have a formal KM strategy to coordinate their KM activities. Consequently, discrepancies between this initial expectation and actual findings would be identified for further exploration. In addition, it was intended to ascertain if a SME identified the key knowledge it needs to realise its organisational goals and objectives; and to ascertain whether or not the SME continuously or on a periodic basis maps or identifies its knowledge. These two attributes are key components of a formal KM strategy (Hansen et al., 1999; Uit Biejerse, 2000; Burke and Jarett, 2004). As a result, these attributes were incorporated into the questionnaire to determine if SMEs in the UK energy sector undertake such activities.

3.4 KM and SMEs

3.4.1 What is a SME?

The importance of defining a small organisation is a necessary and foremost step of any project which engages with such organisations since OECD (2002) and Storey (1994) concur that there is no single definition of a small organisation. Consequently this is reflected in the literature which shows a multiplicity of definitions small organisations (Wong and Aspinwall, 2002). However, in the spirit of progress and advancement, in this thesis, a small organisation is handled the same way as a SME which is an organisation with less than 250 employees (CEC, 1996; DTI, 1999; SBS, 2000).

Furthermore, this definition of a SME is further divided by DTI (2004) into the following: micro firm (0-9 employees); small firm (0-49 employees and would include micro); medium firm (50-249 employees); large firm (over 250 employees). These attributes of the SME sample is identified during the questionnaire stage of the project to ascertain if the size of the SME has any significant affect on its KM and innovation activities which will be explained later in Chapter 3.

In 2004, the DTI estimated that of the 4.3 million business enterprises in the UK, 99.9% were SMEs. This emphasises the major contribution which SMEs make to the UK economy. At the start of 2004, SMEs accounted for:

- more than half (58%) of all UK employment (small enterprises accounting for 46.8%; medium-sized enterprises accounting for 11.7%);
- more than half (51.3%) of the UK's estimated business turnover of £2,400billion (small enterprises accounting for 37%; medium-sized enterprises accounting for 14.3%).

Notably, the enticing statistics presented above provide management researchers with an interesting research area to explore. Nevertheless, it is valuable to distinguish the differences between SMEs and larger organisations so to avoid over-generalisations by treating SMEs as nascent larger organisations and that they should be doing what large organisations are already doing (Macdonald et al., 2001).

3.4.2 Comparison of KM in SMEs and Larger Organisations

The literature on KM and its practice have, until recently, been centred on large organisations; and pertinent issues in SMEs have to a large degree been neglected (McAdam and McCreedy, 1999; McAdam and Reid, 2001; Wong and Aspinwall, 2004). However, it is important to note that SMEs do not necessarily share the same characteristics and ideals as large ones consequently there are certain unique features of SMEs that need to be understood before KM is implemented in their environment (McAdam and Reid, 2001; Desouza and Awazu, 2006). As a result, the recognition of the circumstances which SMEs encounter which are associated with KM may be crucial in order to provide a well-suited KM approach for SMEs.

Generally, larger organisations have tangible and intangible assets compared to SMEs and subsequently they have more knowledge assets hence the focus on them with regards to KM is understandable. In addition, for many larger organisations the business units and departments are stretched across the globe and as a result the need to share and transfer knowledge effectively becomes imperative for the organisation to function effectively as a whole. Nonetheless, the size of the organisation and the spread of its divisions around the globe should not dissuade the need for KM in SMEs! As the success of a SME can be linked to how well they manage their knowledge (Dollinger, 1984, 1985; Brush, 1992; Brush and Vanderwerf, 1992).

Furthermore, Finn and Phillips (2002) note the increasing take-up of KM by larger organisations may cascade down to SMEs since the majority of suppliers of the larger organisations are SMEs (Wong and Aspinwall, 2004). As a result, SMEs may need to further consider the concepts and practices of KM and ascertain how it could enhance their competitiveness.

McAdam and Reid (2001) point out that there is relatively little information available on KM in SMEs. Furthermore, this discovery is parallel to that of the historical growth of most evolving management philosophies of current times which have started in large organisations; for example, Total Quality Management (TQM) (Wilkinson and Willmott, 1994; Kanji and Asher, 1993), Business Process Re-engineering (McAdam and Donaghy, 1999), Balanced Scorecards, etc. However, it is also noted that once the field becomes established, the interest from the SME sector grows.

Lim and Klobas (2000), established in their study of small businesses in Australia and Singapore that the KM needs and challenges are surprisingly similar to those of larger organisations. They also noted that many KM processes are easier to apply in SMEs because it is easier to capture tacit knowledge in less formalised environments. Given the many benefits of KM and how it can enhance the competitiveness of organisations of all sizes, what are the barriers or challenges which SMEs face with regards to KM?

3.4.3 Barriers to KM for SMEs

Storey (1994) reports a survey carried out by the Small Business Research Centre (SBRC) of 1,993 businesses. Respondents were requested to rank eleven possible constraints on growth. For all firms, the two largely significant issues were financial:

- Availability and cost of finance for expansion
- Availability and cost of overdraft facilities
- Overall growth of market demand
- Increasing competition
- Marketing and sales skills
- Management skills
- Availability of skilled labour
- Acquisition of new technology
- Difficulties in implementing new technology
- Availability of appropriate premises or site
- Access to overseas markets

Stable or declining firms ranked 'overall growth in market demand', 'availability and cost of overdraft facilities' and 'increased competition' as key constraints. Fast growth firms ranked 'availability and cost of finance for expansion', and 'marketing and sales skills' as the main problems they have to surmount to expand.

What's more, the issue of lack of resources for SMEs is widely acknowledged in the literature (Welsh and White, 1981; Lee and Oakes, 1995; Motwani et al., 1998; OECD, 2002; Jun and Cai, 2003). This would have a direct impact on the quantity and quality of the various initiatives within the SME.

As a result, this is further mirrored in a SMEs' efforts in establishing a KM initiative and the consequent quantity and quality of time spent on this endeavour. Nevertheless, the lack of resources should not deter SMEs in realising the value of knowledge latent in their organisation but should spur the SME to strive for alternatives and creative solutions to cope with the limitations which they find themselves in. Furthermore, Desouza and Awazu (2006) provide some examples of how SMEs have realised benefits of KM through creative efforts to overcome SME-specific barriers and limitations.

Additionally, what can be seen in the business landscape at the present time is the formation of linkages and alliances. Small companies are starting to develop formal or informal networks with other companies and engaging in other kinds of partnership such as strategic alliances and cross-border merging. In order to enable such networks to be successful, SMEs need to have some KM system compatibility with their partners so that useful knowledge can be easily accessed and shared.

However, as Sparrow (2001) states that it is just not possible to scale-down or infer KM issues from large organisations to small ones. Assuming that KM issues in large organisations are suitable for SMEs and are readily transferable to them is reductionist. This over-simplistic view results from neglecting a proper understanding of SMEs' characteristics and the very volatile and high-pressure environment in which they operate. Like other management aspects, the KM issues that small businesses face will not simply be a scaled-down version of large companies' experiences.

Nonetheless, and like large companies, knowledge is still an essential survival weapon for SMEs. Moreover, for SMEs organisational knowledge, as suggested by Bollinger and Smith (2001) and Meso and Smith (2000), should also be considered as a strategic asset which is valuable, rare, non-substitutable and inimitable by competitors, and is what gives a firm a sustainable competitive advantage. Thus, competitiveness of SMEs will depend increasingly on the quality of the knowledge they apply to their business processes and the amount which is embedded in their outputs. Essentially, prosperity in the twenty-first century will be dependent on their [SME's] ability to establish mechanisms, that enable them to continuously acquire, share and apply knowledge (Wong and Aspinwall, 2004). Knowing the financial and resource constraints which SMEs find themselves in, it is important to design and promote a variety of mechanisms, instruments and activities feasible for the SME budget.

Ghobadian and Gallear (1997) listed some major features of SMEs with regard to aspects such as structure, behaviour, processes and procedures. Adopting their (above authors) work together with those of Yusof and Aspinwall (2000), Spence (1999), Haksever (1996), and d'Amboise and Muldowney (1988) enabled the Wong and Aspinwall (2004) to compile a list of characteristics for SMEs in areas which can have a direct bearing on the design and implementation of KM.

In a brief summary, KM literature on SMEs draws on two main conclusions:

Small businesses generally lack a proper understanding of KM –mostly in terms of key conceptual understanding; and

Small businesses have been slow in adopting formal and systematic KM practices – it does not feature highly as an important agenda in most of them.

These points show that great efforts are needed to assist and encourage SMEs to embrace KM. However, without a proper perspective and understanding of their features, it is difficult to suggest a way forward (Wong and Aspinwall, 2004). This thesis aims at contributing to resolve this gap in understanding.

The following chapter discusses the role of innovation in today's economy by reviewing the literature to help provide theoretical insights for the KMOLI cycle. Furthermore the role of innovation in SMEs is discussed.

3.4.4 KM Activities and Instruments

An extensive literature review was conducted to identify activities and instruments which have been used in previous KM studies on SMEs. However, the literature showed a scarcity of KM studies in the context of SMEs. Consequently, the KM study conducted by Uit Beijerse (2000) on Dutch SMEs was used due to its primary focus of KM in SMEs coupled with an extensive list of KM activities and instruments. These activities and instruments were then contextualised for this study and categorised according to the KM processes discussed in the KMOLI model and then incorporated into the questionnaire. The primary objective here was to determine the KM activity of SMEs in the UK energy sector through the use of KM activities and instruments. It was intended to identify any discrepancies between the initial expectation, which was that SMEs undertake KM activity, and the actual findings subsequently further areas for exploration would then be suggested.

3.5 Summary:

The UK Energy sector is fast becoming a highly competitive environment for small and large organisations alike to operate in due to a plethora of internal and external pressures. Since knowledge is widely acknowledged as the most critical competitive factor for organisations today, these organisations need to realise how to manage their knowledge to provide them with the competitive advantage in this turbulent UK Energy sector.

Given that Small to Medium-sized Enterprises (SMEs) make-up 99.9% of the businesses in the UK (DTI, 2004), it maybe critical to facilitate the management of knowledge in these businesses.

Knowledge is widely considered as the most critical resource in today's economy and the management of this knowledge to utilise its potential benefits could propel organisations into more competitive organisations. KM could provide SMEs with direct business benefits but it would need to be implemented considering the specific circumstances for each SME. This study intends to investigate the current KM activities of SMEs based in this sector to ascertain if and how these SMEs could use KM to support innovation in order to enhance their competitiveness and consequently their survival in this turbulent business environment.

Chapter 4: Innovation and Innovation in Small to Medium-sized Enterprises

4.1 Introduction

This chapter reviews the process of innovation and includes a definition of innovation which was adopted for this study. Furthermore, the importance of innovation in today's economy is explained and how innovative organisations create a competitive edge. In addition, the process of innovation in SMEs is explained by reviewing previous studies. Challenges and barriers for SMEs in realising their innovation goals are presented.

4.2 Innovation

4.2.1 What is innovation?

The DTI (2005) explains that innovation is at the heart of business competitiveness. It is reflected not just in new high-tech 'must-haves' for the Christmas shopping season, but also in the services that companies offer and in the processes and business models that help to shape what companies do and how they do it.

Drucker (1993:173) argues that innovation is the application of knowledge to produce new knowledge. As a result, this emphasises the importance of knowledge in the innovation process. Furthermore, Carniero (2000) argues that innovation should be viewed as a complex process, which involves a set of investment possibilities. In this investment perspective, knowledge has to be considered as a sort of capital. The relationship between knowledge and innovation is explored further in Section 6.

Wolfe (1994:406) argues that the main characteristic of innovation is 'change'. The term can have different meanings in different contexts hence it is difficult to define. This is further reflected in the literature as Amidon (1995) highlights the multiplicity of definitions of innovation encountered in the various fields of its application.

Nonetheless, in the spirit of scientific discovery and progress we use the following definition of innovation: "Innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved manufactured products, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service. R&D is only one of these steps." OECD (1981:15-16)

Why innovate?

The swiftly emerging global economy, resulting from the surfacing and development of new-fangled technologies, raises a multitude of issues for businesses both large and small. Hill (2000) explains that this creates opportunities for businesses to expand their revenues, drive down their costs, and boost their profits. Robbins et al., (2000) argues that the spread, assimilation and further improvement of new technologies largely determine the patterns of competition, growth, and trade amongst international firms and nations at large. The implication is that in the dynamic, chaotic world of

global competition, organisations must innovate if they are to compete successfully. Furthermore, it has been suggested that innovation is indispensable in order to produce long-term stability, growth, shareholder returns, sustainable performance and remain at the leading edge of the organisation's industry (Cook, 1998; Davis and Moe, 1997; Doyle, 1999). The ability to innovate is increasingly viewed as the single most important factor in developing and sustaining competitive advantage (Tidd et al., 2001). It is no longer adequate to do things better; its about "doing new and better things" (Slater and Narver, 1995).

The 1990s was an era characterised by rapid social, political and technological change. From history, the human race has experienced two great waves of change: the Agricultural revolution and Industrial revolution. Many commentators including Toffler (1984) have said that we are in the middle of the 'third wave' where technological and social changes are fast and furious and the need for organisations to innovate is imperative for survival. In the following section the definition of innovation is explored.

There a number of areas in the innovation literature where confusion is ubiquitous.

Innovation and invention

To avoid confusion, invention and innovation should not be made equal because an invention may not necessarily lead to an innovation! Freeman (1982:7) makes a clear distinction between the two terms: "....an invention is an idea, a sketch or model for a new or improved device, product, process or system"; and "....an innovation in the economic sense is accomplished only with the first commercial transaction involving the new product, process, system or device".

Creativity and Innovation

The literature provides a multiplicity of definitions for ``creativity'' in the literature. Heap (1989) suggests that creativity is the ``synthesis of new ideas and concepts by the radical restructuring and re-association of existing ones''. Similarly, Gurteen (1998) defines creativity as the generation of ideas and that creativity is about divergent thinking whereas innovation requires convergent thinking. In addition, Ford (2000) offers a similar definition of creativity to Amabile (1998). He believes that creativity is a context specific and subjective judgement of the novelty and value of an outcome of an

individual's or collective's behaviour. In essence creativity is the generation of ideas from which the process of innovation is used to realise these ideas.

Ahmed and Abdalla (1999) argue that one way to achieve growth and sustain performance is to foster and encourage creativity and innovative practices internally within the organisation. Naturally, there must be a commitment from senior management to facilitate this kind of innovative working environment. Furthermore, Cumming (1998) explains that most authors now agree that the process of idea generation is "creativity", and although creativity is an important precursor to innovation the two terms are not synonymous.

Having clarified some of the misconceptions in the literature the following sections explore the dimension and types of innovation.

Three dimensions of innovation

Innovation can be classified into three areas: product innovation; process innovation; and organisational innovation. Product innovation refers to the new and/or improved product, equipment and service. Process innovation, is the adoption of a new and/or improved manufacturing or distribution process. Neely and Hii (1998) argue that these two areas (product and process innovation) are not exclusive and can overlap, because a process innovation may lead to a product innovation, and a product innovation may induce a process innovation.

As well as product and process innovation there is also organisational innovation, this involves effectively using the human resources in an organisation that are crucial to exploiting new ideas. For this reason this is why innovation has three dimensions: product, process and organisational EU (1995:2): "In brief, innovation is the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; the introduction of changes in management, work organisation, and the working conditions and skills of the workforce".

This study could have specifically focussed on these three dimensions of innovation from the onset and related these to the KM processes and systems of the SME. However, a holistic approach to identify issues in the questionnaire survey was taken and it was intended to explore these dimensions of innovation in the context of the SME during the case study

analyses. Nonetheless, the key discrepancies or issues are presented in the final chapter for further exploration.

Two Types of Innovation Approaches: Radical and Incremental

There are two types of innovation approaches: radical and incremental. An example of radical innovation (breakthrough type) was the launch of the CD player and the introduction of the 32-bit chip to replace the 16-bit chip is an example of incremental innovation (progressive type).

Furthermore, for innovation to benefit, the society as a whole, it must diffuse. Diffusion is the way in which innovations spread, through market or non-market channels. Without diffusion, an innovation will have no economic impact (OECD, 1992:10). Rogers (1983) further explains how the diffusion of innovation can be influenced through the economic, social and political characteristics of a society.

Models of Innovation

There are various different models which attempt to explain how the innovation process works. Rothwell (1994:40-50) classified the models of innovation process into five generations: First generation –technology push; Second generation –market pull; Third generation –coupling model; Fourth generation –integrated model; Fifth generation –systems integration and networking. The models are explained in more detail in Appendix 1.

Linkages to external networks and customer relationship are two important areas of the organisations innovative activities (Von Hippel, 1988; Lundvall, 1988; Normann, 1991; Stevens, 1997). Furthermore, Stevens (1997:17) emphasises importance of networking amongst firms and role of competition in advancing innovation.

As Scarborough et al., (1999) argue that this importance of networking, coupled with ever more sophisticated information technologies and pressures for dealing with global customers, is placing a much greater emphasis on innovation that allows integration both within and across traditional organizational and inter-organizational boundaries. Thus many innovation processes are becoming increasingly interactive, requiring simultaneous networking across multiple ``communities of practice'' (e.g. functional groups, business units, IT suppliers) sometimes on a global scale. This networking involves negotiation among different social communities, which may have distinctive norms, cultural values and interests in the innovation process

(Scarborough and Corbett, 1992; Spender, 1989). Given the characteristics of KM, as discussed previously, it is clear that KM has a role to play in facilitating the networking and interaction of employees and individuals for innovative ends.

The phenomenon of innovation has been studied at three different levels of analysis: firm-level (Wolfe, 1994), regional-level (Camagni et al.,1997) and national-level (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Archibugi and Michie, 1997). Wolfe (1994:413) explains that the literature on innovation at the firm-level can be classified into three main areas: diffusion studies, organisational innovativeness studies and process theory studies. In addition he provides a framework to explore the holistic evaluation of a firm's innovation.

Innovativeness and innovative capacity

Rogers (1962) defines innovativeness as the degree to which an individual or other unit of adoption is relatively earlier in taking new ideas than the other members of a system. The idea of 'innovativeness' is applicable to an individual and the organisation.

Researchers started looking at organisations as a unit of adoption, this is when the term 'organisational innovativeness' emerged. Rogers (1995:380) argues that from the literature there are three factors which influence 'innovativeness': organisational characteristics, managerial characteristics and environmental characteristics.

Neely and Hii (1998) point out that there are various terms used to mean 'innovative capacity'. OECD (1981) define innovative capacity as the potential of a firm, a region or a nation to generate innovative outputs.

Papaconstantinou (1997) argues that the capacity of firms to innovate depends on a multitude of factors, not least the efforts they make to create new products or improve production processes, the extent of skills in their work force, their ability to learn, and the general environment within which they operate. The potential of the firm in terms of generation of innovative outputs depends on the 'synergetic interrelationships' of: firm culture, internal processes and external environment (Neely and Hii, 1998).

A study was carried out by DTI (2003) on "the performance of UK-based companies in innovation" this was based on structured interviews. Appendix 2 identifies the key findings of this study.

The ability of companies to innovate will typically depend on the nature of the company — for example on its internal culture, the business sector in which it operates and the demands of its customers — and the type of work that it does. It will also be affected by the economic and legislative landscape in which the company operates. (DTI, 2005)

Nevertheless, as Bubner (2001) points out that most firms still have difficulty adopting practices and behaviours associated with innovation. This is partly because of the scope and the complexity of underlying capacities that enable a firm to be innovative. Given the volatility in the environment (Robbins et al., 2000), long term economic performance demands that firms develop an adaptive culture in which innovation features prominently (Smith, 1998; Deal and Kennedy, 1999).

Essential to the process of innovation, is the ability of the organisational culture to:

- Develop collective knowledge reservoirs by sharing individual knowledge and experiences which are shared among the members of the organisation and provide the basis for structural capital of the organisation;
- Create knowledge depositories (Howells, 1996),
- Promote a proactive approach to achieve the internal dissemination of knowledge, independently of where it was created and how it was deposited (Fahey and Prusak, 1998).

Companies are increasingly realising, on the one hand, that the basis for competitive advantage is their knowledge base (Sveiby, 1997), and on the other hand, that innovation is paramount for the sustainability of these advantages. There is a world wide agreement that knowledge and innovation are the competitive strength needed for successful companies (Nonaka, 1991; Nonaka & Takeuchi, 1995; European Commission, 1995; Fruin, 1997; Thurrow, 1996; Stewart, 1997; Sveiby, 1997). So, both knowledge and innovation play a key role in the competitive advantage of an organisation this then raises the question which is the best way to manage knowledge to drive innovation?

4.3 Innovation and SMEs

4.3.1 Importance of SMEs to the Economy

Kaufmann and Tödtling (2002) argue that innovation is one of the most important strategies of competition, both for small and large firms. A simplistic view of SMEs is still common among policy makers who see SMEs simply as nascent large firms that should be exploiting innovation to realise their growth potential (Macdonald and Lefang, 1998; Macdonald et al., 2001). But, contrary to this perception, many managers of SMEs have no ambitions at all to manage large companies (Reid, Dunn, Cromie and Adams, 1999) and the economy is dependent upon the part those SMEs play in it exactly as SMEs (Rothwell, 1989).

Nevertheless, Storey (1994:149) holds that innovation is associated with more rapid growth within small firms and, more recently, Heunks (1998:270) found that innovation of any kind fosters growth of small firms.

It is often argued that SMEs innovate in specific ways, different from the innovation process in large firms. Teece (1996) and Klein and Sorra (1996) conclude that there is a scarcity of studies on the implementation of innovation in SMEs which is further reflected in the literature (Hoffman et al., 1998; Motwani et al., 2000; March-Chorda et al., 2002). They stress the need for further research into innovation in the SME-context. Furthermore, Davenport and Bibby (1999) state that SMEs increasingly need to develop their innovation capabilities.

4.3.2 Innovation challenges for SMEs

As mentioned earlier in Section 3 (KM and SMEs), the issue of lack of resources for SMEs is widely acknowledged in the literature (Welsh and White, 1981; Lee and Oakes, 1995; Motwani et al., 1998; OECD, 2002; Jun and Cai, 2003). This could have a direct impact on the quantity and quality of innovation within the SME. Furthermore, Macdonald and Lefang (1998) add that SMEs rely on their own resources for innovation related activities. As Teece (1996) argues that it cannot be assumed that innovation implementation principles in large organisations are directly transferable to SMEs, where the SME is treated as a scaled-down version of the large organisation. Thus, there is a need for studies on how innovation is implemented within the constraints and characteristics of SMEs.

To develop an effective innovation process, SME managers need to focus not only on products, technology and processes, but also on the culture of the organisation, its norms, values and beliefs (Gunasekaran et al., 1996; Ekvall, 1999). There is a need to develop a climate that is conducive to creativity (Ahmed, 1998). Furthermore, innovation in SMEs, is complex and it is the product of serendipity and happenstance as much as managed and controlled process (Macdonald et al., 2001).

Furthermore, the reality of innovation in SMEs is at variance with the theory behind the policy for innovation in SMEs. The evidence is that SMEs are already surprisingly innovative (Pavitt et al., 1987; Acs and Audretsch, 1990). They have to be innovative to survive. Their problems reside elsewhere, the solutions frequently confounded by the demands already made on SME managers. Basically, SME managers are far too busy coping with a wide range of immediate demands to give much attention to less pressing matters. Thus, their horizons are limited, their view of the world restricted.

In this sense, SMEs make a vital and distinctive contribution to innovation, and there is a part for policymakers to play in facilitating their innovation (Rothwell, 1978). Smallbone t al., (2003) also identify the rate of return for innovations coupled with the skills of employees for innovative activity to affect the innovative performance of SMEs.

In summary, acknowledging that innovation has various perspectives, there is a clear challenge for SMEs to effectively implement a process of innovation. These include key factors emerging from the literature, namely culture, technology, leadership, along with a range of other factors, which reflect a broad multifaceted view of innovation (Tidd et al., 2001). SMEs find this challenge particularly easier said than done as they have scarce resources (Jun and Cai, 2003).

Given the clear consensus amongst the literature with regards to knowledge for innovation, the focus of this project is to explore how KM could support innovation in the context of the SME. Consequently, this would further contribute to the understanding of innovation in the SME-context.

4.3.3 Studies of Innovation in SMEs

The literature shows a multiplicity of studies for the innovation process in SMEs. These studies focus on a variety of factors which could influence the process of innovation in SMEs. For example, evidence reviewed by Storey (1994) for small firms suggested that, out of eight studies of the impact of the

introduction of new products on small business performance, five suggested a significant positive link to business performance. Other more recent studies (for example, North and Smallbone, 2000; Roper and Hewitt-Dundas, 1998) have also found that innovative firms have performed much better in terms of sales and employment growth than have non-innovating firms. Furthermore, Love and Roper (2001) surveyed SMEs based in the manufacturing sector and noted a tendency for innovation intensity (that is, innovations per employee) to decline with plant size. In addition, Keeble (1997) suggested a concentration of product innovation activity in the southern regions of the UK on the one hand, but a tendency for process innovation activity to be more concentrated in the northern and more peripheral regions of the UK on the other. However, the literature shows a scarcity of literature with regards to how knowledge could be used to support innovation.

The following chapter discusses the relationship between KM and Innovation and then presents the KMOLI model.

4.4 Innovation Strategy and Activities

4.4.1 Innovation Strategy

Ramanujam and Mensch (1985) define innovation strategy as a timed sequence of internally consistent and conditional resource allocation decisions that are designed to fulfil an organization's objectives. Activities must be consistent with an overarching organizational strategy that implies that management must take conscious decisions regarding innovation goals (Sundbo 1997). Innovation strategy is generally understood to describe an organization's innovation posture with regard to its competitive environment in terms of its new product and market development plans (Dyer and Song 1998).

Furthermore, two complementary approaches to its measurement, which have been described as objective and subjective (Li and Atuahene-Gima 2001). Adams et al., (2006) have recently developed a contemporary framework to enable practitioners, from all backgrounds, to conduct and evaluate their own innovation management activities, identify gaps, weaknesses or deficiencies, and also improvement potential. In addition, this model acknowledges and assesses the contribution of KM to the innovation process. Furthermore, organizations applying the framework will be able to tease out areas where innovation is only nominally adopted in their processes and identify areas where attention and resources might be focused. This model could be used for to further explore the innovation phenomena in the SME-context in a further research project as it was encountered towards the end of this study. For further information with regards to this process the researcher recommends to read the actual article.

Nevertheless, there is scant literature exploring the innovation strategy in the context of the SME given that innovation in SMEs is perceived as a product of serendipity (Macdonald et al., 2001). This study aims to further explore and contribute to this phenomenon. Consequently, it was assumed that SMEs in the UK energy sector have a formal innovation strategy which is aligned with the SME's organisational strategy. This was incorporated into the questionnaire in order to ascertain SME's responses and subsequently identify any discrepancies between initial expectations and actual findings for further exploration. In addition, the innovation activities within these SMEs was also considered and incorporated into the questionnaire.

4.4.2 Innovation Activities

It was intended to explore innovation activity in SMEs based in the UK energy sector through the questionnaire survey. As Sundbo (1997) emphasises that the literature shows a variety of innovation activities and instruments which organisations use to realise their innovation and organisational goals and objectives. However, as Oke et al., (2004) posit that it is clear from the innovation literature that there is a scarcity of studies exploring SME-specific innovation activities. Nevertheless, innovation activities and instruments from Oxbrow and Hart's (2002) Innovation Model were identified and used for this study primarily because of their applicability to all organisation sizes and types. Subsequently, these activities and instruments were incorporated into the questionnaire to determine SME innovation activity in the UK energy sector. It was initially expected that SMEs would undertake these activities. However, any discrepancies between the actual findings and initial expectations would be identified for further exploration.

4.5 Summary:

The process of innovation is indispensable and critical for organisations in today's UK economy to remain competitive and to survive. The definition for innovation adopted for this study is, "Innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved manufactured products, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service. R&D is only one of these steps." OECD (1981:15-16).

SMEs are widely acknowledged to be innovative organisations. However, amongst the traditional finace and resource barriers to innovation, Smallbone t al., (2003) identify the skills of employees for innovative activity to affect the innovative performance of SMEs. The knowledge development and acquisition processes in the KMOLI cycle could provide these SMEs with a potential solution to their innovation challenges.

This study investigates the innovation goals of SMEs by identifying innovative activities, the allocation of resources to innovation activities, and strategies with regards to innovation which SMEs use to remain at the competitive edge of their industry or sector.

Chapter 5: Questionnaire Survey

5.1 Introduction

This chapter presents the key findings from the Questionnaire survey and is divided into two parts. Part 1 presents the key findings with regards to each of the 30 questions from the questionnaire. Bar charts and pie-charts are used to illustrate the key findings and some discussion is provided with regards to these key findings for each question. Part 2 presents the exploratory statistics of 24 relationships which were identified from Part 1, and were decided by the researcher to be relevant in further understanding the research question and objectives. The 24 relationships were explored using Chi-square and Fisher Exact Tests to determine if the relationships were statistically significant of the SMEs in the UK Energy sector. Discussion of these key findings is also presented and possible indications of the key findings are discussed but need to be further explored in order to verify and qualify these initial interpretations.

5.2 Part 1: Descriptive Statistics

5.2.1 Introduction

The purpose of this part is to provide the key findings from the questionnaire survey using descriptive statistics. This part is further divided into three sections based on the questionnaire format as illustrated in the previous chapter:

Section 1: Organisation Characteristics

Section 2: Strategic Components

Section 3: Organisation Systems & Processes

Results from each question within the above three sections in the questionnaire is reviewed using descriptive statistics only. Consequently, these key findings, from Part 1, are discussed in the following chapter.

In addition, the following tables summarise the key theoretical propositions for KM and Innovation presented here in Part 1 and show which propositions provided unexpected findings.

Theoretical Proposition - Knowledge Management	Questionnaire Reference	Discrepancy with Initial Expectation (Y/N)
KM Awareness: The majority of SMEs have heard of KM.	Q7	Y
Knowledge as a competitive factor: The majority of SMEs acknowledge that knowledge is one of their most competitive factors.	Q8	N
Level of KM implementation: The majority of SMEs realise significant benefits from developing a knowledge-conscious style of management and specific knowledge actions.	Q9	N
KM Strategy: The majority of SMEs have a formal KM strategy.	Q11	Y
Continuous Identification and Mapping of knowledge: The majority of SMEs continuously identify and map knowledge within its organisation.	Q14	Y
Organisation facilitation of Employees' acquisition of Information and Expertise: The majority of SMEs facilitate employees to acquire information and expertise.	Q22	N
Awareness of relevant Information and Expertise availability: The majority of SMEs make their employees aware of information and expertise available for current projects and activities.	Q26	N
Encouragement of Information and Expertise dissemination and sharing: The majority of SMEs encourage their employees to share and disseminate expertise and information which may help other employees within the organisation.	Q27	N
Knowledge Acquisition activities and instruments: The majority of SMEs use all 10 Knowledge Acquisition activities and Instruments.	Q21-Q30	Y
Knowledge Development activities and instruments: The majority of SMEs use all 19 Knowledge Development activities and instruments.	Q21-Q30	Y
Knowledge Embodiment activities and instruments: The majority of SMEs use all 17 Knowledge Embodiment activities and instruments.	Q21-Q30	Y
Knowledge Sharing and Dissemination activities and instruments: The majority of SMEs use all 25 Knowledge Sharing and Dissemination activities and instruments.	Q21-Q30	Y
Knowledge Use and Revision: The majority of SMEs use all 17 Knowledge Use and Revision activities and instruments.	Q21-Q30	Y

Table 3 Summary of Key theoretical propositions for KM

Theoretical Proposition - Innovation	Questionnaire Reference	Discrepancy with Initial Expectation (Y/N)
Allocation of resources to KM activities: The majority of SMEs allocate resources to KM activities.	Q12	Y
Innovation Strategy: The majority of SMEs have a formal innovation strategy.	Q15	Y
Allocation of resources to innovation activities: The majority of SMEs allocate resources to innovation activities.	Q16	N
Systems and Processes to facilitate ideas from discovery to implementation: The majority of SMEs 'agree' and 'strongly agree' that they have systems and processes in place to facilitate ideas from discovery to implementation.	Q17	N
Improvements in Strategy, Marketing, Organisation Structure, Operations and Management: The majority of SMEs have made improvements in strategy, marketing, organisation structure, operations, and management.	Q18	Y
Introduction of improved and/or new products and/or services to the market: The majority of SMEs introduce new and/or improved products or services to the market; and develop these on their own.	Q19 & Q20	N
Idea activities and instruments: The majority of SMEs use all 11 'Idea' related activities and instruments.	Q21-Q30	Y
Tacit Knowledge activities and instruments: The majority of SMEs use all 11 'Expertise' related activities and instruments.	Q21-Q30	Y
Explicit Knowledge activities and instruments: The majority of SMEs use all 14 'Information' related activities and processes.	Q21-Q30	Y

Table 4 Summary of Key theoretical propositions for Innovation

The following sections further explain the above theoretical propositions.

5.2.2 Section 1: Organisation Characterisation – Q1 to Q10

Question 1:

Please indicate your position in the organisation:

Key findings

Table 1 and Figure 1 below show that 73.6% of respondents were Managing Directors & Joint Managing Directors of the respondent SME.

Position of Respondent	Frequency	Percent (%)
Chairman & Director	7	13.2
Managing Director & Joint Managing Director	39	73.6
Operations Director	1	1.9
General Management	6	11.3
Missing	3	
	56	100.00

Table 4 Table of results for position of respondents in SME

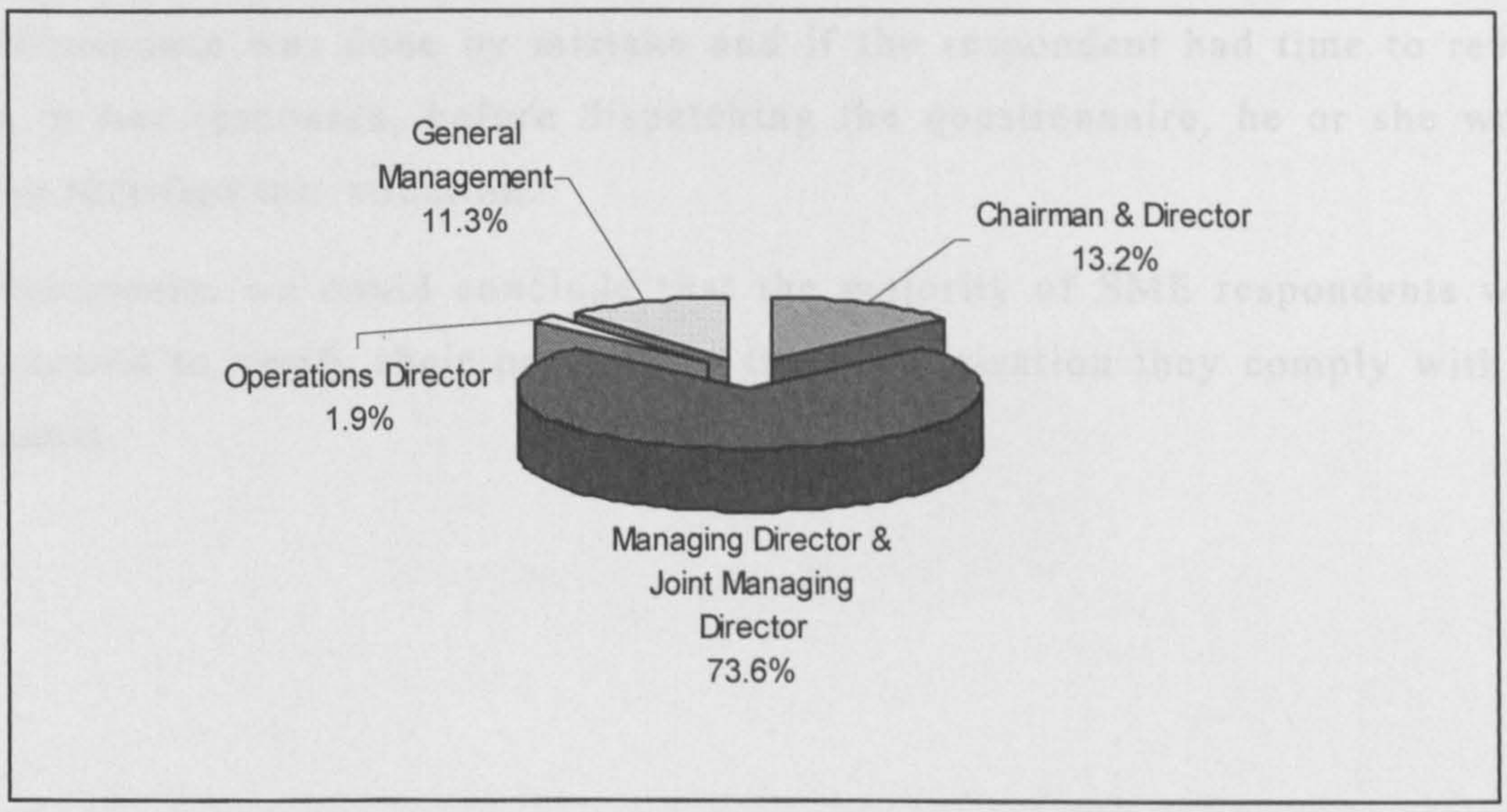

Figure 9 Pie-chart to show position of respondents in SMEs

Discussion

Why was this question chosen?

The questionnaire was addressed to the Managing Director or Senior Executive of the SME and subsequently the purpose of this question was to verify the status of the respondent.

What was the 'initial' expectation of this question?

The initial expectation was that the Managing Director or Senior Executive would respond to the questionnaire as requested on the cover letter accompanying the questionnaire.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 1 and Figure 1 (presented in the previous chapter) show that the majority (73.6%) of respondents were Managing Directors or Joint Managing Directors of the SME. The remaining 26.4% all held senior positions in the organisation. Consequently, all respondents to the questionnaire held senior positions in the SME.

However, there were 3 responses which did not complete this question. De Vaus (2002) identifies four reasons why respondents could miss the questions, as explained in chapter 6. Ideally, the researcher would address this non-response in an interview hence eliciting the actual reasons. Nevertheless, the researcher concludes that given the time constraints that SMEs encounter, this non-response was done by mistake and if the respondent had time to review his or her responses, before dispatching the questionnaire, he or she would have rectified this situation.

Furthermore, we could conclude that the majority of SME respondents when requested to verify their position in their organisation they comply with the request.

Question 2:

Please indicate, by ticking the appropriate box, is your organisation the parent or subsidiary organisation?

1 ☐ Parent (please go to Q4) 2 ☐ Subsidiary

Key findings

Table 2 and Figure 2 show that 69.1% of the respondents are the parent organisation.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent
Valid	Parent	38	67.9	69.1	69.1
	Subsidiary	17	30.4	30.9	100.0
	Total	55	98.2	100.0	
Missing	System	1	1.8		
Total		56	100.0		

Table 5 Table of results to show Parent and Subsidiary SMEs

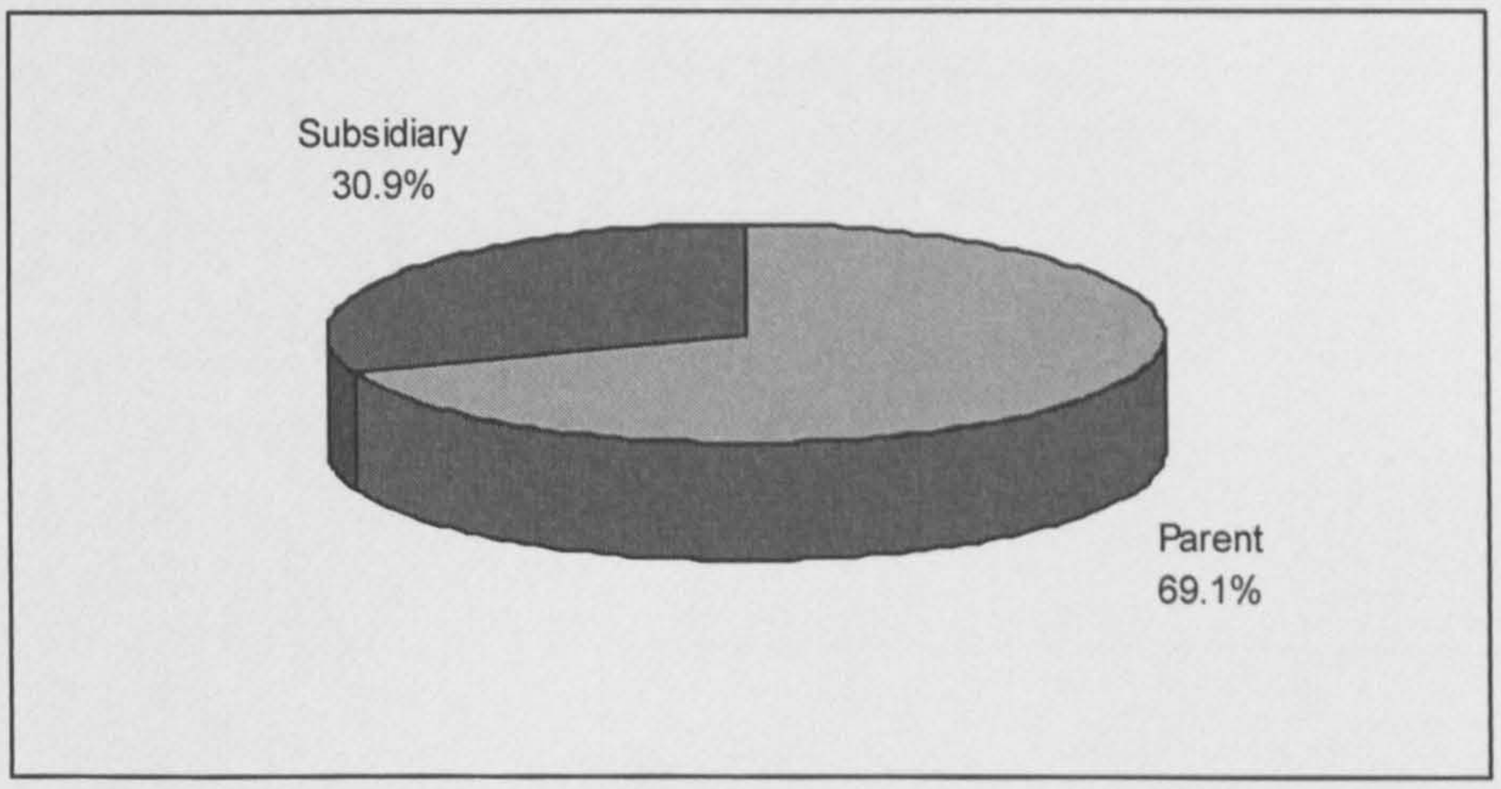

Figure 10 Pie-chart to show the Parent and Subsidiary SMEs

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if the SME was a parent or subsidiary organisation; and to present the descriptive findings to provide some background of the SMEs based in the UK Energy sector.

What was the 'initial' expectation of this question?

The initial expectation was that an equal balance of parent-subsidiary SMEs would be obtained for further exploration.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 2 and Figure 2 show that the majority of SMEs (69.1%) are the parent SME, and 30.9% are subsidiary SMEs possibly part of a larger group of companies. Consequently, it is clear that the majority of SMEs (69.1%) based in the UK Energy sector, for this study, were parent organisations.

Further queries:

1. Explore relationship between parent-subsidiary status of SME and KM and Innovation activity - this maybe outside the scope of this research project. It maybe that subsidiary SMEs generally have a competitive advantage over parent-SMEs.

Question 4

Does your organisation contribute to the UK energy sector?

1 ☐ Yes 2 ☐ No

Key findings

Table 3 and Figure 3 show that 58.9% of respondents do not contribute to the UK Energy sector.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	23	41.1	41.1	41.1
	No	33	58.9	58.9	100.0
	Total	56	100.0	100.0	

Table 36 Table of results to show SMEs which contribute to the UK Energy Sector

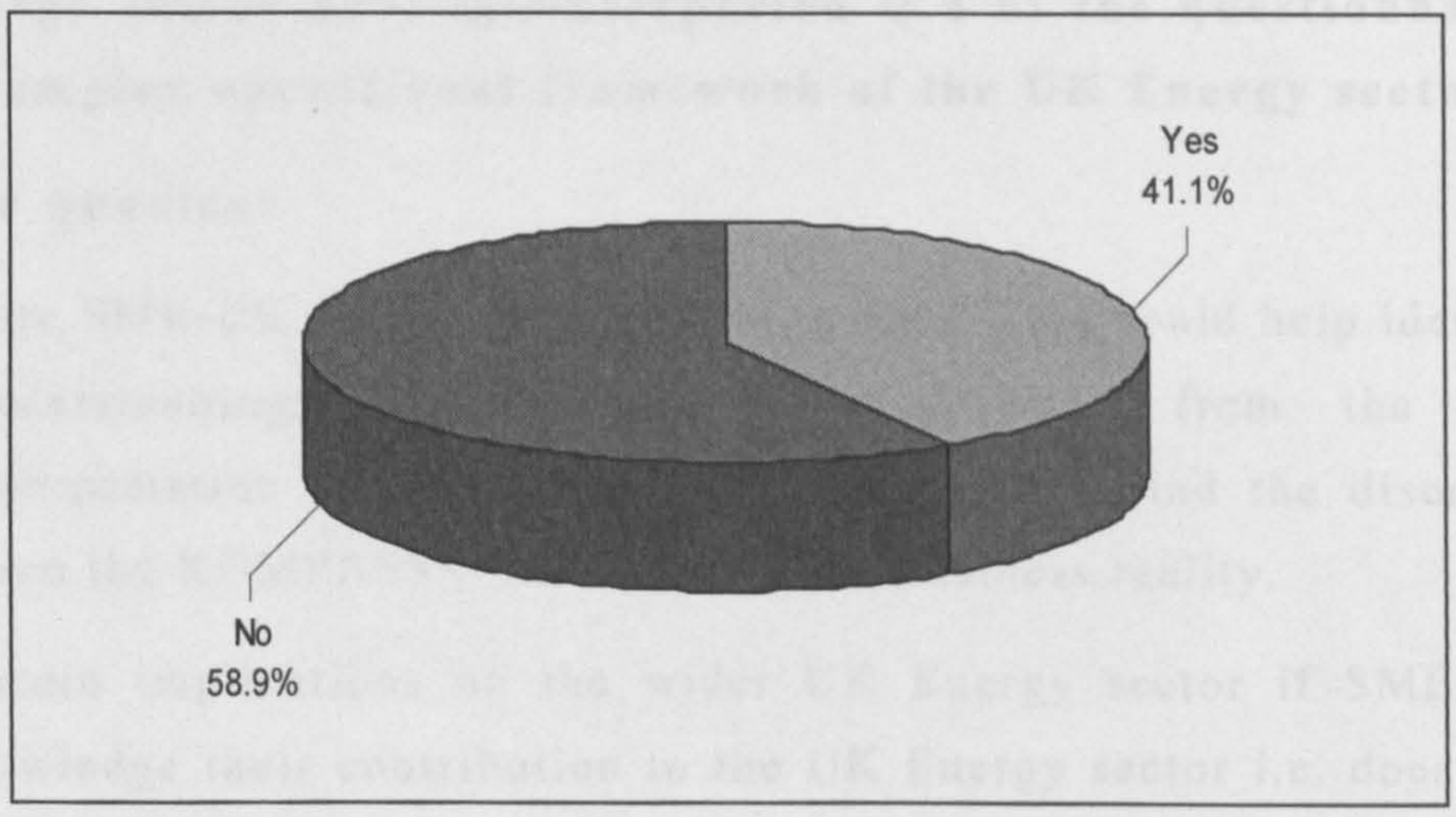

Figure 11 Bar chart to show SMEs which contribute to the UK Energy Sector

Discussion

Why was this question chosen?

The purpose of this question was to verify the SME's contribution to the UK Energy sector.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of respondents would contribute to the UK Energy sector.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 3 and Figure 3 show that the majority (58.9%) of SMEs do not contribute to the UK Energy sector.

As discussed in the literature review, this asserts that the UK Energy sector is a complex framework of organisations with unclear boundaries which in turn presents UK Energy sector SMEs with a further challenge in determining its own business environment. Furthermore, this could present challenges to the government in terms of gauging the impact of the energy policy on the business environment.

Nevertheless, given that these SMEs provide products and services associated with the energy sector, as discussed in chapter 6, the researcher formulated the following assumption to further this study.

All SMEs which respond to the questionnaire survey contribute to the UK Energy sector. SMEs which claim not to contribute to the UK Energy sector have misinterpreted Q.4 of the questionnaire due to the complex operational framework of the UK Energy sector.

Further queries:

1. Explore SME-UK Energy sector relationship. This could help identify any misunderstandings which could have resulted from the possible misinterpretation of this question; and reasons behind the discrepancies between the KOMPASS™ information and business reality.
2. Ascertain implications on the wider UK Energy sector if SMEs do not acknowledge their contribution to the UK Energy sector i.e. does it really matter?

Question 5

Please indicate, by ticking the appropriate box, how many employees (both full-time and part time) do you have in your organisation?

1 ☐ 1 to 49 2 ☐ 50 to 249 3 ☐ 250 or more

Key findings

Table 4 and Figure 4 below show that 5.1% of respondents indicate that they have more than 250 employees.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	1 to 49	41	69.5	69.5	69.5
	50 to 249	15	25.4	25.4	94.9
	250 or more	3	5.1	5.1	100.0
	Total	59	100.0	100.0	

Table 7 Table of results to show sizes of the SME

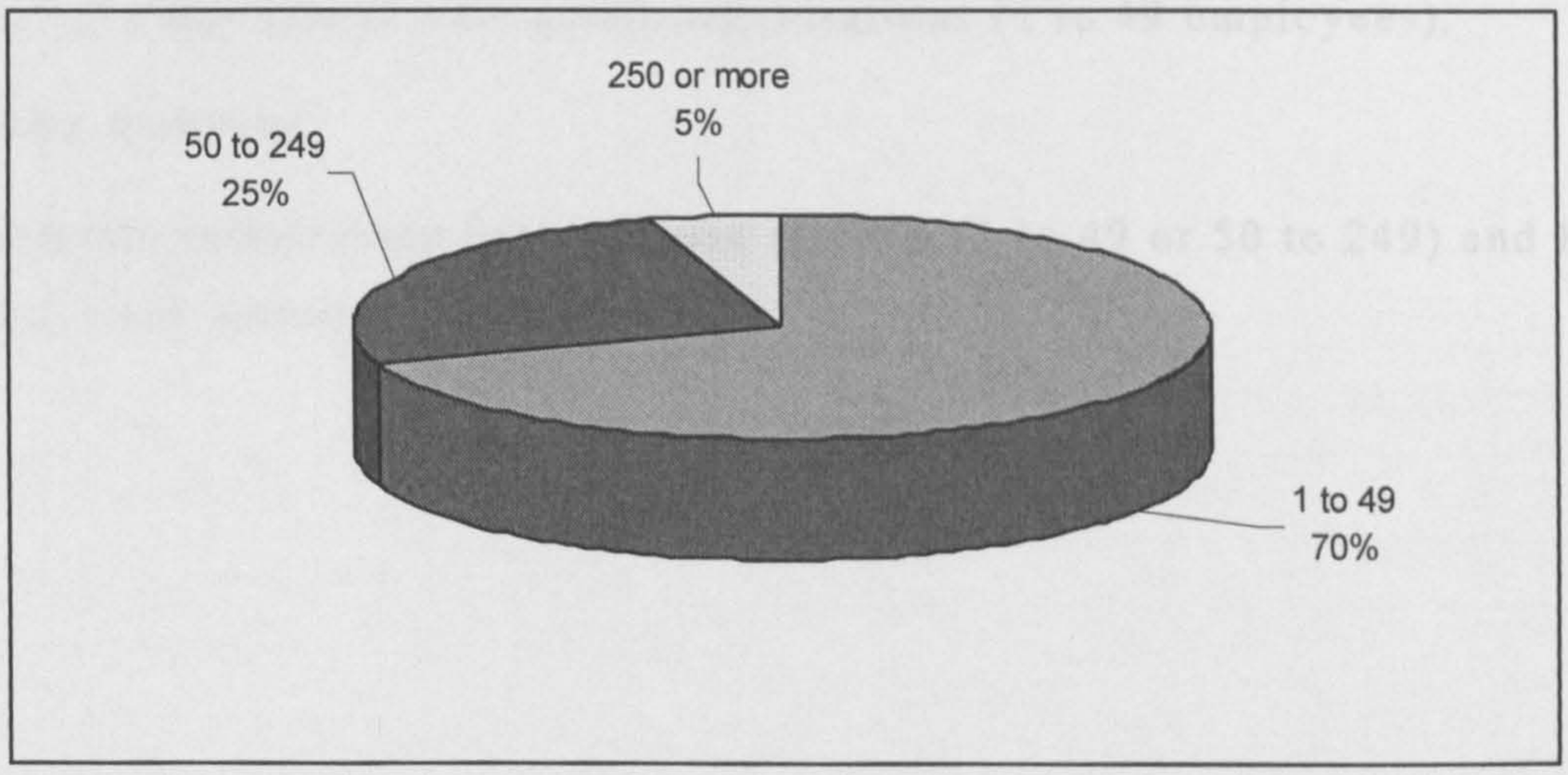

Figure 12 Bar-chart to show sizes of SME

Discussion

Why was this question chosen?

The purpose of this question was to verify the size of the SME; and provide some background descriptive information on SMEs based in the UK Energy sector.

What was the 'initial' expectation of this question?

The initial expectation was that all respondents would have less than 250 employees i.e. select either option 1 or 2.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 4 and Figure 4 show that 5.1% (3/59) of respondents indicate that they have more than 250 employees. Respondents which had more than 250 employees i.e. selected option 3, do not meet the organisation characteristic requirements for this survey, and therefore were excluded during the subsequent analysis.

The KOMPASS™ database was used to identify organisations with less than 250 employees. Due to the dynamic and ever-changing nature of SMEs and organisations in general, it is likely that these organisations i.e. more than 250 employees, did have less than 250 employees at the time they were surveyed by KOMPASS™ but have fallen outside this boundary when this questionnaire survey was conducted.

Nonetheless, from the SMEs which qualified for this survey, the majority (73.2%) of respondents were small-organisations (1 to 49 employees).

Further queries:

1. Ascertain relationship between size of SME (1 to 49 or 50 to 249) and KM-Innovation activity.

Question 6

Please indicate, by ticking the appropriate box(es), the main activities of your organisation:

Production of consumer goods	☐	1
Production of raw or refined materials	☐	2
Production of product parts and components	☐	3
Production of production equipment	☐	4
Wholesale business in consumer goods	☐	5
Wholesale business in raw and refined materials	☐	6
Wholesale business in product parts and components	☐	7
Wholesale business in production equipment	☐	8
Business services; (engineering, IT service)	☐	9
Other, please describe below		
.....		10

Key Findings

Table 5 and Figure 5 show that 29.1% of SMEs indicate that they provide 'Business Services'.

ACTIVITY	PERCENT (%)	FREQUENCY
Production of Consumer Goods [1]	14.5	8
Production of Raw or Refined materials [2]	3.6	2
Production of Product parts & components [3]	27.3	15
Production of production equipment [4]	18.2	10
Wholesale Business in Consumer Goods [5]	5.5	3
Wholesale Business in Raw or Refined Materials [6]	5.5	3
Wholesale Business in Product parts & components [7]	12.7	7
Wholesale Business in Production equipment [8]	0	0
Business services [9]	29.1	16
Other [10]	9.1	5

Table 8 Table of results to show main activities of SMEs

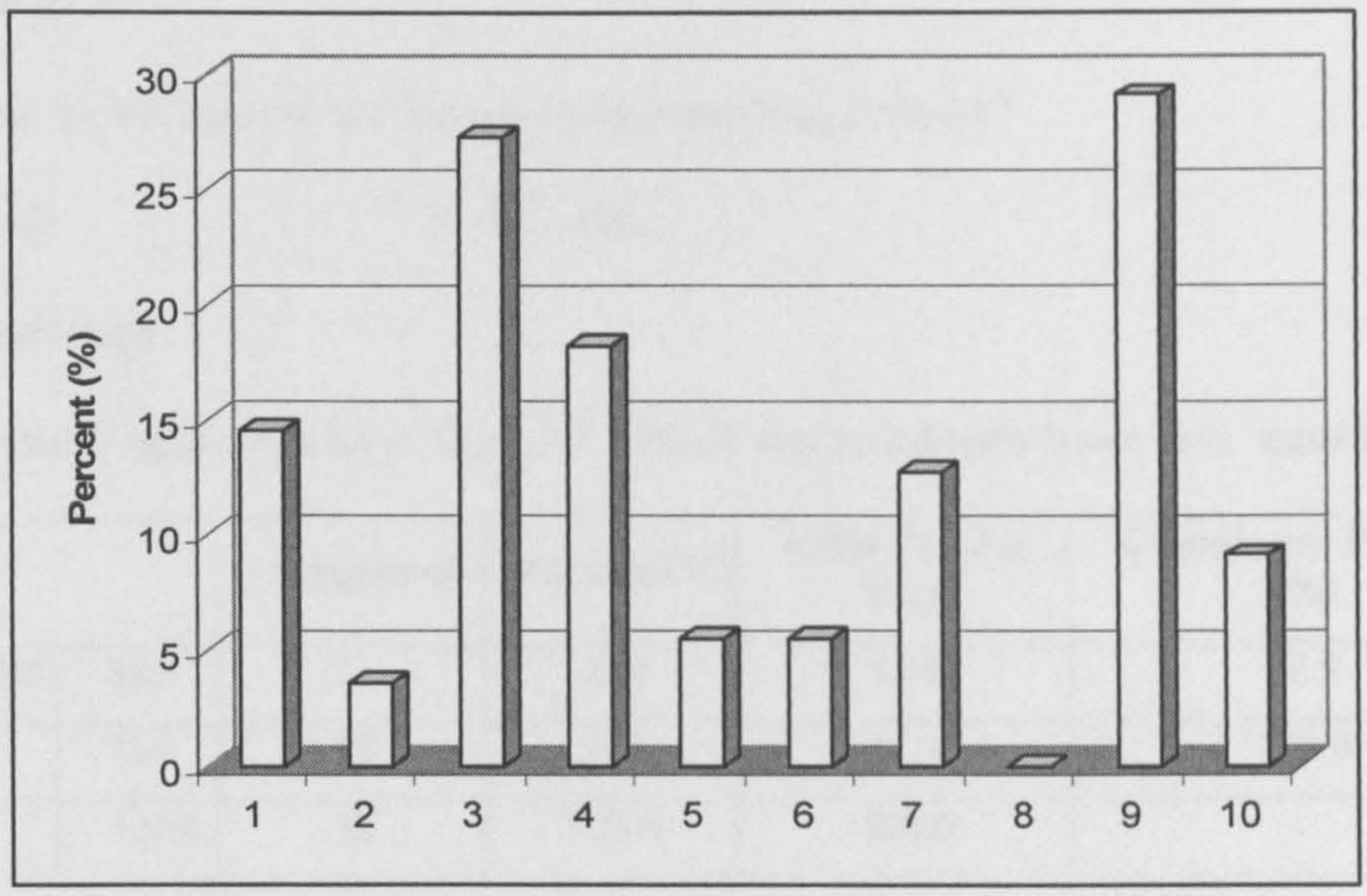

Figure 13 Bar-chart to show main activities of SMEs

Discussion

Why was this question chosen?

The purpose of this question was to identify the main activities of the respondents; and provide some background descriptive information on SMEs based in the UK Energy sector.

What was the 'initial' expectation of this question?

The initial expectation was that SMEs would select a variety of the main activities reflecting the diversity and significance of SMEs in both the UK economy and the UK Energy sector.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 5 and Figure 5 show that the majority (29.1%) of SMEs indicate that they provide 'Business Services'. Furthermore, 8 of the 9 main activities, noted above, were acknowledged by the respondents which further emphasises the diversity of the SME contribution to both the UK economy and energy sector.

However, there were no respondents which acknowledged the 'wholesale business of production equipment' this is not surprising as organisations which perform such activities have a propensity to be larger and well-financed organisations.

Further queries:

1. Determine relationships between 'main activity of SME' and 'KM-Innovation activity.

Question 7

Have you ever heard of knowledge management?

1 ☐ Yes 2 ☐ No

Key findings

Table 6 and Figure 6 show that 57.1% of respondents have not heard of KM.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	24	42.9	42.9	42.9
	No	32	57.1	57.1	100.0
	Total	56	100.0	100.0	

Table 9 Table of results to show SMEs which have heard of Knowledge Management

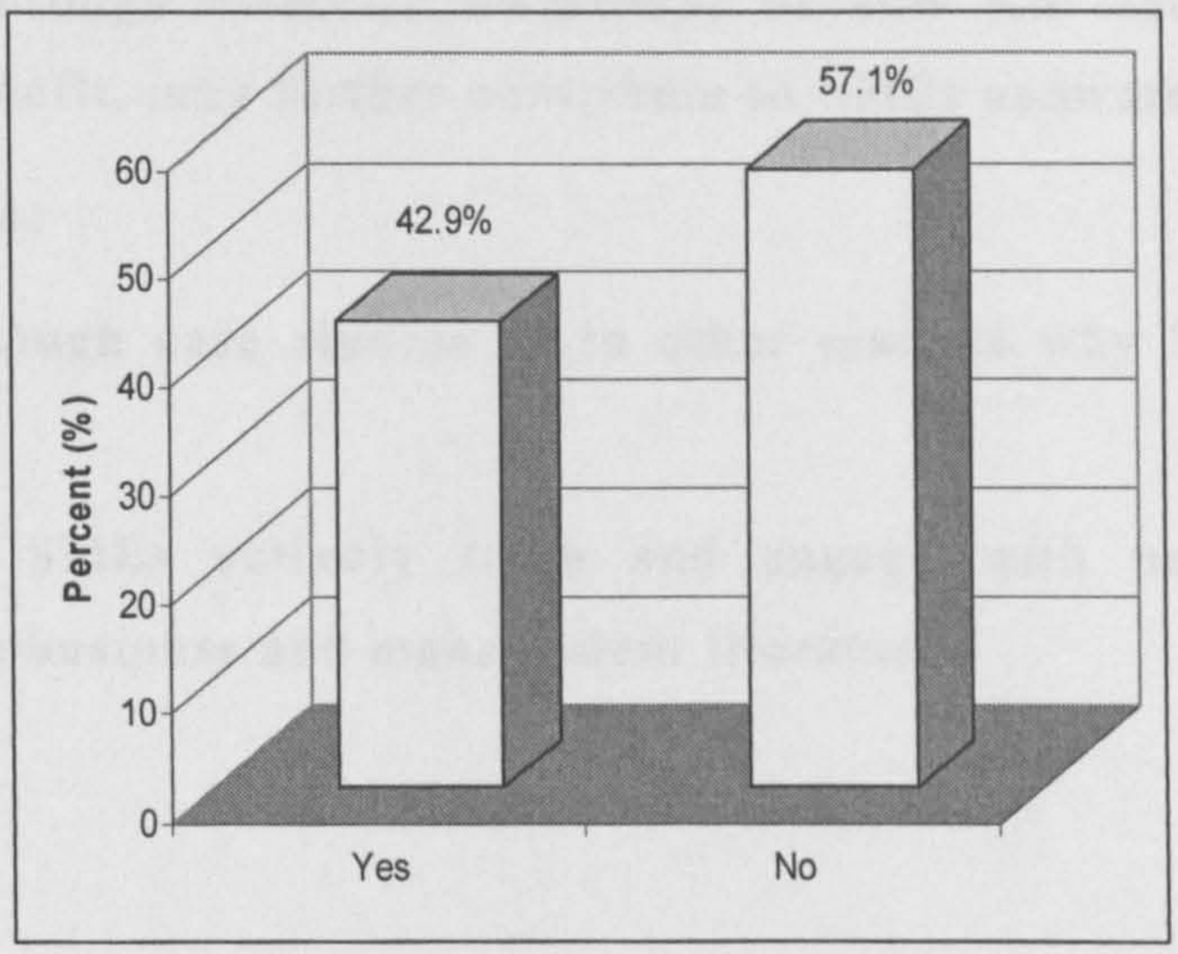

Figure 14 Bar chart to show SMEs which have heard of Knowledge Management

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs have or have not heard of KM; and to establish relationships between this and other KM-Innovation variables from the questionnaire e.g. innovation activities.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs have heard of KM. As KM has received wide publicity in both the academic and business communities in the UK since the early 1990s (Wilson, 2002); and there are a

number of success stories reflecting the direct business benefit of KM to a range of organisations.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 6 and Figure 6 show that the majority of SMEs (57.1%) have not heard of KM. This finding contradicts our initial expectation and requests an explanation as to why this is the case. It may be that the publicity of KM has not reached the hard-to-reach organisations in the SME sector as it is widely acknowledged that SMEs are heavily engaged in the day-to-day activities and concerns related to their own business survival. Furthermore, the lack of resources to learn and engage with existing or new business and management concepts may be another reason for this finding given the widely acknowledge fact that SMEs have finance and resource constraints. In addition, as noted in the literature review, the lack of contextualisation of KM with the SME's business needs, through effective awareness of how KM can help provide direct business benefit, may further contribute to SMEs unawareness of KM.

Further queries:

1. Investigate through case studies as to other reasons why SMEs have not heard of KM.
2. Investigate if SMEs actively learn and engage with new or existing concepts in the business and management literature.

Question 8

Would you say that knowledge is one of your organisation's most competitive factors?

1 ☐ Yes 2 ☐ No

Key findings

Table 7 and Figure 7 below show that 83.3% of the respondents indicate that knowledge is one of their most competitive factors.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	Yes	45	80.4	83.3	83.3
	No	9	16.1	16.7	100.0
	Total	54	96.4	100.0	
Missing	System	2	3.6		
Total		56	100.0		

Table 10 Table of results to show SMEs which claim knowledge is their most competitive factor

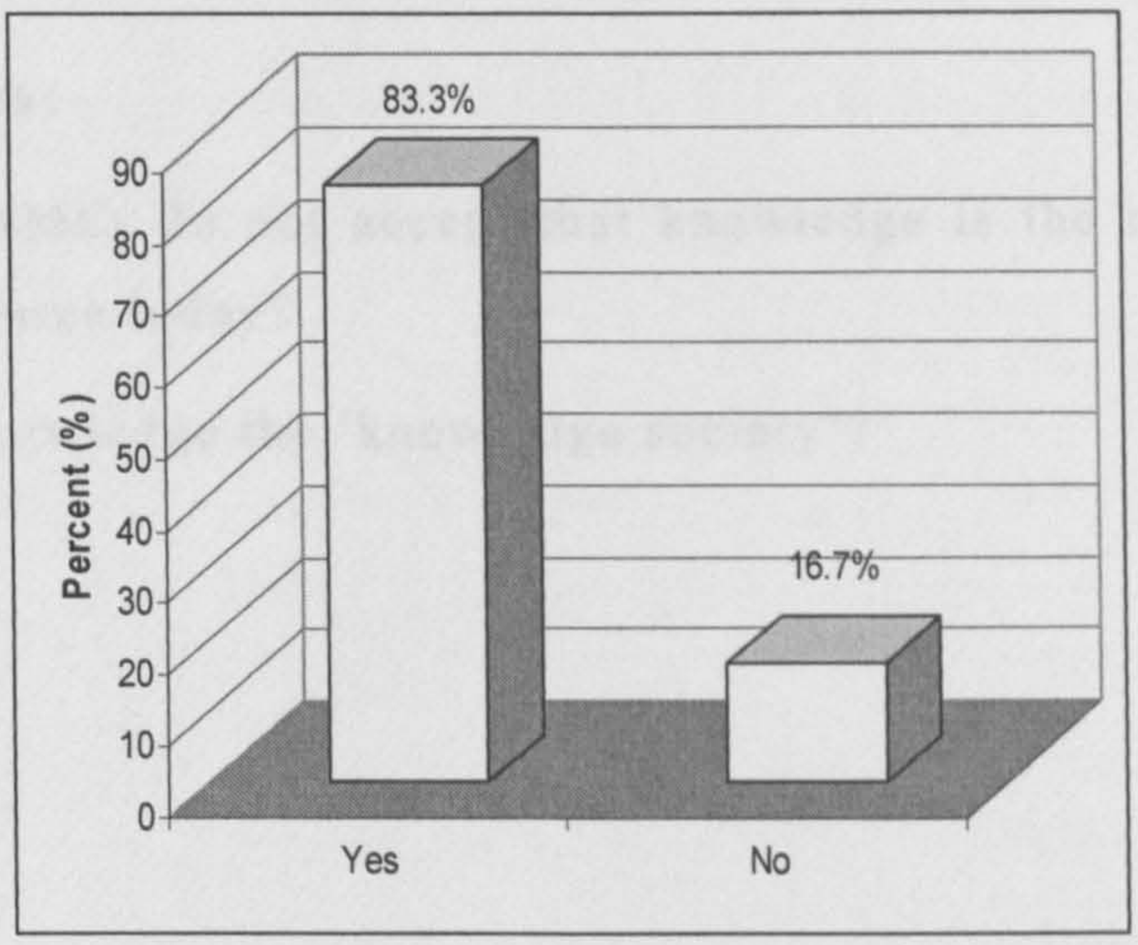

Figure 15 Bar chart to show SMEs which claim knowledge is their most competitive factor

Discussion

Why was this question chosen?

The purpose of this question was to determine SMEs acceptance of knowledge as one of its most competitive factors; and establish relationships between this and other variables in the questionnaire e.g. KM-Innovation activity.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs acknowledge that knowledge is one of its most competitive factors.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 7 and Figure 7 show that the vast majority (83.3%) of SMEs acknowledge that knowledge is one of its most competitive factors.

As discussed in the literature review, Drucker (1993) described knowledge, rather than capital or labour as the only meaningful economic resource in the knowledge society today. However, do SMEs acknowledge that they are in a 'knowledge society'? Nevertheless, from the findings we can acknowledge that the vast majority of SMEs based in the UK energy sector accept the importance of knowledge as its most competitive factors.

There are a number of respondents which do not accept that knowledge is one of its most competitive factors. Consequently, a possible reason for this finding maybe that these respondents still perceive capital or labour to be the meaningful economic resource. However, this could only be verified with regards to SMEs based in this sector through further exploration.

Further queries:

1. Explore why SMEs do not accept that knowledge is the more meaningful economic resource today?
2. Do SMEs acknowledge the 'knowledge society'?

Question 9

Please indicate, by ticking ONE box, which of the following statements best describes your organisation:

Our organisation has realised significant benefits from developing a knowledge-conscious style of management ☐ 1

Our organisation has realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions ☐ 2

Our organisation is still considering how the core principles and practices of knowledge management could deliver business benefit. ☐ 3

None of the above ☐ 4

Key findings

- Table 8 and Figure 8 below show that 43.7% of SMEs have: "....realised significant benefits from developing a knowledge-conscious style of management" and ".....realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions".

- 29.1% of respondents indicate that they are not considering how the core principles and practices of KM could deliver business benefit.

Response	Frequency	Percent (%)	Valid Percent (%)
Our organisation has realised significant benefits from developing a knowledge-conscious style of management [1]	10	17.9	18.2
Our organisation has realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions [2]	14	25.0	25.5
Our organisation is still considering how the core principles and practices of knowledge management could deliver business benefit. [3]	15	26.8	27.3
None of the above [4]	16	28.6	29.1
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 11 Table of results to show level of KM implementation in SMEs

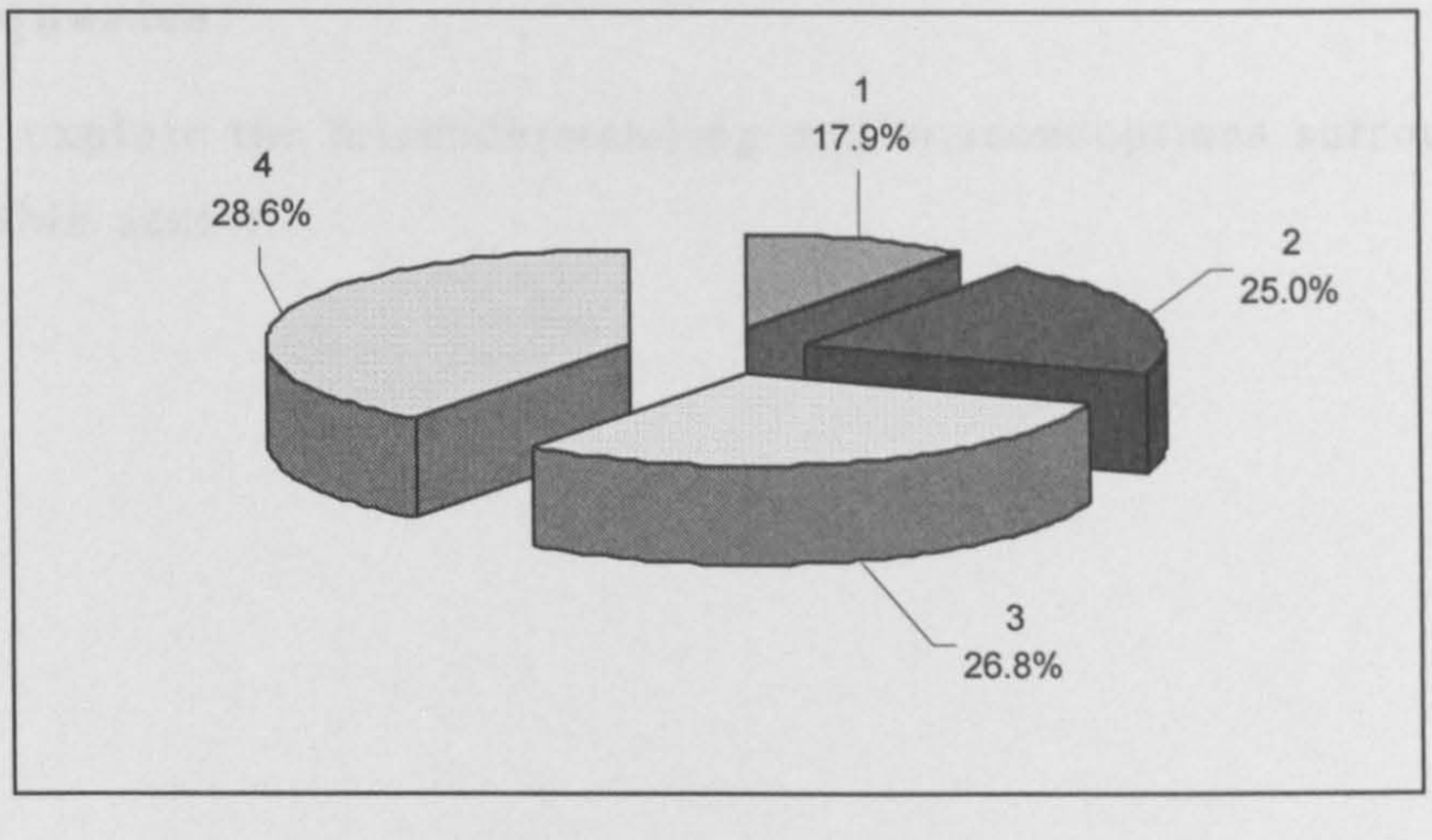

Figure 16 Pie-chart to show level of KM implementation in SMEs

Discussion

Why was this question chosen?

The purpose of this question was to determine the level of KM implementation in SMEs using a different terminology: 'knowledge-conscious style of management'.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs would: "...have realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions" [option 1 and 2].

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 8 and Figure 8 show that the majority (43.7%) of respondents have: "....realised significant benefits from developing a knowledge-conscious style of management"; and "...realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions". This indicates that SMEs acknowledge the importance of knowledge in the management and actions the organisation.

Furthermore, 27.1% of SMEs acknowledge that they are "...still considering how the core principles and practices of KM could deliver direct business benefit" and 29.1% of respondents indicate that none of the statements describes their organisation. This further emphasises that respondents are still be unaware of how KM can add direct business benefit to their organisation.

Further queries:

1. Further explore the misunderstanding and misconceptions surrounding KM in the SME sector.

Question 10

Please indicate, by ticking ONE box, which ONE of the following is your organisation's most critical success factor?

Customer loyalty: a company which primarily cultivates a one-to-one relationship with its customers ☐ 1

Innovation: a company which is primarily a product or service innovator ☐ 2

Cost control: a company which primarily focuses on a low price and/or hassle free service ☐ 3

Key findings

Table 9 and Figure 9 below show that 66.7% of respondents indicate that 'Customer Loyalty' is their most critical success factor.

Response	Frequency	Percent (%)	Valid Percent (%)
Customer Loyalty	36	64.3	66.7
Innovation	12	21.4	22.2
Cost Control	6	10.7	11.1
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 12 Table of results to show critical success factors for SMEs

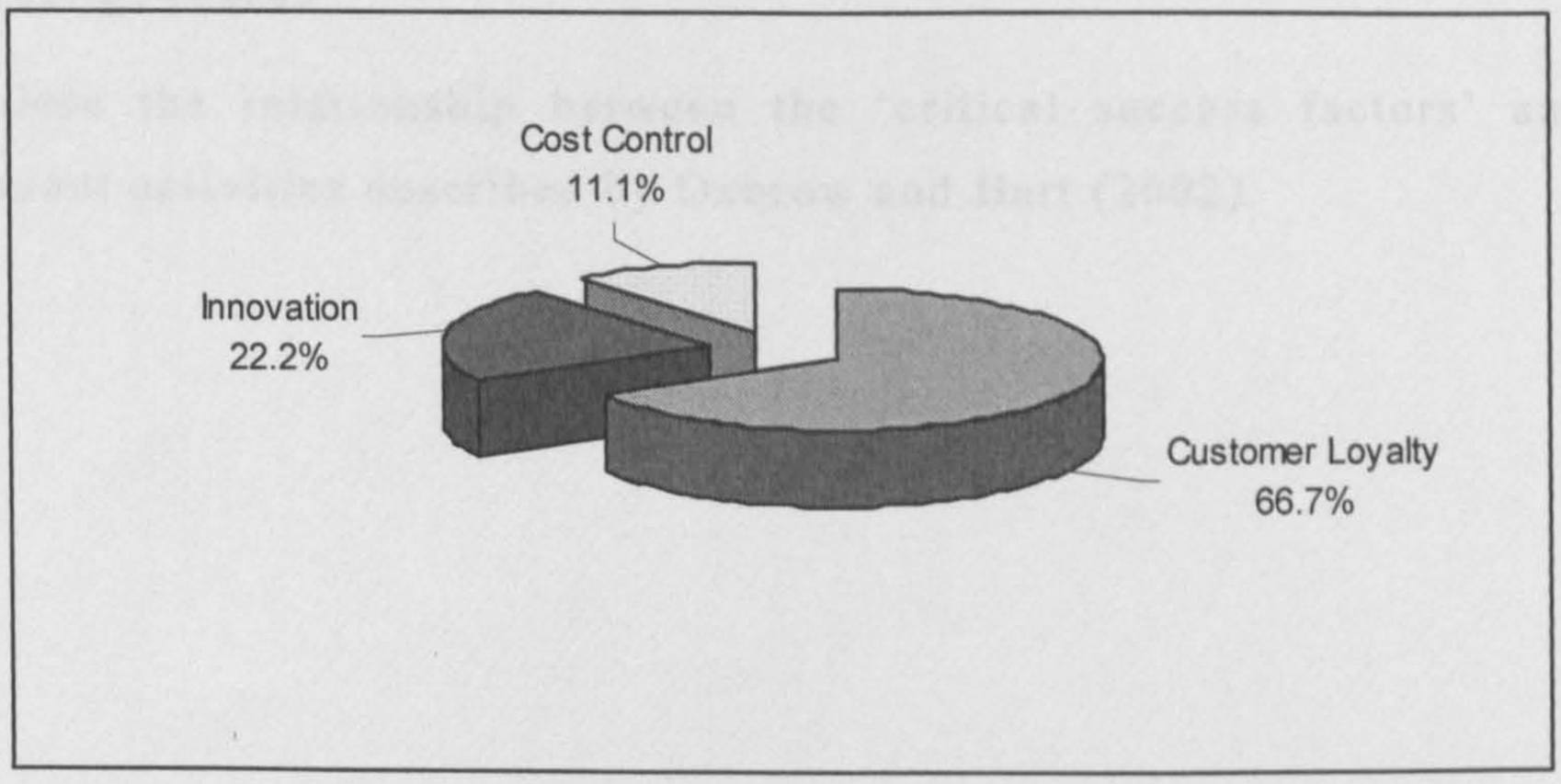

Figure 17 Pie-chart to show critical success factors for SMEs

Discussion

Why was this question chosen?

The purpose of this question was to determine the 'critical success factor' of SMEs based in the UK energy sector; and provide background descriptive information on these SMEs.

What was the 'initial' expectation of this question?

The initial expectation was that SMEs would acknowledge 'customer loyalty' as their most critical success factor.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 9 and Figure 9 show that the majority (66.7%) of respondents indicate that 'Customer Loyalty' is their most critical success factor. This confirms our initial expectation and emphasizes the focus of SMEs on market development activities. According to a DTI survey of UK SMEs, nearly a third earn more than half their turn over from their three largest customers (Marsh, 1996). Given the modest resources of SMEs compared to the larger and well-financed organisations, it becomes imperative for these organisations to maintain customer loyalty with their customer base.

In addition, from the literature review, McAdam and Reid (2001) explain that SMEs have a profound focus on market development activities, which would include developing 'Customer Loyalty', compared to business efficiency and improvement related activities such as 'Cost Control' and 'Innovation'.

Further queries:

1. Explore the relationship between the 'critical success factors' and the relevant activities described by Oxbrow and Hart (2002).

5.2.3 Section 2: Strategic Components – Q11 to 21

Question 11

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Key findings

Table 10 and Figure 10 show that 85.2% of the respondents indicate that they do not have a formal KM strategy.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	8	14.3	14.8
No	46	82.1	85.2
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 13 Table of results to show SMEs which have a Knowledge Management Strategy

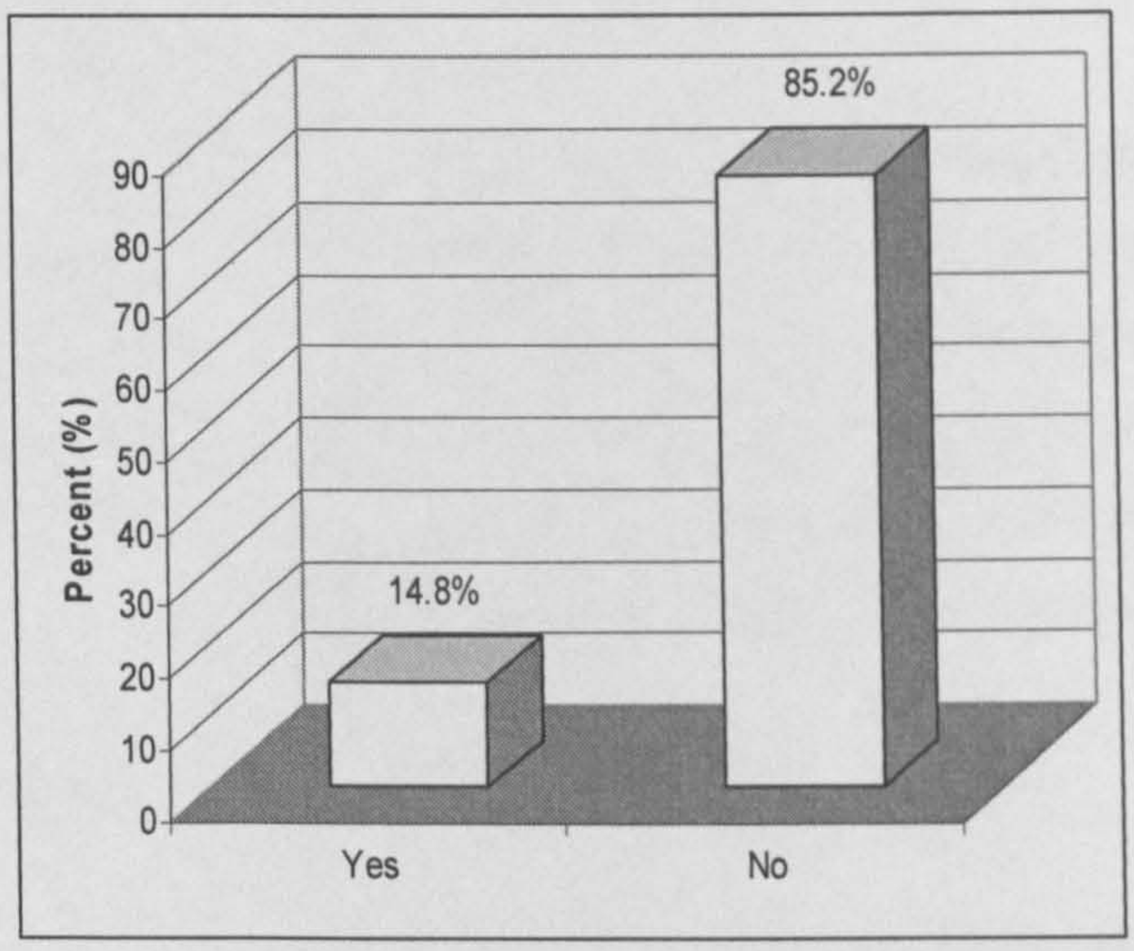

Figure 18 Bar-chart to show SMEs which have a Knowledge Management Strategy

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs have a KM strategy; and relate this to other KM-Innovation variables from the questionnaire.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs have a formal KM strategy.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 10 and Figure 10 show that the vast majority (85.2%) of respondents do not have a formal KM strategy.

Given the importance of a formal KM strategy to co-ordinate KM activities in today's knowledge economy, it is clear that the vast majority of SMEs in the UK energy sector do not have such a strategy. However, as explained in the literature review, the formal KM strategy coupled with the 'informal' KM strategy form the overall KM strategy of an organisation. Subsequently, SMEs may have a case of an 'informal' KM strategy which could only be verified with further exploration beyond the scope of this study.

Nevertheless, as discussed in the literature review, Beijerse (2000) in a survey of Dutch SMEs concluded that the majority of SMEs have little or no explicit KM policy or strategy. Consequently, this is also reflected in SMEs based in the UK energy sector.

The main reason for the lack of a formal KM strategy may be due to the SME's intense engagement with day-to-day activities and issues which in-turn could implore the need for a tacit day-to-day or short-term strategic plan rather than the distinguished long-term strategic plan put into practice in the larger and well-financed organisation. Subsequently, this general approach to the SMEs strategic planning may be reflected in the approach to KM strategy which is near absent.

Further queries:

1. Further explore and verify the SME's understanding of the KM strategy; and real barriers and issues to its implementation?

Question 12

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Key findings

Table 11 and Figure 11 show that 66.7% of respondents indicate that they have not allocated resources to KM activities.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	18	32.1	33.3
No	36	64.3	66.7
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 14 Table of results to show SMEs which allocate resources to KM activities

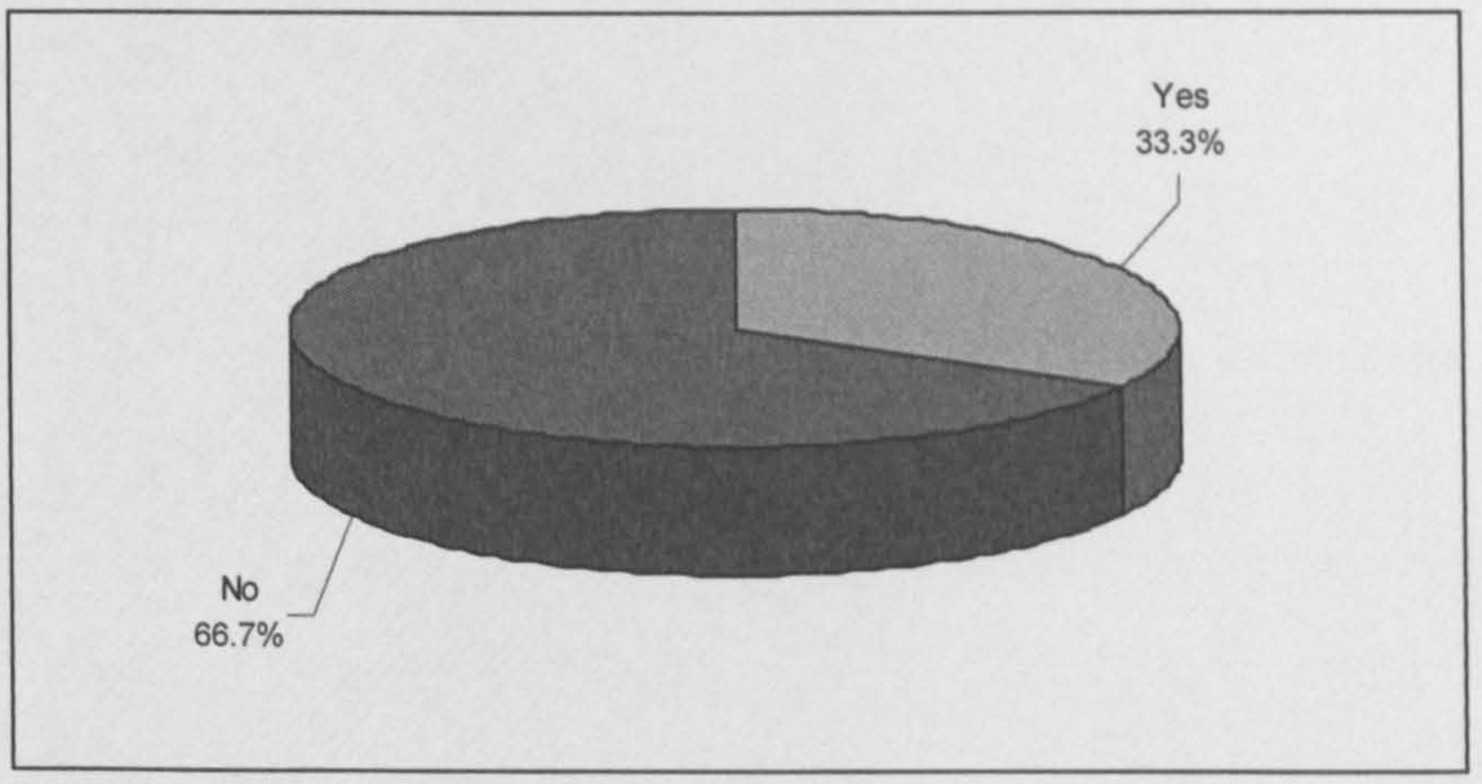

Figure 19 Bar-chart to show SMEs which allocate resources to KM activities

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs allocate resources to KM activities.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs allocate resources to KM activities.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 11 and Figure 11 show that the majority (66.7%) of respondents do not allocate resources to KM activities.

Why don't SMEs allocate resources to KM activities? This may be due to a number of reasons for example it could be a consequence of not being convinced with regards to how KM could deliver direct business benefit to the SME- this will be further explored and discussed in the following sections.

Nevertheless, Beijerse (2000) in a survey of Dutch SMEs concluded that SMEs have little or no systematic approach to KM including allocation of resources to KM activities. Similarly, this is reflected in SMEs based in the UK energy sector.

Further queries:

1. What are the real barriers to why SMEs do not allocate resources to KM activities?

Question 13

Our organisation has identified the key knowledge it needs to achieve it's strategic goals and objectives?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1 O	2 O	3 O	4 O	5 O

Key findings

Table 12 and Figure 12 show that 50.9% of respondents indicate that they agree (and strongly agree) that they identify the key knowledge they need to achieve their strategic goals and objectives.

Response	Frequency	Percent (%)	Valid Percent (%)
Strongly agree	4	7.1	7.3
Agree	24	42.9	43.6
Neither agree nor disagree	22	39.3	40.0
Disagree	4	7.1	7.3
Strongly disagree	1	1.8	1.8
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 15 Table of results to show SMEs which identify key knowledge to achieve strategic goals and objectives

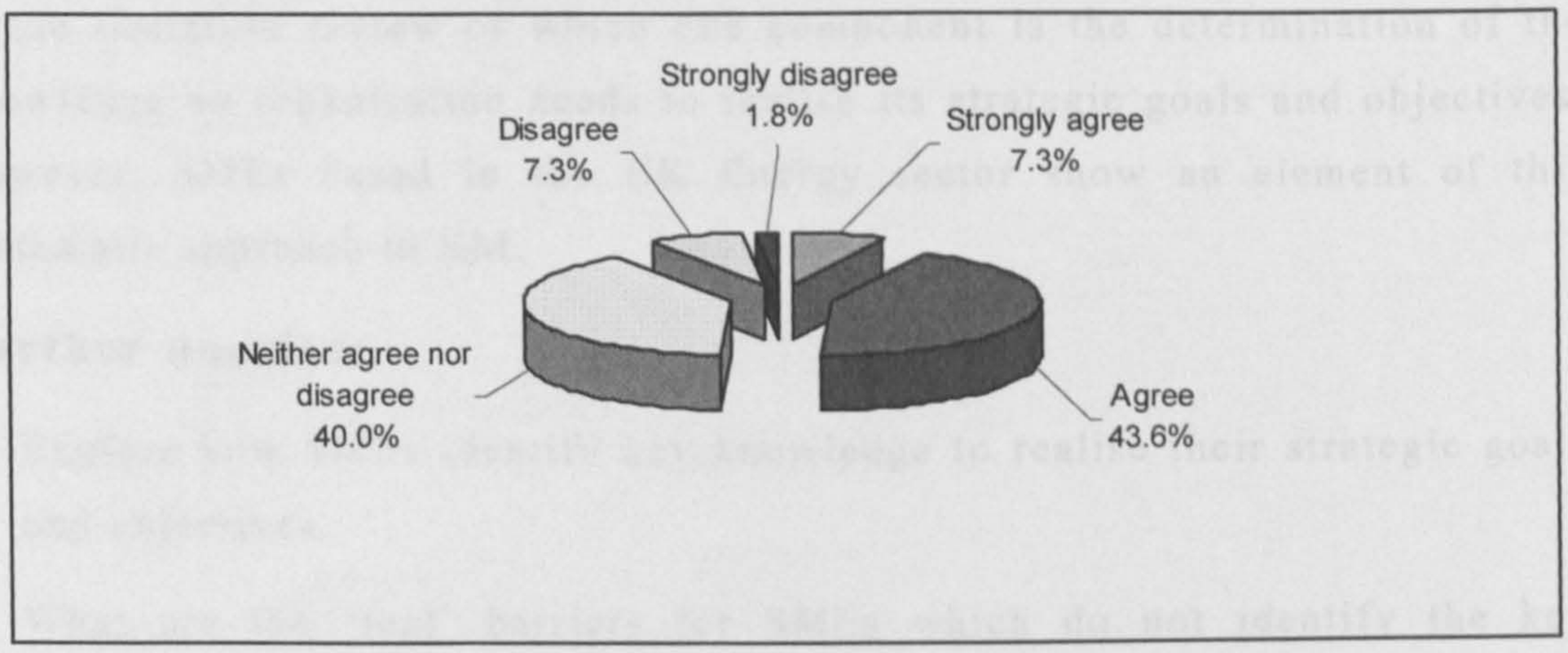

Figure 20 Pie-chart to show SMEs which identify key knowledge to achieve strategic goals and objectives

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs identify the key knowledge it needs to achieve its strategic goals and objectives; and relate this to other KM-Innovation variables in the questionnaire.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs would 'agree'; or 'strongly agree' that they identify key knowledge to achieve its strategic goals and objectives.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 12 and Figure 12 show that the majority of SMEs (50.9%) 'agree' and 'strongly agree' that they identify key knowledge to achieve their strategic goals and objectives.

As discussed in the literature review, the identification of key knowledge for strategic purposes is a critical component of any KM strategy. Subsequently, the majority of SMEs in this sector clearly perform the above activity. This maybe due to a number of reasons, for example Smes in this sector acknowledge the importance of knowledge as a competitive factor and hence actively pursue this by implementing systems and processes to ascertain what they need to know.

Nevertheless, Beijerse (2000) concluded that Dutch-based SMEs have little or no systematic approach to KM. The systematic approach to KM is discussed in the literature review of which one component is the determination of the knowledge an organisation needs to realise its strategic goals and objectives. However, SMEs based in the UK Energy sector show an element of this systematic approach to KM.

Further queries:

1. Explore how SMEs identify key knowledge to realise their strategic goals and objectives.
2. What are the 'real' barriers for SMEs which do not identify the key knowledge it needs to achieve its strategic goals and objectives?

Question 14

Our organisation continuously maps or identifies its knowledge?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1 O	2 O	3 O	4 O	5 O

Key findings

- Table 13 and Figure 13 below show that 33.4% of respondents indicate that they agree (and strongly agree) that they continuously map or identify the knowledge within their organisation.
- 29.6% of respondents disagree (and strongly disagree). 37.0% neither agree nor disagree.

Response	Frequency	Percent (%)	Valid Percent (%)
Strongly agree	3	5.4	5.6
Agree	15	26.8	27.8
Neither agree nor disagree	20	35.7	37.0
Disagree	14	25.0	25.9
Strongly disagree	2	3.6	3.7
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 16 Table of results to show SMEs which continuously map and identify knowledge

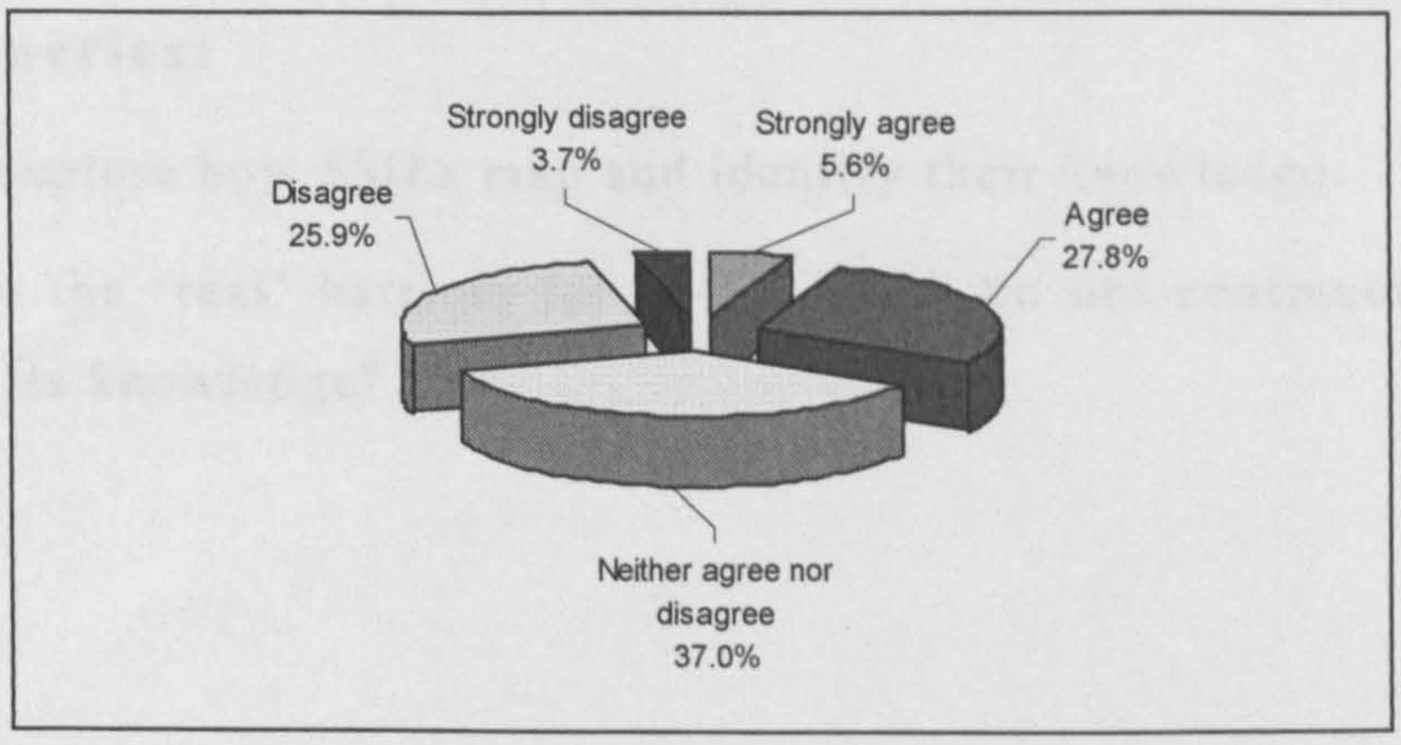

Figure 21 Pie-chart to show SMEs which continuously map and identify knowledge

Discussion

Why was this question chosen?

The purpose of this question was to determine if SME's continuously map or identify its knowledge; and relate this to the KM-Innovation variables in the questionnaire.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs continuously map or identify knowledge.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 13 and Figure 13 show that the majority (37.0%) of respondents 'neither agree nor disagree' that they continuously map or identify knowledge.

As discussed in the literature review, the continuous mapping or identification of knowledge in an organisation is a critical component in sustaining and maintaining a KM strategy in an organisation. Even though the majority of respondents (37.0%) were unsure with regards to performing this activity, the findings show that SMEs are more likely (4.0%) to 'strongly agree' and 'agree' rather than 'disagree' and 'strongly disagree' in mapping and identifying its knowledge.

Furthermore, the fact that the majority of SMEs are unsure with regards to continuously mapping and identifying its knowledge may indicate that SMEs have not yet considered mapping and identifying their knowledge on a continuous basis as they may be doing this intermittently or on an infrequent basis.

Further queries:

1. Further explore how SMEs map and identify their knowledge.
2. What are the 'real' barriers for SMEs which do not continuously map or identify its knowledge?

Question 15

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Key findings

Table 14 and Figure 14 show that 81.5% of respondents indicate that they do not have a formal innovation strategy

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	10	17.9	18.5
No	44	78.6	81.5
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 17 Table of results to show SMEs which have an Innovation Strategy

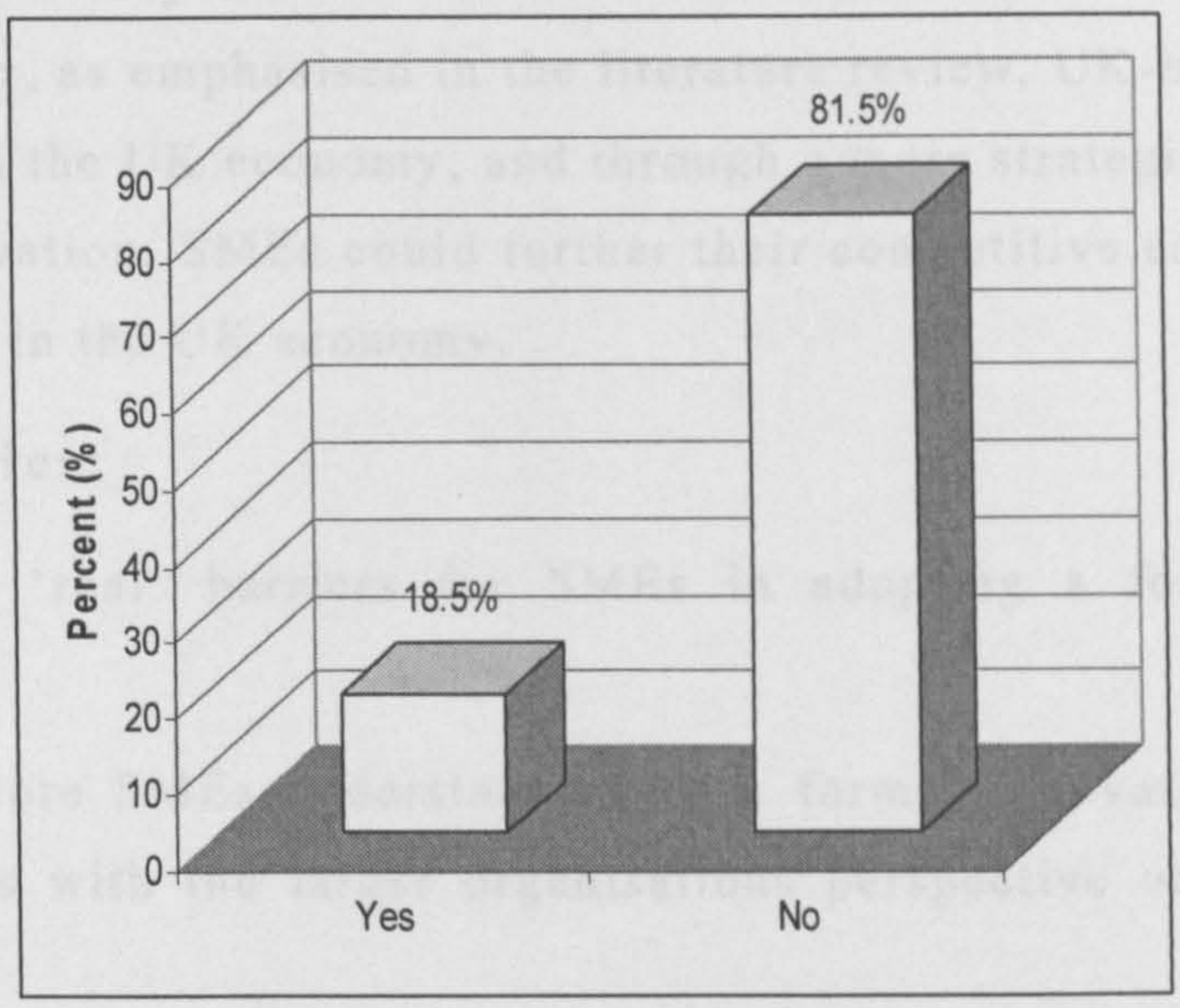

Figure 22 Bar-chart to show SMEs which have an Innovation Strategy

Discussion

Why was this question chosen?

The purpose of this question was to determine if SME's have a formal innovation strategy; and relate this to the other KM-Innovation variables in the questionnaire.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs have a formal innovation strategy to co-ordinate their innovation activities.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 14 and Figure 14 show that the vast majority (81.5%) of SMEs do not have a formal innovation strategy. This contradicts our initial expectation. However, as it is widely acknowledged that SMEs have time and resource constraints, consequently the SME's intense engagement with day-to-day activities and issues may in-turn implore the need for a tacit day-to-day or short-term strategic plan rather than the distinguished long-term strategic plan put into practice in the larger and well-financed organisation. Subsequently, this general approach to the SMEs strategic planning may be reflected in the approach to its innovation strategy. This may be a possible reason for this contradiction and could be verified through further exploration.

Nevertheless, Macdonald et al., (2001) assert that innovation in SMEs is more a consequence of serendipity and happenstance as much as a managed and controlled process directed through a formal innovation strategy. Subsequently, this may also be the case with SMEs based in the UK energy sector. However, as emphasised in the literature review, UK-based SMEs play a critical role in the UK economy; and through a more strategic and controlled process of innovation, SMEs could further their competitive edge, create more jobs and wealth in the UK economy.

Further queries:

1. Explore the 'real' barriers for SMEs in adopting a formal innovation strategy.
2. Further explore SMEs understanding of a formal innovation strategy and compare this with the larger organisations perspective on the innovation strategy.

Question 16

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Key findings

Table 15 and Figure 15 show that 53.6% of respondents indicate that they allocate resources to innovation activities.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	30	53.6	54.5
No	25	44.6	45.5
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 18 Table of results to show SMEs which allocate resources to Innovation activities

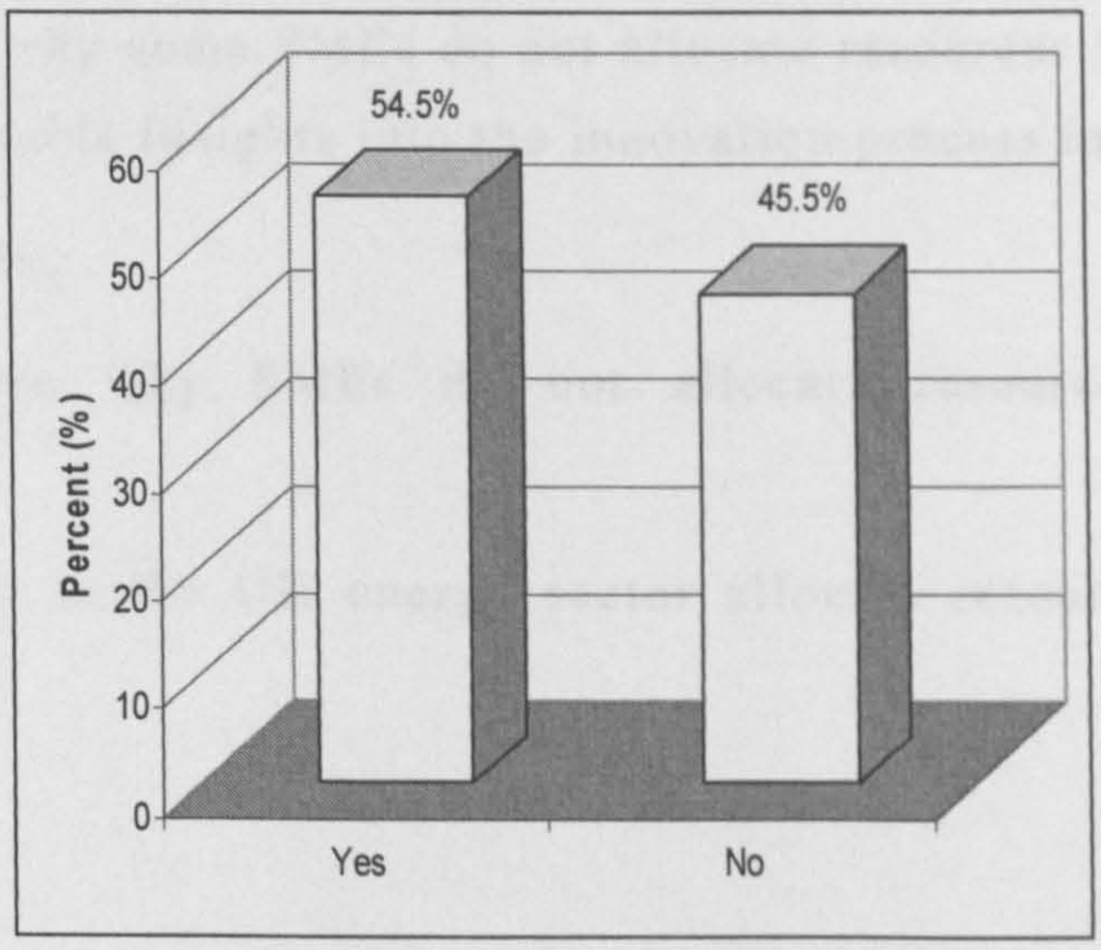

Figure 23 Bar-chart to show SMEs which allocate resources to Innovation activities

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs allocate resources to innovation activities.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs allocate resources to innovation activities.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 15 and Figure 15 show that the majority (54.5%) of respondents allocate resources to innovation activities. This confirms our initial expectation derived from the literature review.

As Macdonald and Lefang (1998) explain that the majority of SMEs in the UK claim to allocate resources to innovative activities e.g. Research and Development. Similarly, this is further reflected in SMEs based in the UK energy sector.

However, 45.5% of respondents do not allocate resources to innovation activities. This may be due to a number of reasons, for example as discussed in the literature review Macdonald et al., (2001) argue that the process of innovation in SMEs is a consequence of serendipity and happenstance as much as a managed and controlled process. As a result, these SMEs may perceive innovation as something which "just happens" subsequently making no real effort in allocating resources to realise innovations. However, further exploration as to why some SMEs do not allocate resources to innovation may provide some valuable insights into the innovation process in SMEs.

Further queries:

1. Further explore why SMEs do not allocate resources to innovation activities.
2. How do SMEs in the UK energy sector allocate resources to innovative activities?

Question 17

Our organisation has systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1 O	2 O	3 O	4 O	5 O

Key findings

Table 16 and Figure 16 show that 52.0% of respondents indicate that they agree (and strongly agree) that they have systems and processes in place which facilitate ideas for new or improved products, services, processes from idea discovery to sustained implementation.

Response	Frequency	Percent (%)	Valid Percent (%)
Strongly agree	5	8.9	9.3
Agree	23	41.1	42.6
Neither agree nor disagree	15	26.8	27.8
Disagree	10	17.9	18.5
Strongly disagree	1	1.8	1.9
Total	54	96.4	100.0
Missing	2	3.6	
Total	56	100.0	

Table 19 Table of results to show SMEs which have systems and processes to facilitate ideas

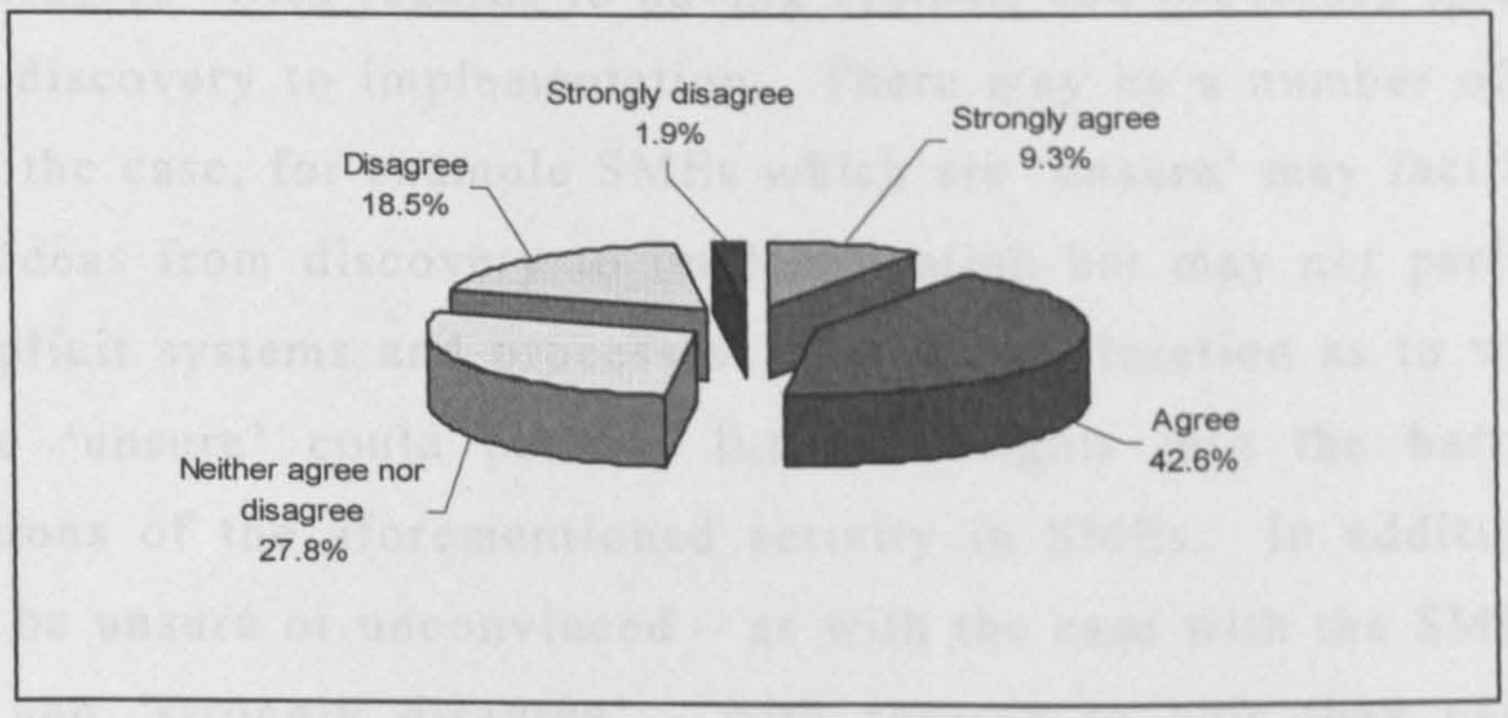

Figure 24 Pie-chart to show show SMEs which have systems and processes to facilitate ideas

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs have systems and processes which facilitate ideas from discovery to implementation; and to explore relationships with other KM-Innovation variables from the questionnaire.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs will have systems and processes in place which facilitate ideas from discovery to implementation.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 16 and Figure 16 show that the majority (51.9%) of SMEs 'agree' and 'strongly agree' that they have systems and processes in place which facilitate innovations from idea generation to implementation. This confirms our initial expectation derived from the literature review as Macdonald and Lefang (1998) found that SMEs based in the UK generally claim to be innovative. Consequently, this is further reflected in SMEs based in the UK Energy sector and more specifically in the form that the majority of SMEs claim to have systems and processes to facilitate ideas from discovery to implementation.

Furthermore, the findings show that SMEs are 30.5% more likely to 'agree' and 'strongly agree' rather than 'disagree' and 'strongly disagree' that they have systems and processes to facilitate ideas from discovery to implementation.

However, 48.1% of respondents 'neither agree nor disagree', 'disagree' and 'strongly disagree' with regards to having systems and processes to facilitate ideas from discovery to implementation. There may be a number of reasons why this is the case, for example SMEs which are 'unsure' may facilitate and encourage ideas from discovery to implementation but may not perform this through explicit systems and processes. Further exploration as to why these SMEs were 'unsure' could provide further insights into the barriers and misconceptions of the aforementioned activity in SMEs. In addition, these SMEs may be unsure or unconvinced – as with the case with the SMEs which 'disagree' and 'strongly disagree' - with regards to how they can realise innovations by facilitating ideas from discovery to implementation.

Further queries:

1. How do SMEs facilitate ideas from discovery to implementation?
2. What are the 'real' barriers for SMEs in implementing systems and processes to facilitate ideas from discovery to implementation?

Question 18

Please indicate, by ticking any of the appropriate boxes, if your organisation has undertaken any improvements in the following areas?

Strategy:

Implementation of new or significantly changed corporate strategies ☐ 1

Market:

Changing significantly your organisation's marketing concepts or strategies ☐ 2

Structure:

Implementation of new or significantly changed organisational structures ☐ 3

Management:

Implementation of new advanced management techniques ☐ 4

Operations:

Implementation of new or significantly changed internal processes ☐ 5

Key findings

Table 17 and Figure 17 show that 67.3% of respondents indicate that they have made improvements in Market.

Response	Frequency	Percent (%)
Strategy	30	54.5
Market	37	67.3
Structure	24	43.6
Management	8	14.5
Operations	30	54.5

Table 20 Table of results to show types of Improvements undertaken in SMEs.

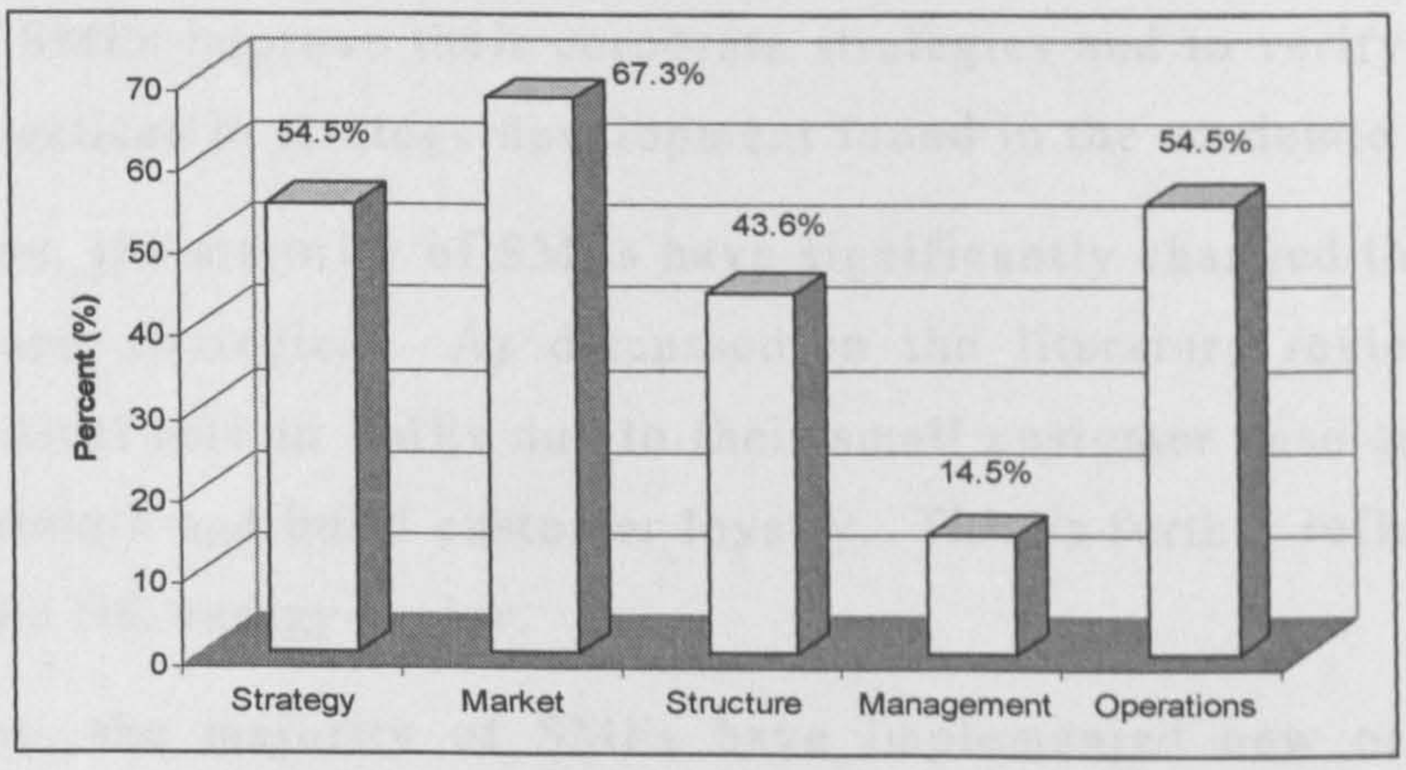

Figure 25 Bar-chart to show types of Improvements undertaken in SMEs.

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs have made improvements in the above categories; and where improvements have been made, to ascertain if there is a focus on a particular category of the organisation; and relate this with other KM-Innovation variables from the questionnaire.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs have made improvements in: Strategy; Market; Structure; Management and Operations.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 17 and Figure 17 show that majority of SMEs have made improvements in: Market (67.3%); Strategy (54.5%); and Operations (54.5%). However, the least majority of SMEs claim to have made improvements in Management (14.5%) and Structure (43.6%).

Nonetheless, this contradicts our initial expectation that the majority of SMEs make improvements in all the categories mentioned above given the relative importance of these categories in any organisation as explained below.

From these findings it is clear that SMEs based in the UK Energy sector endeavour to improve their corporate strategies. As discussed in the literature review, strategy plays a critical role in any organisation with regards to coordinating its internal activities to meet the organisations strategic goals and objectives for its business environment. This is further reflected in SMEs based in the UK Energy sector. Furthermore, it could be useful to explore how these SMEs improve their corporate strategies and to verify this with the existing practices in strategy development found in the academic literature.

Furthermore, the majority of SMEs have significantly changed their marketing concepts and strategies. As discussed in the literature review, marketing plays a critical role in SMEs due to their small customer base and subsequent zeal to maintain and build customer loyalty. This is further reflected in SMEs based in the UK energy sector.

In addition, the majority of SMEs have implemented new or significantly changed internal processes, which indicate that SMEs understand the importance of process improvement and how it could help their organisation realise its strategic goals and objectives. However, further exploration into

how SMEs improve there internal processes could provide valuable insights into the innovation process in SMEs.

However, there are a number of respondents which did not respond to having made improvements in the three categories mentioned: strategy, marketing and operations. There may be a number of reasons why this was the case, for example the respondent could have misinterpreted this question as having made improvements in the last financial year or the last time the SME received a similar questionnaire. Furthermore, it may be case that these SMEs do not acknowledge the importance of making improvements in the above areas consequently it could be useful to explore why this maybe the case and thus identify key barriers and misconceptions surrounding SMEs in implementing improvements in these areas. Nonetheless, the question did not explicitly ask the respondent if it had not made improvements to these improvements thus the researcher can not conclude that SMEs do not make improvements in these categories unless this non-response is acknowledged as a negation of the relevant improvement.

Nonetheless, it is clear from the findings that the least majority of SMEs acknowledged having made improvements in 'Structure' and 'Management'. With regards to 'Structure', there may be a number of reasons why SMEs did not acknowledge having made improvements here. As discussed in the literature review, the organisation structure of SMEs is widely acknowledged to be "less structured" to enable flexibility and agility required in today's ever-changing and dynamic business markets. As a result, SMEs may be less likely to have an explicit organisation structure from the onset to make improvements in. Nevertheless, further exploration to verify and determine why SMEs have not made improvements in its organisation structure could be valuable in providing further insights into the innovation process in SMEs. However, this is beyond the scope of this study where the focus is on how knowledge enables these SMEs to make its improvements.

Furthermore, the findings show that the least majority of SMEs acknowledged having made improvements in 'Management'. This contradicts our initial expectation derived from the literature review which shows that improvements in 'Management' of the SME could provide direct business benefit to the organisation. Nevertheless, there maybe a number of reasons why this is the case, for example as explained earlier, SMEs are under intense time and resource constraints hence making it difficult for SME managers to allocate time where they can evaluate and develop aspects of their SME management to

further the strategic goals and objectives of the organisation. The literature provides many cases where SME managers have managed to identify ways to develop theirs and the management team's management capabilities using e-learning and on-the-job learning. However, this is beyond the scope of this study but could provide a platform for further exploration with regards to SMEs based in the UK energy sector.

Nonetheless, as with the previous three categories, the question did not explicitly ask the respondent if it had not made improvements to these improvements thus the researcher can not conclude that SMEs do not make improvements in'Structure' and 'Management'.

Further queries:

1. How do SMEs make improvements in marketing, strategy and operations? Is this incorporated into a formal innovation strategy?
2. What are the 'real' barriers to improvements in 'Management' and 'Structure'?

Question 19

Has your organisation introduced products and /or services onto the market, which were improved or new to your organisation?

1 ☐ Yes 2 ☐ No

If yes, please tick the appropriate box below:

Developed mainly by a third party ☐ 1

Developed together with a third party ☐ 2

Developed mainly by your own organisation ☐ 3

Key findings

- Tables 18 and 19; and Figures 18 and 19 show that 81.8% of respondents indicated that they have introduced products and/services onto the market, which were improved or new to your organisation.
- 58.3% of respondents, which have introduced products and/services onto the market, which were improved or new to your organisation, developed this on their own.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	45	80.4	81.8
No	10	17.9	18.2
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 21 Table of results to show SMEs which have introduced new or improved products/service to the market

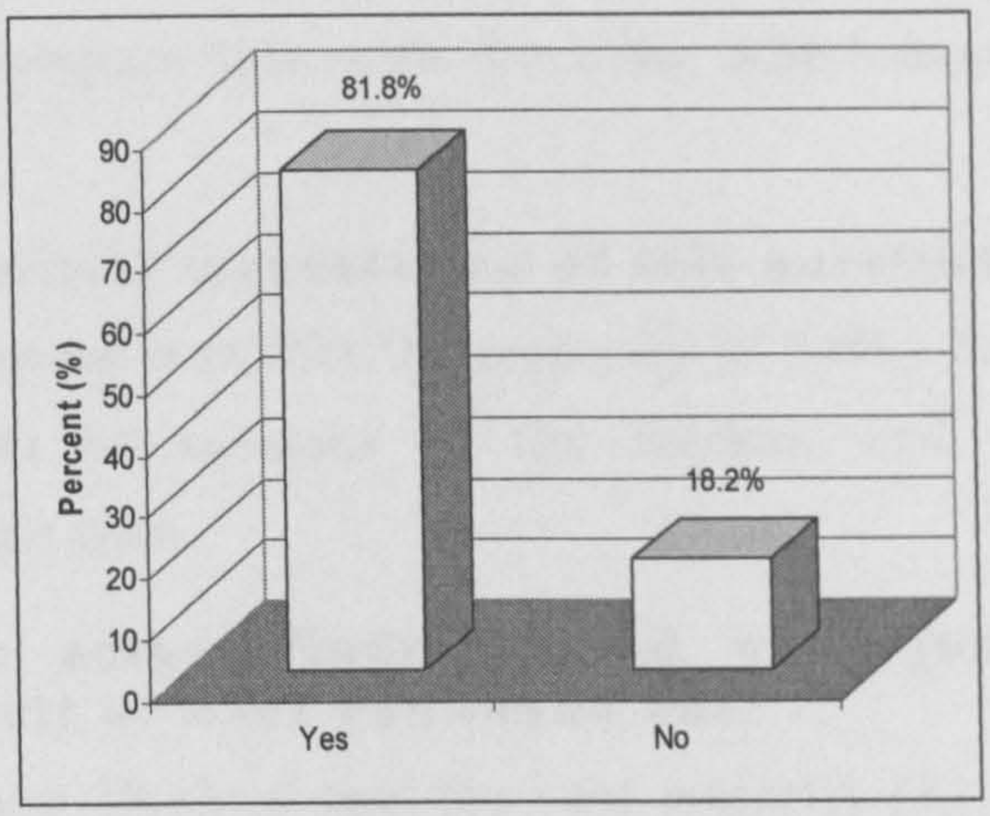

Figure 26 Bar-chart to show SMEs which have introduced new or improved products/service to the market

Response	Frequency	Percent (%)
Developed mainly by a third party	9	18.8
Developed together with a third party	11	22.9
Developed mainly by your own organisation	28	58.3
Total	48	100.0

Table 22 Table of results to show how SMEs developed new or improved products/service to the market

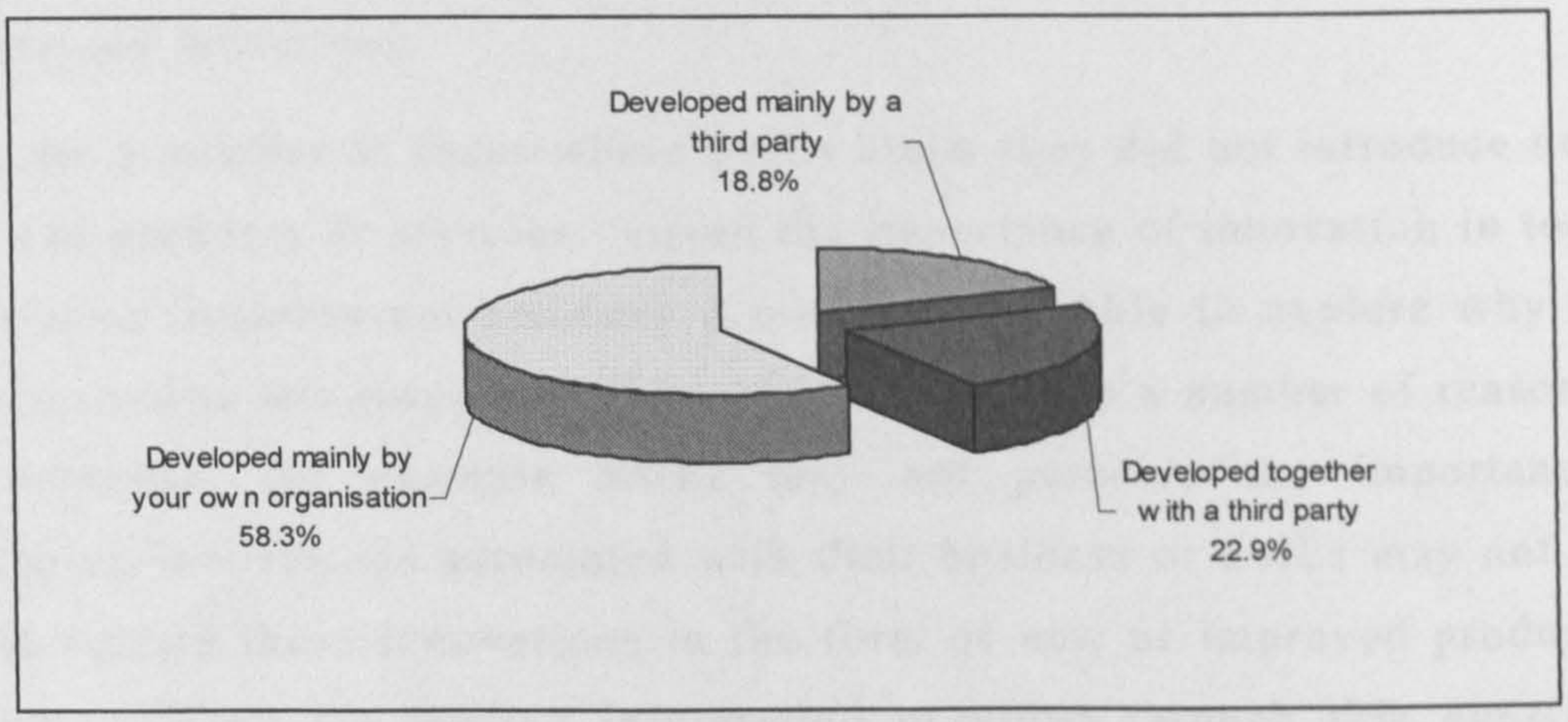

Figure 27 Pie-chart to show how SMEs developed new or improved products/service to the market

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs have introduced new or improved products or services on to the market; and how these improvements

were made; and compare this with the other KM-Innovation variables in the questionnaire.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs have introduced new or improved products or services to the market; and would develop these innovations on their own.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 18 and Figure 18 show that the vast majority (81.8%) of SMEs claim to have introduced new or improved products or services to the market.

This confirms our initial expectation derived from the literature review as Macdonald and Lefang (1998) explain that the majority of SMEs in the UK perceive themselves as innovative and to allocate resources to innovative activities for the production of innovations. The findings show that this is further reflected in SMEs based in the UK Energy sector.

Furthermore, Table 19 and Figure 19 show that the majority (58.3%) of respondents, which introduced products and/services onto the market, were developed by the SME. This confirms our initial expectation derived from the literature review, as SMEs heavily rely on their own resources for initiatives and projects. The findings show that this is further reflected in SMEs based in the UK Energy sector more specifically with their innovation related projects and initiatives.

There are a number of cases where SMEs claim they did not introduce new or improved products or services. Given the importance of innovation in today's competitive business environment it could be valuable to explore why these SMEs provided this response. However, there maybe a number of reasons for this response, for example SMEs may not perceive the importance of developing innovations associated with their business or SMEs may not know how to realise these innovations in the form of new or improved products or services. Given the limited information provided through this question it could be valuable to approach these SMEs to further explore this response which could provide further insights into the barriers and misconceptions SMEs face with regards to the innovation process.

However, there were a number of cases where SMEs, which have introduced new or improved products or services, developed these innovations with a third party and in some cases innovations were outsourced to a third party. These findings may indicate that SMEs, based in this sector, collaborate to an

extent with other organisations to realise their innovations and consequently share knowledge and experience in the process. It could be valuable to explore how SMEs based in this sector manage collaborative innovation projects with other organisations and then compare this across other sectors. In addition, in some cases SMEs claim to have outsourced their innovation projects to third parties, there could be a number of reasons for this, for example given the finance constraints associated with SMEs it may be the most cost-effective option to realise the innovation; or it could be part of a government supported initiative to help SMEs realise their innovations by providing funds to outsource such projects. Nonetheless, further exploration as to why SMEs outsource their innovation projects could provide further insights into the innovation process in SMEs.

Further queries:

1. Further explore how SMEs approach innovation projects associated with the introduction of new or improved products or services.
2. What are the 'real' barriers of SMEs in developing innovations with a third party and/or by a third part?

Question 20

Has your organisation introduced new or significantly improved production processes including methods of supplying services and ways of delivering products?

1 ☐ Yes 2 ☐ No

If yes, please tick the appropriate box below:

Developed mainly by a third party	☐	1
Developed together with a third party	☐	2
Developed mainly by your own organisation	☐	3

Key findings

- Table 20 and Figure 20 show that 52.7% of respondents introduced new or improved production processes including methods of supplying services and ways of delivering products.
- Table 21 and Figure 21 show that 72.4% of respondents, which have introduced new or improved production processes including methods of supplying services and ways of delivering products, developed these on their own.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	29	51.8	52.7
No	26	46.4	47.3
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 23 Table of results to show SMEs which have introduced new or improved production processes

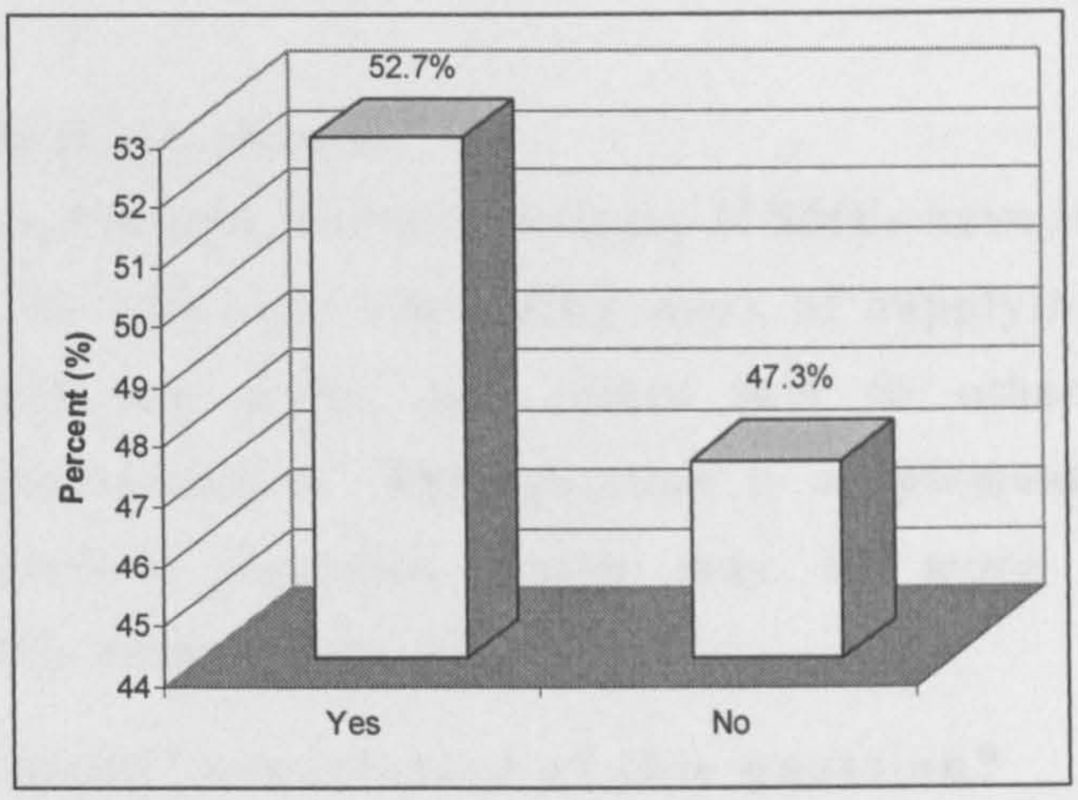

Figure 28 Bar-chart to show SMEs which have introduced new or improved production processes including methods of supplying services and ways of delivering products.

Response	Frequency	Percent (%)
Developed mainly by a third party	0	0.0
Developed together with a third party	8	27.6
Developed mainly by your own organisation	21	72.4
Total	29	100.0

Table 24 Table of results to show how SMEs developed new or improved production processes including methods of supplying services and ways of delivering products.

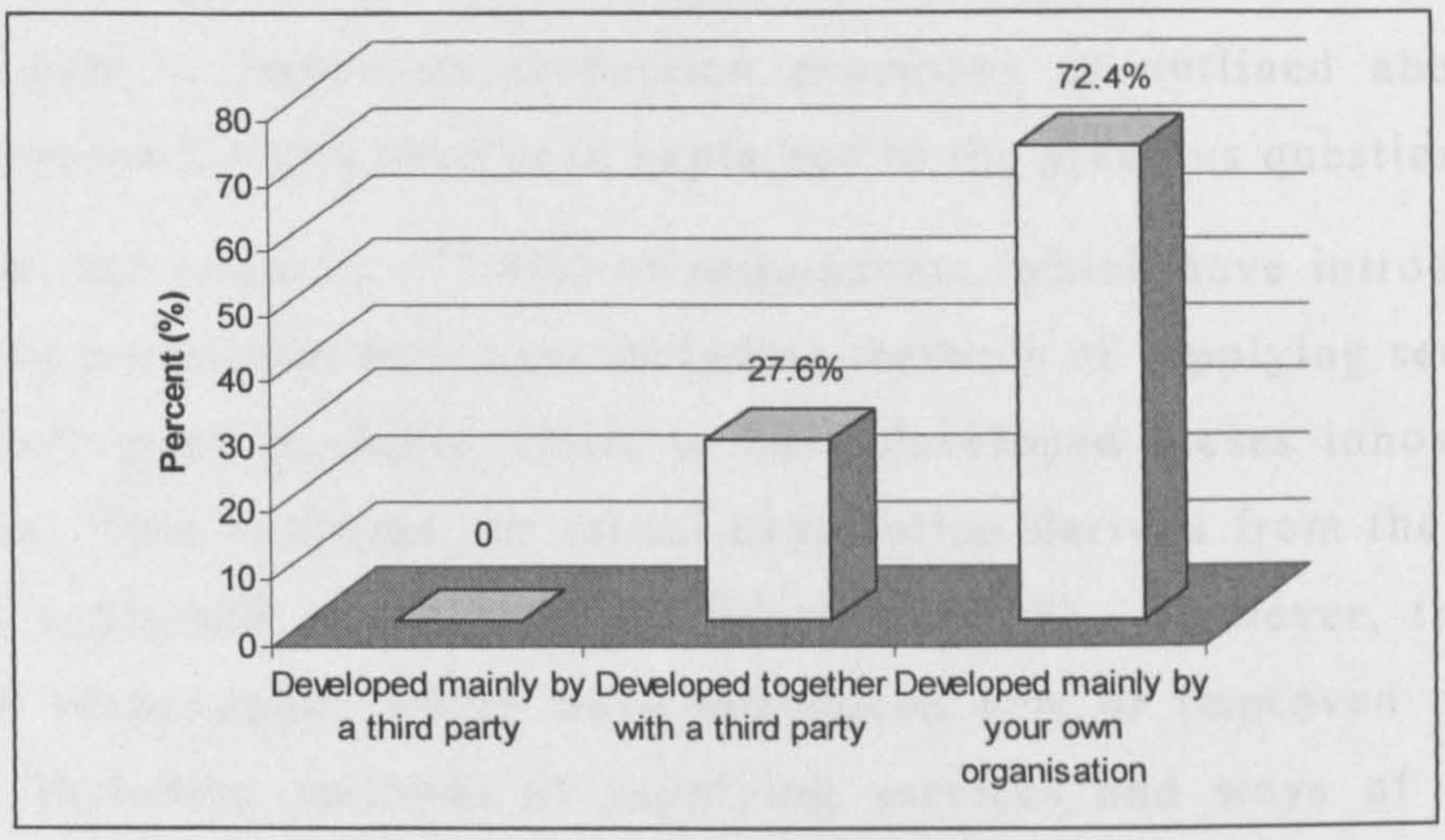

Figure 29 Bar-chart to show how SMEs developed new or improved production processes including methods of supplying services and ways of delivering products.

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs have introduced new or improved production processes (including ways of supplying services); how these improvements are made; and relate this to other KM-Innovation variables in the questionnaire. This question is supplementary to Q19 as it focuses on production processes which may be more relevant to the manufacturing SMEs from the sample.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs would introduce new or improved production processes (including ways of supplying services); and develop these on their own.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Tables 20 and Figure 20 show that the majority (52.7%) of respondents introduced new or improved production processes including methods of supplying services and ways of delivering products.

This confirms our initial expectation derived from the literature review, similar to Q19, as Macdonald and Lefang (1998) explain that the majority of SMEs in the UK perceive themselves as innovative and to allocate resources to innovative activities for the production of innovations. These findings show that this is further reflected in SMEs based in the UK Energy sector.

However, there are a number of respondents which claim that they did not introduce new or improved production processes as outlined above. The possible reasons for this have been explained in the previous question (Q19).

In addition, the majority (72.4%) of respondents, which have introduced new or improved production processes including methods of supplying services and ways of delivering products, claim to have developed theses innovations by themselves. This confirms our initial expectation derived from the literature review as explained in the previous question (Q19). However, there are a number of respondents, which have introduced new or improved production processes including methods of supplying services and ways of delivering products, with a third party and in some cases by a third party. The possible reasons for this have been explained in the previous question (Q19).

Further queries:

1. Further explore how SMEs approach innovation projects associated with the introduction of new or improved production processes.
2. What are the 'real' barriers of SMEs in developing innovations with a third party and/or by a third part?

Question 21

Please indicate, by ticking ANY of the following boxes, which activities apply to your organisation?

Build external networks e.g. with universities	☐	1
Create organisational capabilities built around clients' needs	☐	2
Create organisational structures built around clients' needs	☐	3
Organise processes for early idea generation	☐	4
Organise processes for idea application	☐	5
Develop an innovation culture	☐	6
Stimulate and reward new product ideas	☐	7
Ensure that all parts of the organisation contribute ideas	☐	8

Key findings

Table 22 and Figure 22 below show that 63.6% of respondents indicated they 'Create organisational capabilities built around clients' needs'.

Activity	Frequency	Percent (%)
Build external networks	17	30.9
Create organisational capabilities built around clients' needs	35	63.6
Create organisational structures built around clients' needs	23	41.8
Organise processes for early ideas generation	10	18.2
Organise processes for idea application	11	20.0
Develop an innovation culture	15	27.3
Stimulate and reward new product ideas	11	20.0
Ensure that all parts of the organisation contribute ideas	27	49.1

Table 25 Table of results to show SME KM and Innovation activities

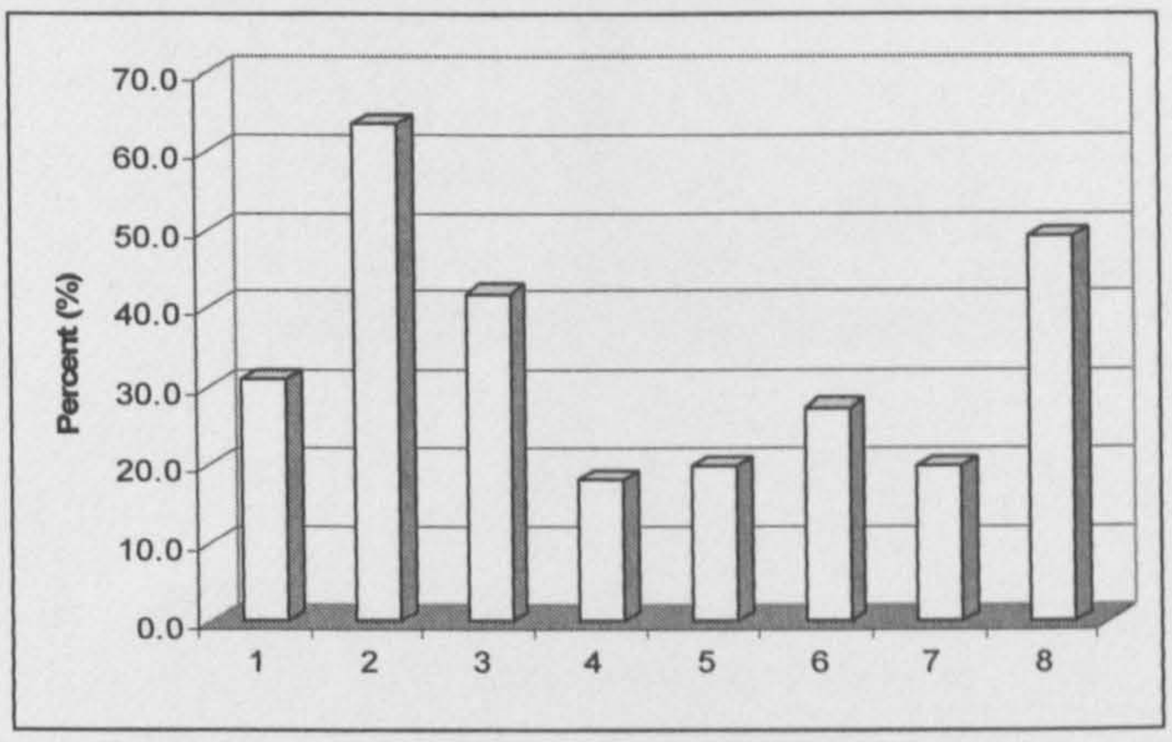

Figure 30 Bar-chart to show SME KM and Innovation Activities

5.2.4 Section 3: Organisation Systems & Processes – Q22 to Q30

Question 22

Does your organisation facilitate employees to acquire information and experience from within and/or outside the organisation e.g. employee education?

1 ☐ Yes 2 ☐ No

Key findings

Table 23 and Figure 23 show that 89.1% of respondents indicate that they facilitate their employees to acquire information and experience from within and/ or outside the organisation e.g. employee education.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	49	87.5	89.1
No	6	10.7	10.9
Total	55	98.2	100.0
Missing	1	1.8	
Total	56	100.0	

Table 26 Table of results to show SMEs which facilitate employees to acquire information and experience

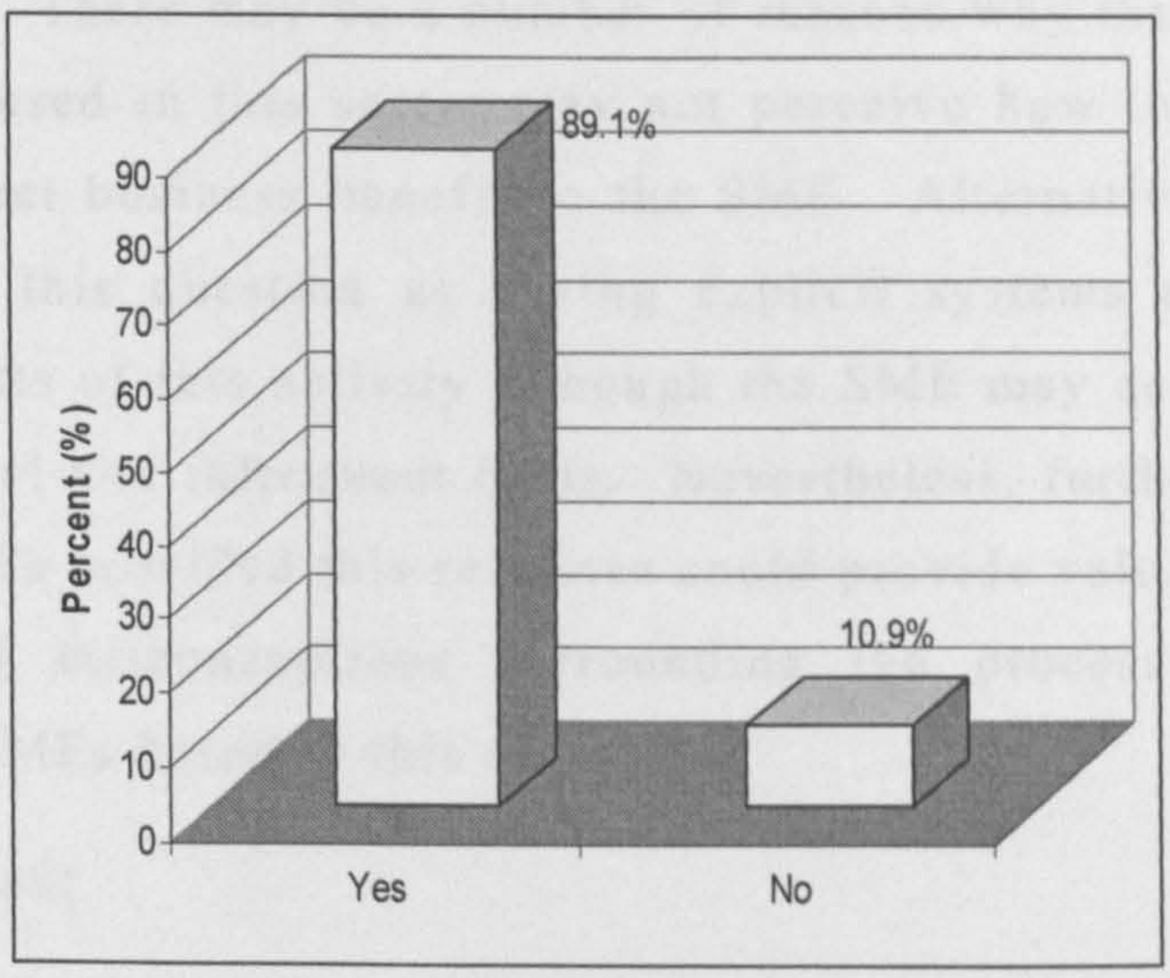

Figure 31 Bar-chart to show SMEs which facilitate employees to acquire information and experience

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs facilitate employees to acquire information and expertise; and review this as part of the KMOLI cycle as a whole.

What was the 'initial' expectation of this question?

Our initial expectation was that the majority of SMEs would facilitate employees to acquire information and expertise.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 23 and Figure 23 show that the vast majority (89.1%) of SMEs facilitate employees to acquire information and experience from within and/or outside the organisation. This confirms our initial expectation derived from the literature review and reflects the importance which SMEs, based in the UK energy sector, attach to the process of 'Knowledge Acquisition' in general.

Nonetheless, this question does not ascertain how SMEs perform this process of 'Knowledge Acquisition' which is addressed in the following sections. However, there are a number of respondents which claim not to facilitate employees to acquire information and experience from within and/or outside the organisation. There may be a number of reasons why this is the case, for example SMEs based in this sector may not perceive how this activity could help provide direct business benefit to the SME. Alternatively, SMEs could have interpreted this question as having explicit systems and processes to realise the benefits of this activity although the SME may acknowledge doing this at an informal and infrequent basis. Nevertheless, further exploration as to why these SMEs provided this response could provide valuable insights into the barriers and misconceptions surrounding the process of 'Knowledge Acquisition' in SMEs based in this sector.

Further queries:

1. How do these SMEs facilitate employees to acquire information and experience from within and/or outside the organisation?
2. Further explore why SMEs claim not to facilitate employees to acquire information and experience from within and/or outside the organisation.

Question 23

Please indicate, by ticking ANY of the following boxes, which activities apply to your organisation?

R&D (in house)	☐	**1**	**R&D (outsource)**	☐	**2**
Employee education	☐	**3**	**Employee training**	☐	**4**
Customer satisfaction studies	☐	**5**	**Training (in house)**	☐	**6**
Company takeovers	☐	**7**	**Training (outsource)**	☐	**8**
Staff training requirement analysis	☐	**9**	**Organise lectures**	☐	**10**
Learn from previous project evaluations	☐	**11**	**Purchase software**	☐	**12**
Employ specifically qualified personnel	☐	**13**	**Student placements**	☐	**14**
Purchase licences or patents	☐	**15**	**Active networking**	☐	**16**
Excuse employees for a certain amount of time to let them work out their ideas				☐	**17**

Key findings

Table 24 and Figure 24 show that 81.8% of respondents indicate 'Employee Training'.

Activity	Frequency	Percent (%)
R&D (in-house) [1]	29	52.7
R&D (outsource) [2]	10	18.2
Employee education [3]	29	52.7
Employee training [4]	45	81.8
Customer satisfaction studies [5]	27	49.1
Training (in-house) [6]	42	76.4
Company take-overs [7]	6	10.9
Training (outsource) [8]	32	58.2
Staff training requirement analysis [9]	24	43.6
Organise lectures [10]	8	14.5
Learn from previous project evaluations [11]	25	45.5
Purchase software [12]	31	56.4
Employ specifically qualified personnel [13]	27	49.1
Student placements [14]	18	32.7
Purchase licenses or patents [15]	7	12.7
Active networking [16]	17	30.9
Employee time-out for creativity [17]	9	16.4

Table 27 Table of results to show SME KM and Innovation Activities

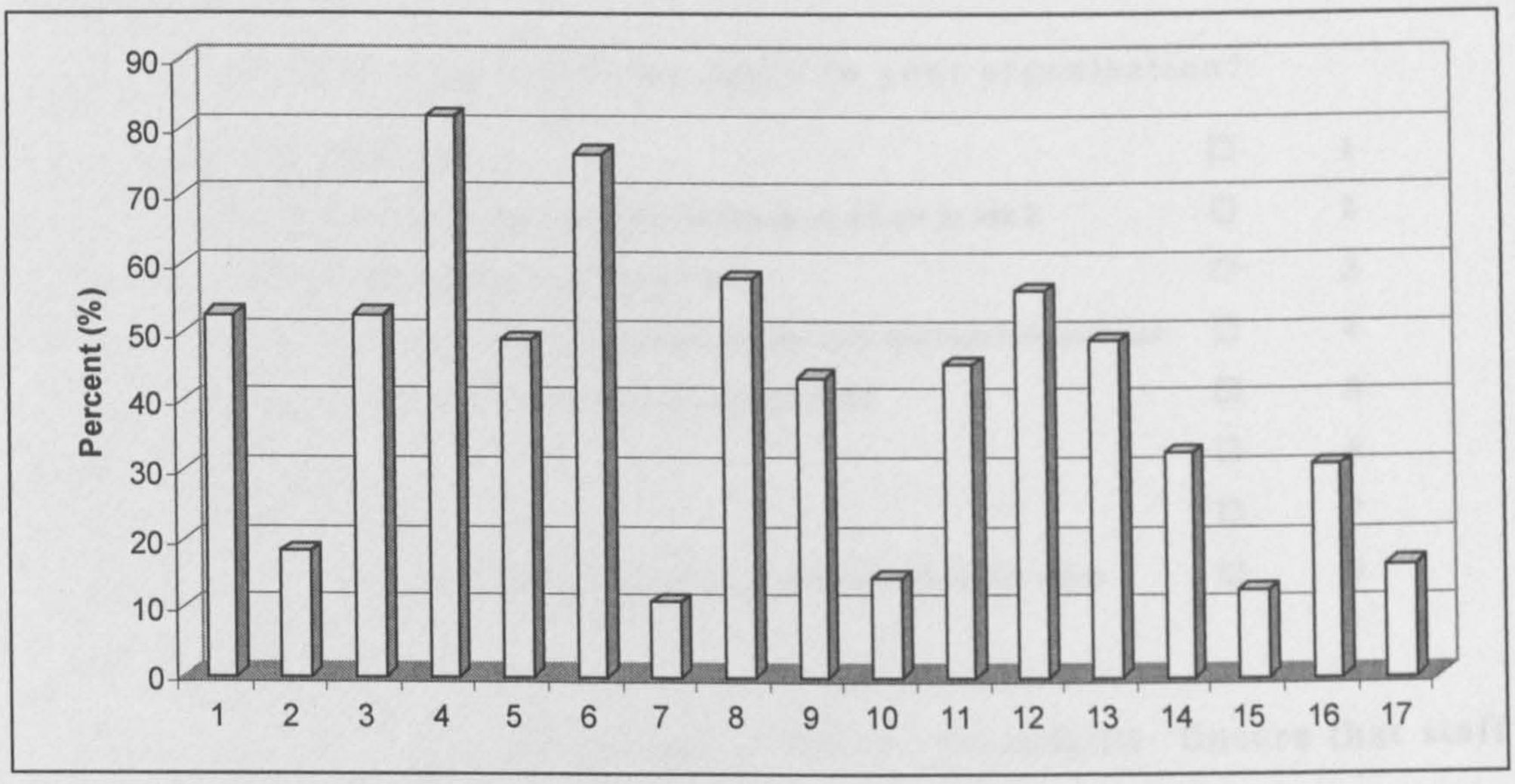

Figure 32 Bar-chart to show SME KM and Innovation Activities

Question 24

Which of the following activities apply to your organisation?

Encourage learning and insight	☐	**1**
Train and coach –how to encourage customer feedback and how to use it	☐	**2**
Develop active listening throughout the organisation	☐	**3**
Ensure that staff can readily match customer problems with appropriate services	☐	**4**
Coach people to look at new innovative ways of doing things	☐	**5**
Enable distance learning	☐	**6**
Develop employee creativity	☐	**7**
Develop management education and communication to help embed the value	☐	**8**

Key findings

Table 25 and Figure 25 show that 63.6% of respondents 'Ensure that staff can readily match customer problems with appropriate services'.

Activity	Frequency	Percent (%)
Encourage learning and insight [1]	28	50.9
Train and coach: how to encourage and use customer feedback [2]	22	40.0
Develop active listening throughout the organisation [3]	20	36.4
Ensure that staff can readily match customer problems with appropriate services [4]	35	63.6
Coach people to look at new innovative ways of doing things [5]	16	29.1
Enable distance learning [6]	10	18.2
Develop employee creativity [7]	12	21.8
Develop management education and communication to help embed the value [8]	12	21.8

Table 28 Table of results to show SME KM and Innovation Activities

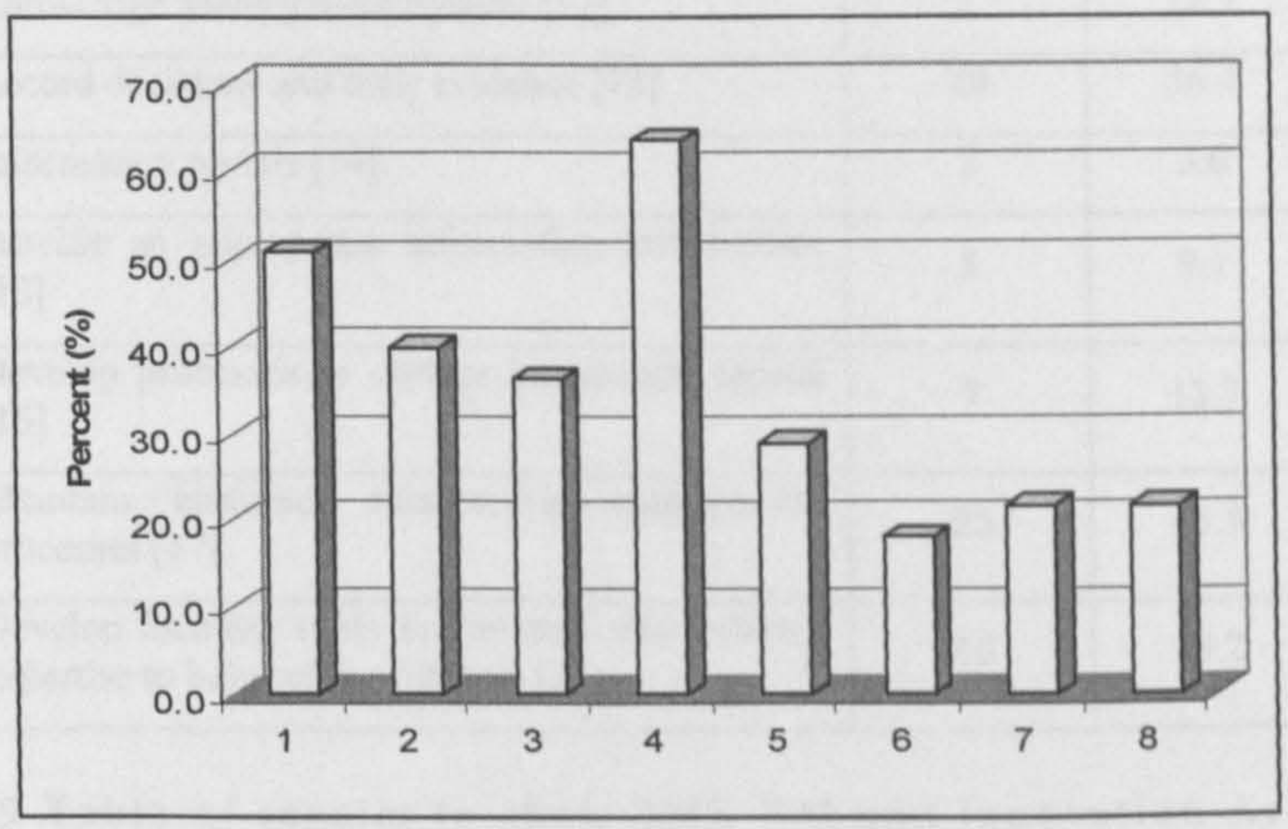

Figure 33 Bar-chart to show SME KM and Innovation Activities

Question 25

Please indicate, by ticking ANY of the following boxes, which activities apply to your organisation?

Ensure that expertise can be local	☐	**1**	**Prevent information duplication**	☐	**2**
Capture repeatable practices	☐	**3**	**Capture and share performance data**	☐	**4**
Maintain portfolio intelligence	☐	**5**	**Manage the product portfolio**	☐	**6**
Maintain project files	☐	**7**	**CV file of personnel**	☐	**8**
Electronic networks	☐	**9**	**Intranet**	☐	**10**
Central archive for information	☐	**11**	**Knowledge Management System**	☐	**12**
Record decisions and their evidence	☐	**13**	**Information portals**	☐	**14**
Provide an appropriate information architecture				☐	**15**
Develop processes to capture intellectual capital				☐	**16**
Maintain customer relationship management processes				☐	**17**
Develop location tools for internal and external expertise to help solve problems				☐	**18**

Key findings

Table 26 and Figure 26 show that 69.1% of respondents maintain project files.

Activity	Frequency	Percent (%)
Ensure that expertise can be local [1]	23	41.8
Prevent information duplication [2]	10	18.2
Capture repeatable practices [3]	17	30.9
Capture and share performance data [4]	17	30.9
Maintain portfolio intelligence [5]	12	21.8
Manage the product portfolio [6]	25	45.5
Maintain project files [7]	38	69.1
CV file of personnel [8]	27	49.1
Electronic networks [9]	26	47.3
Intranet [10]	23	41.8
Central archive for information [11]	24	43.6
Knowledge Management System [12]	7	12.7
Record decisions and their evidence [13]	20	36.4
Information portals [14]	2	3.6
Provide an appropriate information architecture [15]	5	9.1
Develop processes to capture intellectual capital [16]	7	12.7
Maintain customer relationship management processes [17]	25	45.5
Develop location tools for internal and external expertise to help solve problems [18]	10	18.2

Table 29 Table of results to show SME KM and Innovation Activities

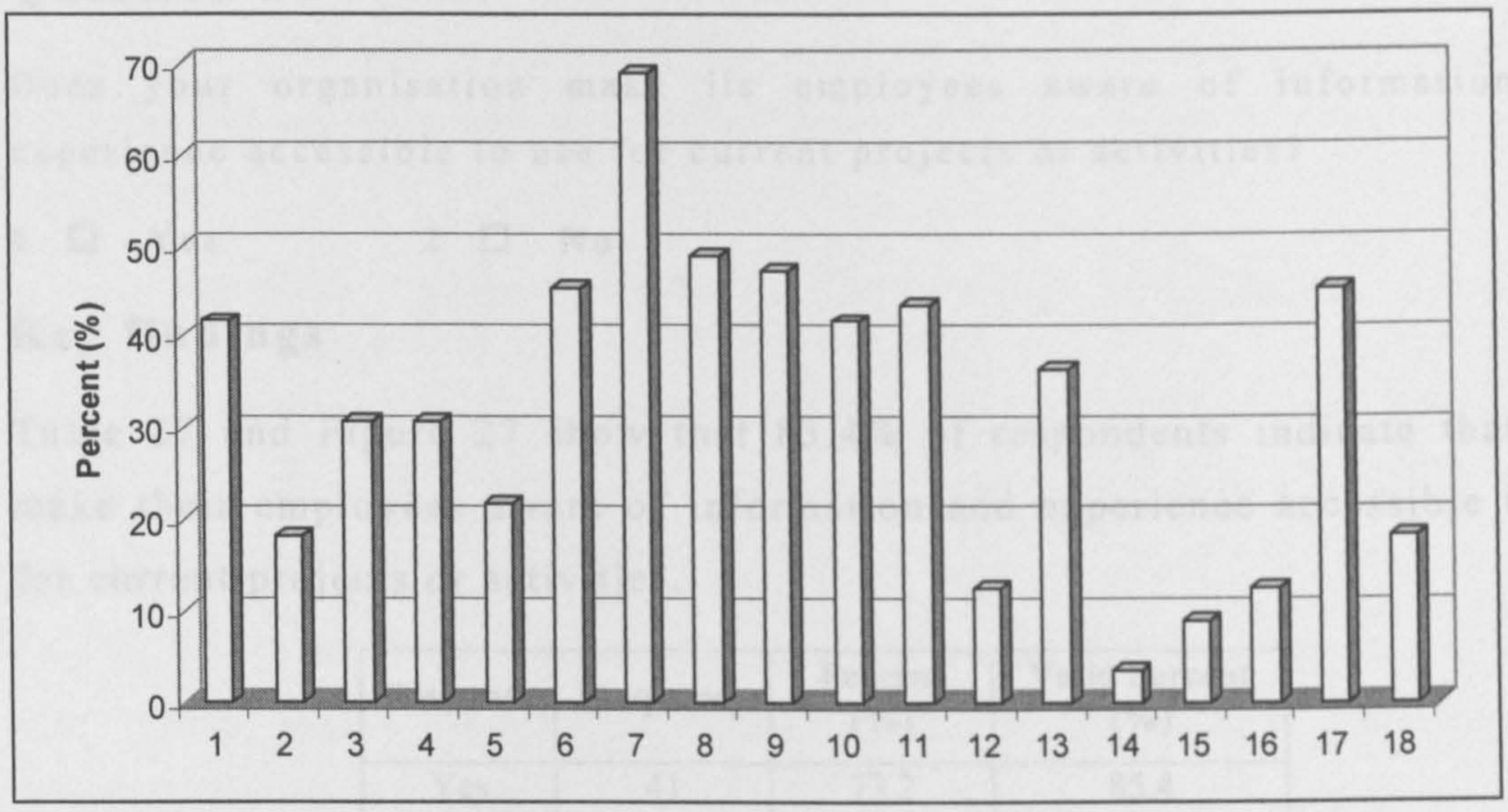

Figure 34 Bar-chart to show SME KM and Innovation Activities

Question 26

Does your organisation make its employees aware of information and experience accessible to use for current projects or activities?

1 ☐ Yes **2 ☐ No**

Key findings

Table 27 and Figure 27 show that 85.4% of respondents indicate that they make their employees aware of information and experience accessible to use for current projects or activities.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	41	73.2	85.4
No	7	12.5	14.6
Total	48	85.7	100.0
Missing	8	14.3	
Total	56	100.0	

Table 30 Table of results to show SMEs which make employees aware of available information and experience

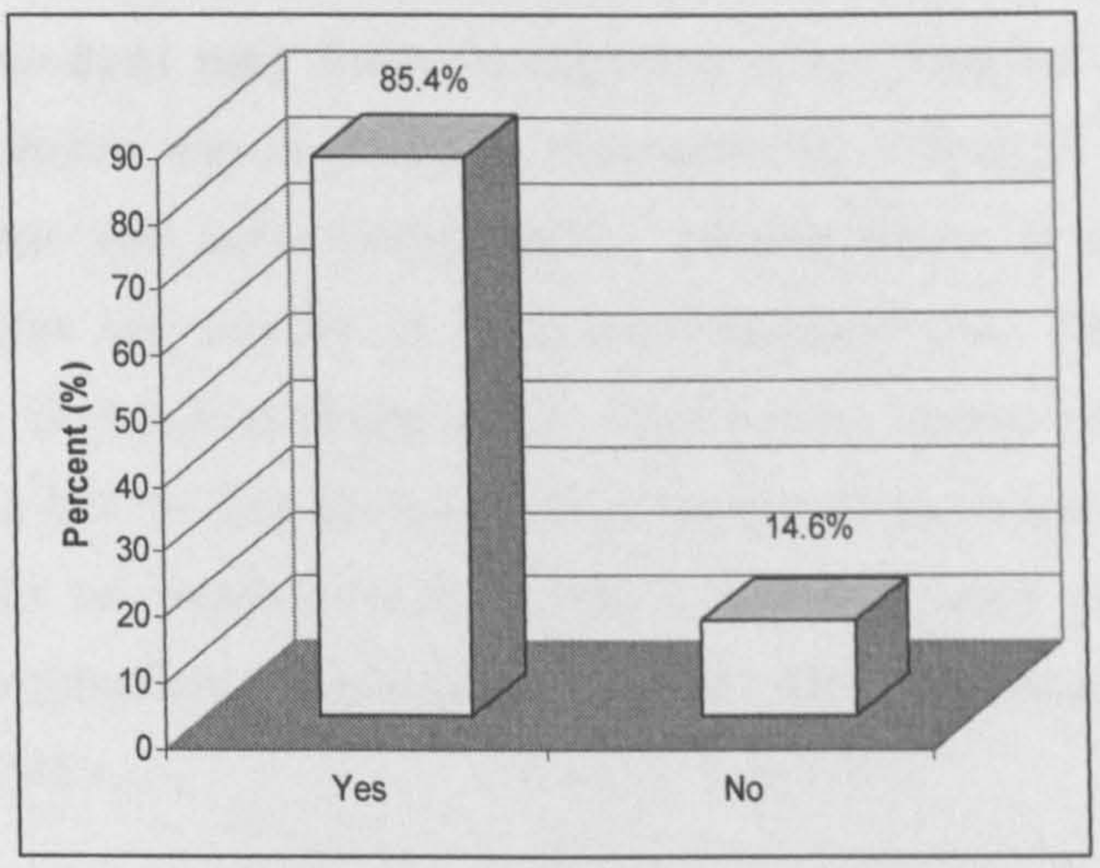

Figure 35 Bar-chart to show SMEs which make employees aware of available information and experience

Discussion

Why was this question chosen?

The purpose of this question was to ascertain if SMEs make their employees aware of information and experience accessible to use for current projects or activities; and compare this with other KM-Innovation variables from the questionnaire.

What was the 'initial' expectation of this question?

The initial expectation was that the majority of SMEs make their employees aware of information and experience accessible to use for current projects or activities.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 27 and Figure 27 show that the vast majority (85.4%) of respondents make their employees aware of information and experience accessible to use for current projects or activities.

This substantiates our initial expectation derived from the literature review that SMEs acknowledge the importance of 'Knowledge Sharing' and 'Knowledge Dissemination' in general.

Nonetheless, as with the process of 'Knowledge Acquisition' discussed previously, this question does not confirm that these SMEs perform activities to realise the benefits of the above processes. However, this will be explored and verified in the following sections.

The findings also show that there are respondents which claim not to make their employees aware of information and experience accessible to use for current projects or activities. There could be a number of reasons for this, for example the respondent may have interpreted this question as having explicit systems and processes which perform this activity although they may perform this in an informal and infrequent basis. Furthermore, it may be that SMEs based in this sector are unsure or even unconvinced how they can gain direct business benefit through making their employees aware of information and experience accessible to use for current projects or activities. Nonetheless, it could be valuable to explore why these SMEs provided such a response to further the understanding of possible barriers and misconceptions in the KM process within SMEs.

Further queries:

1. How do these SMEs make their employees aware of information and experience accessible to use for current projects or activities?
2. Further explore why SMEs claim not to make their employees aware of information and experience accessible to use for current projects or activities.

Question 27

Does your organisation encourage its employees to disseminate information and experience which may be useful to other employees within the organisation?

1 ☐ Yes 2 ☐ No

Key findings

Table 28 and Figure 28 show that 87.8% of respondents indicate that they encourage their employees to disseminate information and experience which may be useful to other employees within the organisation.

Response	Frequency	Percent (%)	Valid Percent (%)
Yes	43	76.8	87.8
No	6	10.7	12.2
Total	49	87.5	100.0
Missing	7	12.5	
Total	56	100.0	

Table 31 Table of results to show SMEs which encourage employees to disseminate information and experience

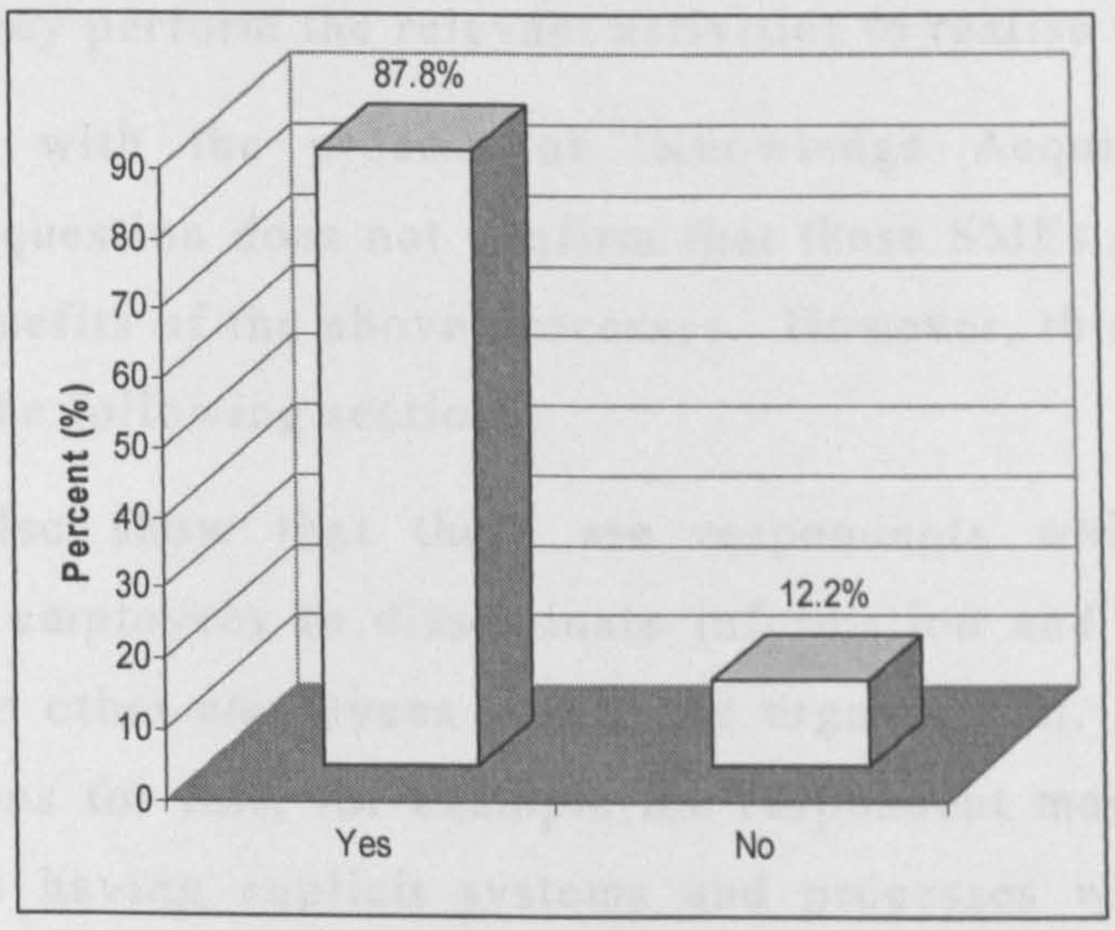

Figure 36 Bar-chart to show SMEs which encourage employees to disseminate information and experience

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs encourage its employees to disseminate information and experience which may be useful to other employees within the organisation; and compare this with the other KM-Innovation variables from the questionnaire. This question is supplementary to the previous question (Q26) and focuses more on the 'Knowledge Sharing' and 'Knowledge Dissemination' process amongst employees.

What was the 'initial' expectation of this question?

The initial expectation was that SMEs would encourage its employees to disseminate information and experience which may be useful to other employees within the organisation.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 28 and Figure 28 show that the vast majority (87.8%) of respondents encourage their employees to disseminate information and experience which may be useful to other employees within the organisation.

This confirms our initial expectation derived from the literature review that SMEs acknowledge the importance of the 'Knowledge Sharing' and 'Knowledge Dissemination' processes in general and consequently begs for the question if they perform the relevant activities to realise this claim.

Nonetheless, as with the process of 'Knowledge Acquisition' discussed previously, this question does not confirm that these SMEs perform activities to realise the benefits of the above processes. However, this will be explored and verified in the following sections.

The findings also show that there are respondents which claim not to encourage their employees to disseminate information and experience which may be useful to other employees within the organisation. There could be a number of reasons for this, for example the respondent may have interpreted this question as having explicit systems and processes which perform this activity although they may perform this in an informal and infrequent basis. Furthermore, it may be that SMEs based in this sector are unsure or even unconvinced how they can gain direct business benefit through encourage their employees to disseminate information and experience which may be useful to other employees within the organisation. Nonetheless, it could be valuable to explore why these SMEs provided such a response to further the

understanding of possible barriers and misconceptions in the KM process within SMEs.

Further queries:

1. How do these SMEs encourage their employees to disseminate information and experience which may be useful to other employees within the organisation?

2. Further explore why SMEs claim not to encourage their employees to disseminate information and experience which may be useful to other employees within the organisation.

Question 28

Please indicate, by ticking ANY of the following boxes, which activities apply to your organisation?

Encourage creative communities	☐	**1**
Supportive environment for sharing	☐	**2**
Share information with clients	☐	**3**
Share performance data	☐	**4**
Lunchtime meetings	☐	**5**
Job rotation	☐	**6**
Mentoring	☐	**7**
Debriefing departing employees	☐	**8**
Internal secondment	☐	**9**
Direct collaborative working	☐	**10**
Team building	☐	**11**
Organising experience swapping sessions	☐	**12**
Mobilise customer, market and competitor intelligence	☐	**13**
Make capabilities, information and insights visible to customers	☐	**14**
Share knowledge with customers and partners	☐	**15**
Direct knowledge sharing between projects	☐	**16**
Make product information easily available to employees and customers	☐	**17**
Provide research and information to take appropriate actions	☐	**18**
Develop processes for sharing ideas with suppliers and partners	☐	**19**
Provide information that allows staff to deliver the right solutions for each client	☐	**20**
Develop processes to support rapid re-use of new solutions for other clients.	☐	**21**

Key findings

Table 29 and Figure 29 show that 61.2% of respondents indicate that they make product information easily available to employees and customers.

Activity	Frequency	Percent (%)
Encourage creative communities [1]	12	24.5
Supportive environment for sharing [2]	19	38.8
Share information with clients [3]	23	46.9
Share performance data [4]	21	42.9
Lunchtime meetings [5]	7	14.3
Job rotation [6]	10	20.4
Mentoring [7]	9	18.4
Debriefing departing employees [8]	15	30.6
Internal secondment [9]	7	14.3
Direct collaborative working [10]	9	18.4
Team building [11]	15	30.6
Organising experience swapping sessions [12]	5	10.2
Mobilise customer, market and competitor intelligence [13]	18	36.7
Make capabilities, information and insights visible to customers [14]	14	28.6
Share knowledge with customers and partners [15]	29	59.2
Direct knowledge sharing between projects [16]	22	44.9
Make product information easily available to employees and customers [17]	30	61.2
Provide research and information to take appropriate actions [18]	12	24.5
Develop processes for sharing ideas with suppliers and partners [19]	11	22.4
Provide information that allows staff to deliver the right solutions for each client [20]	24	49.0
Develop processes to support rapid re-use of new solutions for other clients [21]	7	14.3

Table 32 Table of results to show SME KM and Innovation Activities

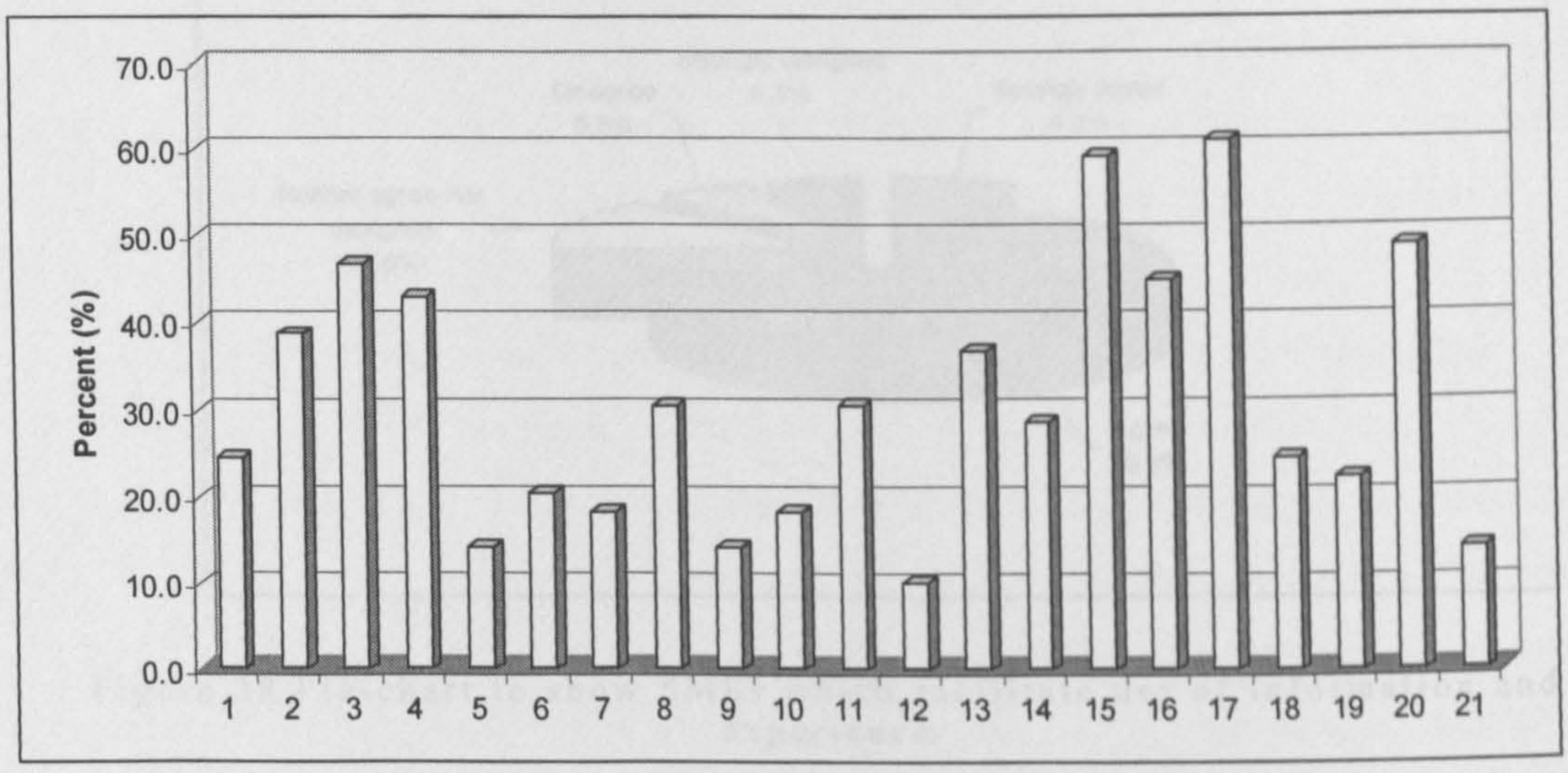

Figure 37 Bar-chart to show SME KM and Innovation Activities

Question 29

Our organisation facilitates the use of information and experience from within the organisation for new or improved products/services/processes?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
1 O	2 O	3 O	4 O	5 O

Key findings

Table 30 and Figure 30 show that 79.1% of respondents agree (and strongly agree) that they facilitate the use of information and experience from within the organisation for new or improved products/services/processes.

Response	Frequency	Percent (%)	Valid Percent (%)
Strongly agree	4	7.1	8.3
Agree	34	60.7	70.8
Neither agree nor disagree	7	12.5	14.6
Disagree	3	5.4	6.3
Strongly disagree	3	5.4	6.3
Total	48	85.7	100.0
Missing	8	14.3	
Total	56	100.0	

Table 33 Table of results to show SMEs which facilitate use of information and experience

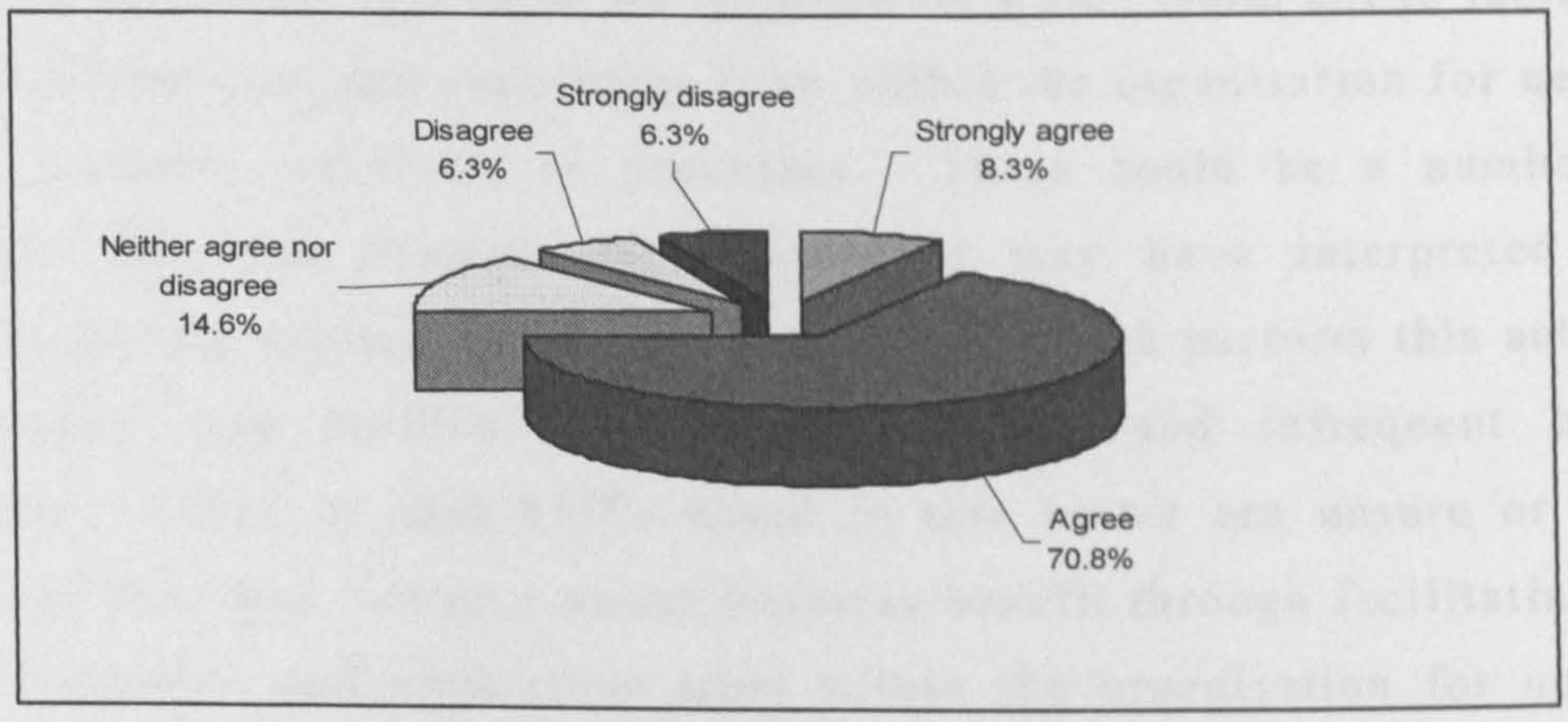

Figure 38 Pie-chart to show SMEs which facilitate use of information and experience

Discussion

Why was this question chosen?

The purpose of this question was to determine if SMEs facilitate the use of information and experience from within the organisation for new or improved products, services or processes; and compare this with the other KM-Innovation related variables from the questionnaire.

What was the 'initial' expectation of this question?

The initial expectation was that majority of SMEs 'agree' and 'strongly agree' that they facilitate the use of information and experience from within the organisation for new or improved products, services, or processes.

What were the actual findings, and what judgements have you formed as a result of what you found out?

Table 3.8 and Figure 3.8 show that majority (79.1%) 'agree' and 'strongly agree' that they facilitate the use of information and experience from within the organisation for new or improved products, services or processes.

This validates the initial expectation obtained from the literature review that SMEs acknowledge the importance of 'Knowledge Use' with regards to information and experience for the realisation of innovations in general.

Nonetheless, as with the process of 'Knowledge Acquisition' discussed previously, this question does not confirm that these SMEs perform activities to realise the benefits of the above process. However, this will be explored and verified in the following sections.

The findings also show that there are respondents which claim not to facilitate the use of information and experience from within the organisation for new or improved products, services, or processes. There could be a number of reasons for this, for example the respondent may have interpreted this question as having explicit systems and processes which perform this activity although they may perform this in an informal and infrequent basis. Furthermore, it may be that SMEs based in this sector are unsure or even unconvinced how they can gain direct business benefit through facilitating the use of information and experience from within the organisation for new or improved products, services, or processes. Nonetheless, it could be valuable to explore why these SMEs provided such a response to further the understanding of possible barriers and misconceptions in the KM process within SMEs.

Further queries:

1. How do these SMEs facilitate the use of information and experience from within the organisation for new or improved products, services, or processes?

2. Further explore why SMEs claim not to facilitate the use of information and experience from within the organisation for new or improved products, services, or processes.

Question 30

Please indicate, by ticking ANY of the following boxes, which activities apply to your organisation?

Project evaluations	☐	**1**
Internal or external audits	☐	**2**
Benchmarking	☐	**3**
Customer satisfaction studies or feedback	☐	**4**
Performance appraisals	☐	**5**
Performance meetings	☐	**6**
Staff appraisals	☐	**7**
Turn good practice into common practice	☐	**8**
Create feedback processes	☐	**9**
Conduct After Action reviews	☐	**10**
Supportive environment for applying ideas and knowledge	☐	**11**
Provide the time and permission for reflection	☐	**12**
Enable flexible solutions rather than off-the-shelf products	☐	**13**
Ensure sales proposals build on previous successful approaches	☐	**14**
Ensure that all expertise is applied to continuous improvement	☐	**15**
Measure how good you are, coming up with better ways and making these happen	☐	**16**
Use decision making models	☐	**17**
Encourage new perspectives to be applied to processes and problems	☐	**18**

Key findings

Table 31 and Figure 31 show that 69.4% of respondents indicate that they carry out 'internal or external audits'.

Activity	Frequency	Percent (%)
Project evaluations [1]	23	46.9
Internal or external audits [2]	34	69.4
Benchmarking [3]	11	22.4
Customer satisfaction studies [4]	27	55.1
Performance appraisals [5]	30	61.2
Performance meetings [6]	17	34.7
Staff appraisals [7]	33	67.3
Turn good practice into common practice [8]	18	36.7
Create feedback processes [9]	13	26.5
Conduct After Action Reviews [10]	5	10.2
Supportive environment for applying ideas and knowledge [11]	22	44.9
Provide the time and permission for reflection [12]	7	14.3
Enable flexible solutions rather than off-the-shelf products [13]	28	57.1
Ensure sales proposals build on previous successful approaches [14]	28	57.1
Ensure that all expertise is applied to continuous improvement [15]	11	22.4
Measure how good your are coming up with better ways and making these happen [16]	13	26.5
Use decision making models [17]	2	4.1
Encourage new perspectives to be applied to processes and problems [18]	17	34.7

Table 34 Table of results to show SME KM and Innovation Activities

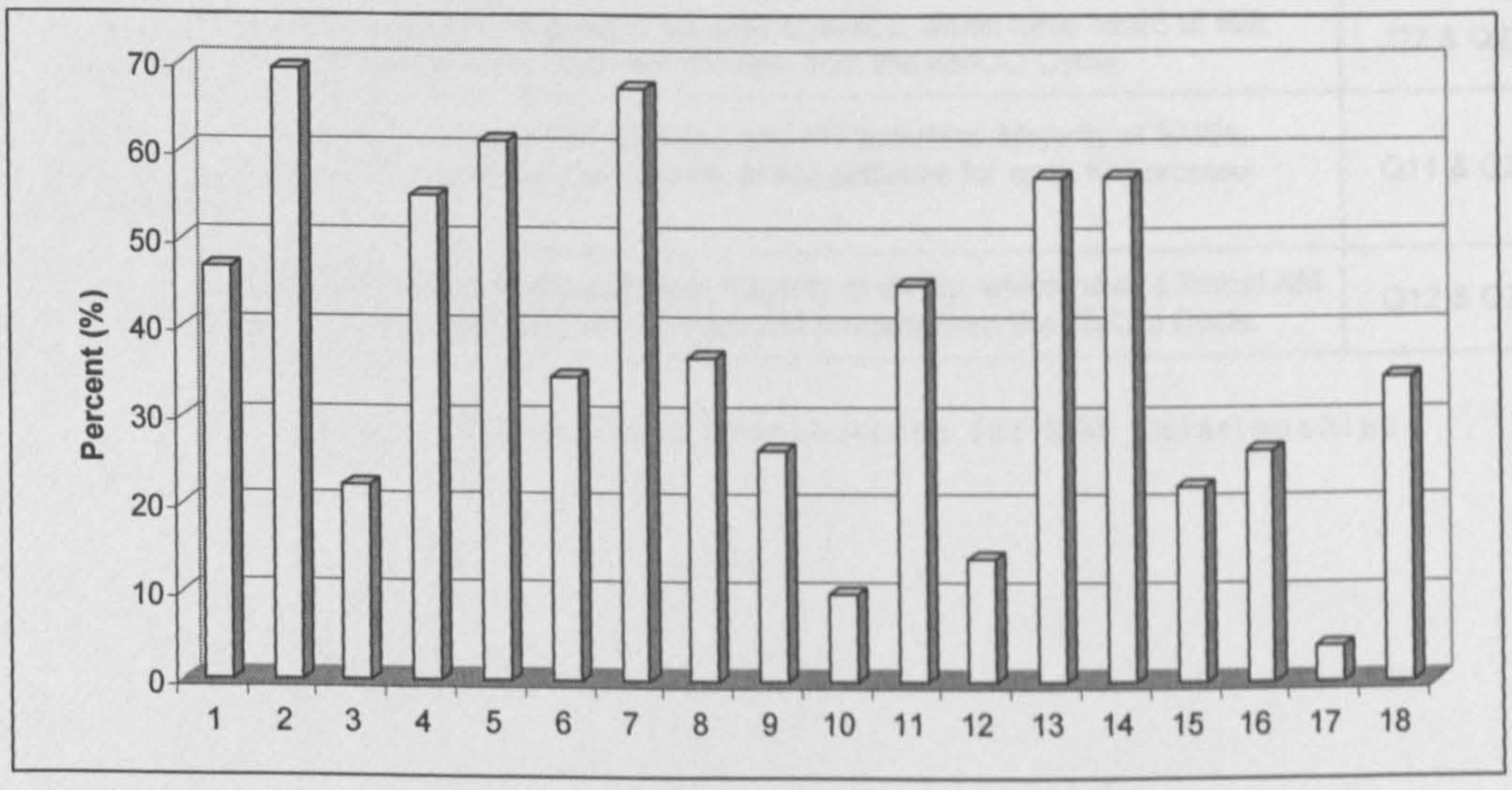

Figure 39 Bar-chart to show SME KM and Innovation Activities

5.3 Part 2: Exploratory Statistics

5.3.1 Introduction

This part presents the key findings from the exploratory data analysis of the key relationships identified from the descriptive analysis of the questionnaire survey by the researcher. These key relationships were decided by the researcher to be most closely associated with the original research question and objectives.

The following three tables present the 24 relationships identified from the descriptive analysis with theoretical propositions and appropriate location of questions from the questionnaire where they were operationalised.

Theoretical Proposition - KM Relationships	Questionnaire Reference
Relationship 1: Acknowledgement of Knowledge as a Competitive factor and KM Awareness: Majority of SMEs, which acknowledge that knowledge is one of their most competitive factors, have heard of KM.	Q7 & Q8
Relationship 2: KM Awareness and Allocation of Resources to KM Activities: Majority of SMEs, which have heard of KM, allocate resources to KM activities.	Q7 & Q12
Relationship 3: Allocation of Resources to KM activities and KM Strategy: Majority of SMEs, which allocate resources to KM activities, do not have a formal KM strategy.	Q11 & Q12
Relationship 4: Identification of Key Knowledge to achieve Strategic Goals and Objectives and KM Strategy: Majority of SMEs, which 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives, have a formal KM strategy.	Q11 & Q13
Relationship 5: Allocation of Resources to KM Activities and Identification of Knowledge to Achieve Strategic Goals and Objectives: Majority of SMEs, which allocate resources to KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives.	Q12 & Q13
Relationship 6: Continuous Mapping or Identification of Knowledge and KM Strategy: Majority of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, have a formal KM strategy.	Q11 & Q14
Relationship 7: KM Awareness and KM Activities: Majority of SMEs, which have heard of KM, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q7 & Q21-Q30
Relationship 8: Allocation of Resources to KM Activities and KM activities: Majority of SMEs, which allocate resources to KM, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q11 & Q21-Q30
Relationship 9: Formal KM Strategy and KM activities: Majority of SMEs, which have a formal KM strategy, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q12 & Q21-Q30

Table 35: Key Theoretical Propositions for KM Relationships

Theoretical Proposition - Innovation Relationships	Questionnaire Reference
Relationship 10: Systems and Processes to facilitate ideas from discovery to implementation and Innovation strategy: Majority of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to implementation, have a formal innovation strategy.	Q15 & Q17
Relationship 11: Allocation of Resources to Innovation Activities and Systems and Processes to facilitate ideas from discovery to implementation: Majority of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.	Q16 & Q17
Relationship 12: Innovation Strategy and Organisational Improvements: Strategy - Majority of SMEs, which have made improvements in their corporate strategy, have a formal innovation strategy; Market - Majority of SMEs, which have significantly changed their organisation's marketing concepts or strategies, have a formal innovation strategy; Structure - Majority of SMEs, which have implemented new or significantly changed organisational structures, have a formal innovation strategy; Management - Majority of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy; Management - Majority of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy; Operations - Majority of SMEs, which have implemented new or significantly changed internal processes, have a formal innovation strategy.	Q15 & Q18
Relationship 13: Introduction of new or improved products and services and Innovation Strategy: Introduction of new or improved products or services - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME, do not have a formal innovation strategy; Introduction of new or improved products or services developed by a third party - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME (and developed by a third party), have a formal innovation strategy; Introduction of new or improved products or services developed with a third party - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME and developed with a third party, have a formal innovation strategy; Introduction of new or improved products or services developed on own - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME (and developed on its own), have a formal innovation strategy.	Q15 & Q19
Relationship 14: Allocation of Resources to Innovation activities and Organisational improvements: Strategy - Majority of SMEs, which implement new or significantly changed corporate strategies, allocate resources to innovation activities; Market - Majority of SMEs, which significantly change their marketing concepts or strategies, allocate resources to innovation activities; Structure - Majority of SMEs, which implement new or significantly changed organisational structures, allocate resources to innovation activities; Management - Majority of SMEs, which implement new or advanced management techniques, allocate resources to innovation activities; Operations - Majority of SMEs, which implement new or significantly changed internal processes, allocate resources to innovation activities.	Q16 & Q18
Relationship 16: Allocation of Resources to Innovation Activities and Introduction of New or Improved Products or Services: Introduction of new or improved products or services - Majority of SMEs, which allocate resources to innovation activities, introduce products and/or services onto the market.	Q16 & Q19
Relationship 18: Innovation Strategy and Allocation of Resources to Innovation Activities: Majority of SMEs, which allocate resources to innovation activities, have a formal innovation strategy.	Q15 & Q16
Relationship 19: Allocation of Resources to Innovation Activities and Innovation activities: Ideas - The majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Ideas"; Tacit Knowledge - Majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Tacit Knowledge"; Explicit Knowledge - Majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Explicit Knowledge".	Q16 & Q21-Q30
Relationship 20: Innovation activities and Formal Innovation Strategy: Ideas - Majority of SMEs, which implement activities associated with "Ideas", have a formal innovation strategy; Tacit Knowledge - Majority of SMEs, which implement activities associated with "Explicit Knowledge", have a formal innovation strategy; Explicit Knowledge - Majority of SMEs, which implement activities associated with "Explicit Knowledge", have a formal innovation strategy.	Q19 & Q21-Q30

Table 36: Key Theoretical Propositions for Innovation Relationships

Theoretical Proposition - KM & Innovation Relationships	Questionnaire Reference
Relationship 21: KM Strategy and Innovation Strategy: Majority of SMEs, which have a formal KM strategy, have a formal innovation strategy.	Q11 & Q15
Relationship 22: Allocation of resources to KM activities and Allocation of resources to innovation activities: Majority of SMEs, which allocate resources to knowledge management activities, allocate resources to innovation activities.	Q12 & Q16
Relationship 23: Allocation of Resources to KM Activities and Systems and processes to facilitate ideas from discovery to implementation: Majority of SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.	Q12 & Q17
Relationship 24: Allocation of resources to KM activities and Organisational improvements: Strategy - Majority of SMEs, which implement new or significantly changed corporate strategies, do not allocate resources to KM activities; Marketing - Majority of SMEs, which significantly change their marketing concepts or strategies, allocate resources to KM activities; Structure - Majority of SMEs, which implement new or significantly changed organisational structures, do not allocate resources to KM activities; Management - Majority of SMEs, which implement new advanced management techniques, allocate resources to KM activities; Operations - Majority of SMEs, which implement new or significantly changed internal processes, allocate resources to KM activities.	Q12 & Q18

Table 37: Key Theoretical Propositions for KM & Innovation Relationships

Further discussion, including conclusions drawn from these key findings for descriptive and exploratory analysis, is provided in the following chapter.

However, in this part, the relationships are presented in the following three categories:

Section 1: Knowledge Management [Relationships 1 to 9]

Section 2: Innovation [Relationships 10 to 20]

Section 3: Knowledge Management & Innovation [Relationships 21 to 24]

The following section will explain the statistical techniques used in the exploratory analysis before presenting the key findings for the above relationships.

Rationale for Exploratory Statistics Techniques

The key objectives of the exploratory analysis are to: identify an association between any two variables from the above relationships; and consequently ascertain the strength of the association where applicable.

The applicability of statistical techniques for analysis was determined by the data type. The questionnaire comprised of 'categorical data' as Saunders et al., (2003) explain "...categorical data refers to data whose values cannot be measured numerically but can be either classified into sets (categories) according to the characteristics in which you are interested or placed in rank order". As a result, the Chi-square test was selected by the researcher to ascertain an association, the following sections will explain the process of the aforementioned statistical technique.

Chi-square Test [χ^2]

As Kinnear and Gray (2001) explain, the chi-square test is a technique which establishes if there is or is not an association between any two qualitative variables. The rejection of the null hypothesis (H0) by means of chi-square, however, only establishes the existence of a statistical association it does not measure its strength. The null hypothesis (H0) is that there is no association between the variables (Saunders et al., 2003). In fact, Kinnear and Gray (2001) argue that the chi-square statistic is unsuitable as a measure of association, because it is affected by the total frequency.

It is important to realise that the calculated statistic is only approximately distributed as the theoretical chi-square distribution: the greater the expected frequencies, the better the approximation, hence the rule about the minimum expected frequencies. It is also important to note that the use of the chi-square statistic requires that each individual studied contributes to the count in only one cell in the cross-tabulation. However, where the minimum expected frequency is breached it does not nullify the use of the chi-square test but is found to be more effective (Agresti, 1996).

There are several other potential problems the user should be aware of. A lucid account of the rationale and assumptions of the chi-square test is given by Howell (1997), and a survey of the errors and misconceptions about chi-square that abound in the research literature is given by Delucchi (1983).

During the analysis there are a number of cases where the frequencies were below the minimum expected value (5). Here, Fisher's Exact Test [FET] was used instead of the chi-square test.

Fisher's Exact Test [FET]

The FET is recommended when analysing small samples (Dixon & Massey, 1983; Siegel & Castellan, 1988). Moreover, due to the low response rates for SME questionnaire surveys and lack of resources for large scale surveys in PhD research projects the exact test is more suitable.

Nevertheless, numerous statistical studies have already provided evidence that the FET is seriously conservative and of low power as test for independence (Liddell, 1976; Camilli & Hopkins, 1978, 1979; Upton, 1982; Overall et al., 1987; D'Agostino et al., 1988; Barnard, 1989). In fact, several statisticians have described the FET as `extremely conservative', `inappropriate' and ` irrelevant' (Liddell, 1976; Upton, 1982; D'Agostino et al., 1988). This is mainly due to the fact the FET does not provide a measure for the strength of

association between variables as the chi-square test does (Kinnear and Gray, 2001).

Measures of Strength of Association

As Reynolds (1984) explains that an ideal measure should mimic the correlation co-efficient by having a maximum absolute value of 1 for perfect association, and a value of 0 for no association. The choice of the appropriate statistic depends on whether the contingency table is 2x2 (each variable has two categories) or larger.

Kinnear and Gray (2001) explain that one such statistic, for example, is the Phi coefficient [ϕ], obtained by dividing the value of chi-square by the total frequency and taking the square root. For two-way contingency tables involving variables with more than two categories, another statistic, known as Cramér's V, is preferred because with more complex tables, Cramér's measure can still, as in 2x2 case, achieve its maximum value of unity. These measures are usually provided for samples where there is a significant association.

Significance testing

Significance testing is the probability of a relationship between variables occurring by chance alone (Saunders et al., 2003). Statistical software packages provide the p-value to show the significance between variables. De Vaus (2002) recommends using the 0.05 significance level for smaller samples (less than 100) and the 0.001 significance level for larger samples (more than 100). Subsequently, for this study the 0.05 significance level was used as the number of respondents was 56. So, a p-value less than or equal to the significance level will result in rejecting the null hypothesis, as explained above.

The SPSS software package was used by the researcher for the exploratory analysis due to the researcher having prior experience with this package.

Layout of the following sections

Each section contains the following sub-sections: the key questions from the questionnaire being explored; hypothesis or hypotheses drawn from the descriptive statistics; a summary of the key findings from the exploratory analysis including the p-value and strength of association where applicable; key findings from the cross-tabulation between the variables; key findings from the chi-square test or Fisher's Exact Test where applicable.

5.3.2 Section 1: Knowledge Management Relationships

The following table provides a summary of the key findings from this section:

Theoretical Proposition - KM Relationships	Questionnaire Reference	Discrepany with Initial Expectation (Y/N)	Significance
Relationship 1: Acknowledgement of Knowledge as a Competitive factor and KM Awareness: Majority of SMEs, which acknowledge that knowledge is one of their most competitive factors, have heard of KM.	Q7 & Q8	Y	$p > 0.05$
Relationship 2: KM Awareness and Allocation of Resources to KM Activities: Majority of SMEs, which have heard of KM, allocate resources to KM activities.	Q7 & Q12	N	$p < 0.05$
Relationship 3: Allocation of Resources to KM activities and KM Strategy: Majority of SMEs, which allocate resources to KM activities, do not have a formal KM strategy.	Q11 & Q12	Y	$p < 0.05$
Relationship 4: Identification of Key Knowledge to achieve Strategic Goals and Objectives and KM Strategy: Majority of SMEs, which 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives, have a formal KM strategy.	Q11 & Q13	Y	$p < 0.05$
Relationship 5: Allocation of Resources to KM Activities and Identification of Knowledge to Achieve Strategic Goals and Objectives: Majority of SMEs, which allocate resources to KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives.	Q12 & Q13	N	$p < 0.05$
Relationship 6: Continuous Mapping or Identification of Knowledge and KM Strategy: Majority of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, have a formal KM strategy.	Q11 & Q14	Y	$p < 0.05$
Relationship 7: KM Awareness and KM Activities: Majority of SMEs, which have heard of KM, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q7 & Q21-Q30	Y	See Table X
Relationship 8: Allocation of Resources to KM Activities and KM activities: Majority of SMEs, which allocate resources to KM, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q11 & Q21-Q30	Y	See Table X
Relationship 9: Formal KM Strategy and KM activities: Majority of SMEs, which have a formal KM strategy, implement the majority of KM activities for each KM process from the KMOLI Cycle.	Q12 & Q21-Q30	Y	See Table X

Table 38: Summary of Findings for the Key Theoretical Propositions for KM

The following sections present the findings for each of the key theoretical propositions above.

Relationship 2: KM Awareness and Allocation of Resources to KM Activities

Question 7:

Have you ever heard of knowledge management?

1 ☐ Yes 2 ☐ No

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Hypothesis 1: SMEs which have heard of KM allocate resources to KM activities

Hypothesis 2: SMEs which have not heard of KM do not allocate resources to KM activities

Summary of Key Findings:

1. 54.2% of SMEs, which have heard of KM, allocate resources to KM activities.
2. 83.3% of SMEs, which have not heard of KM, have not allocated resources to KM activities.
3. $p < 0.05$ (0.004; Chi-square Test); $\phi = 0.395$ (Phi-co-efficient)

Results: Cross tabulation:

		Q12		Total
		1	2	
Q7	1	13	11	24
	2	5	25	30
Total		18	36	54

1 = Yes; 2 = No

Table 39: Cross-tabulation for Relationship 3

Key findings (Table 7):

1. 54.2% of SMEs, which have heard of KM, allocate resources to KM activities.
2. 45.8% of SMEs, which have heard of KM, have not allocated resources to KM activities.

3. 16.7% of SMEs, which have not heard of KM, allocate resources to KM activities.
4. 83.3% of SMEs, which have not heard of KM, have not allocated resources to KM activities.

Results: Chi-square Test

			Choice		Total
			Q12 (1)	Q12 (2)	
Group	Q7 (1)	Count	13	11	24
		Expected Count	8.0	16.0	24.0
	Q7 (2)	Count	5	25	30
		Expected Count	10.0	20.0	30.0
Total		Count	18	36	54
		Expected Count	18.0	36.0	54.0

1 = Yes; 2 = No

Table 40: Contingency table for Relationship 3

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.438	1	.004		
Continuity Correction(a)	6.834	1	.009		
Likelihood Ratio	8.606	1	.003		
Fisher's Exact Test				.008	.004
Linear-by-Linear Association	8.281	1	.004		
N of Valid Cases	54				

Table 41: Statistics for Relationship 3

	Value	Approx. Sig.
Nominal by Phi	.395	.004
Nominal Cramer's V	.395	.004
Number of valid cases	54	

Table 42: Strength of Association for Relationship 3

Key findings (Tables 8, 9 & 10):

1. $p < 0.05$ (0.004)

2. $\phi = 0.395$ (Phi-co-efficient)

Relationship 3: KM Strategy and Allocation of Resources to KM activities

Question 11:

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Hypothesis 1: SMEs which allocate resources to KM activities do not have a formal KM strategy

Hypothesis 2: SMEs which do not allocate resources to KM activities do not have a formal KM strategy

Summary of Key Findings:

1. 52.9% of SMEs, which allocate resources to KM activities, do not have a formal KM strategy.
2. 100.0% of SMEs, which do not allocate resources to KM activities, do not have a formal KM strategy.
3. $p < 0.001$ [FET]

Results: Cross-tabulation:

		Q12		Total
		1	2	
Q11	1	8	0	8
	2	9	36	45
Total		17	36	53

1 = Yes; 2 = No

Table 43: Cross-tabulation for Relationship 4

Key findings -Table 11:

1. 52.9% of SMEs, which allocate resources to KM activities, do not have a formal innovation strategy.
2. 47.1% SMEs, which allocate resources to KM activities, have a formal innovation strategy.

3. 100.0% of SMEs, which do not allocate resources to KM activities, do not have a formal innovation strategy.

Results: Fishers Exact Test [FET]:

			Choice		Total
			Q12 (1)	Q12 (2)	
Group	Q11 (1)	Count	8	0	8
		Expected Count	2.6	5.4	8.0
	Q11 (2)	Count	9	36	45
		Expected Count	14.4	30.6	45.0
Total		Count	17	36	53
		Expected Count	17.0	36.0	53.0

1 = Yes; 2 = No

Table 44: Contingency table for Relationship 4

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	19.953	1	.000		
Continuity Correction(a)	16.450	1	.000		
Likelihood Ratio	21.472	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	19.576	1	.000		
N of Valid Cases	53				

Table 45: Statistics for Relationship 4

Key findings - Table 11:

1. $p < 0.001$ [FET]

Relationship 4: KM Strategy and Identification of Key Knowledge to achieve Strategic Goals and Objectives

Question 11:

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Question 13:

Our organisation has identified the key knowledge it needs to achieve it's strategic goals and objectives?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 O	2 O	3 O	4 O	5 O

Hypothesis 1: SMEs which 'strongly agree' and 'agree' that they identify key knowledge to achieve its strategic goals and objectives do not have a formal KM strategy

Hypothesis 2: SMEs which 'strongly agree' and 'agree' that they have a formal KM strategy identify key knowledge it needs to achieves its strategic goals and objectives

Summary of Key Findings

1. 74.1% of SMEs, which 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives, do not have a formal KM strategy.
2. 87.5% of SMEs, which have a formal KM strategy, 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives.
3. $p < 0.05$ (0.006; Chi-square Test); $\phi = 0.515$ [Phi-co-efficient]; $V = 0.515$ [Cramer's V]

Results: Cross-tabulation:

		Identify Key Knowledge					Total
		1	2	3	4	5	
Formal KM Strategy	Yes	3	4	1	0	0	8
	No	1	19	21	4	1	46
Total		4	23	22	4	1	54

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 46: Cross-tabulation for Relationship 5

Key Findings (Table 21):

1. 74.1% of SMEs, which 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives, do not have a formal KM strategy.
2. 87.5% of SMEs, which have a formal KM strategy, 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives.

Results: Chi square Test:

			Formal KM Strategy		Total
			No	Yes	
Identify Key Knowledge	1	Count	1	3	4
		Expected Count	3.4	.6	4.0
	2	Count	19	4	23
		Expected Count	19.6	3.4	23.0
	3	Count	21	1	22
		Expected Count	18.7	3.3	22.0
	4	Count	4	0	4
		Expected Count	3.4	.6	4.0
	5	Count	1	0	1
		Expected Count	.9	.1	1.0
Total		Count	46	8	54
		Expected Count	46.0	8.0	54.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 47: Contingency for Relationship 5

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.310(a)	4	.006
Likelihood Ratio	11.416	4	.022
Linear-by-Linear Association	8.703	1	.003
N of Valid Cases	54		

Table 48: Statistics for Relationship 5

	Value	Approx. Sig.
Nominal by Phi	.515	.006
Nominal Cramer's V	.515	.006
Number of valid cases	54	

Table 49: Strength of Association for for Relationship 5

Key findings (Table 14, 15 & 16):

1. $\chi^2 = 14.310$; df = 4; p = 0.006 [Chi-square Test]

2. $\phi = 0.515$ [Phi-co-efficient]; Cramer's V= 0.515 [Cramer's V]

Relationship 5: Allocation of Resources to KM Activities and Identification of Knowledge to Achieve Strategic Goals and Objectives

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Question 13:

Our organisation has identified the key knowledge it needs to achieve it's strategic goals and objectives?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 O	2 O	3 O	4 O	5 O

Hypothesis 1: SMEs which allocate resources to KM activities 'strongly agree' and 'agree' that they identify key knowledge to achieve strategic goals and objectives.

Hypothesis 2: SMEs, which 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives, allocate resources to KM activities.

Summary of Key Findings

1. 88.9% of SMEs, which allocate resources to KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives.
2. 57.1% of SMEs, which 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives, allocate resources to KM activities.
3. $p < 0.05$ (0.001; Chi-square Test); $\phi = 0.590$ [Phi-co-efficient]; $V = 0.590$ [Cramer's V]

Results: Cross-tabulation:

		Identify Key Knowledge					Total
		1	2	3	4	5	
Allocate Resources to KM	Yes	4	12	2	0	0	18
	No	0	12	20	3	1	36
Total		4	24	22	3	1	54

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 50: Cross-tabulation for Relationship 6

Key findings (Table 18):

1. 57.1% of SMEs, which 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives, allocate resources to KM activities.
2. 88.9% of SMEs, which allocate resources to their KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives.
3. 55.6% of SMEs, which do not allocate resources to KM activities, 'neither agree nor disagree' that they identify knowledge to achieve strategic objectives.
4. 33.3% of SMEs, which do not allocate resources to their KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives.
5. 11.1% of SMEs, which do not allocate resources to KM activities, 'disagree' and 'strongly disagree' that they identify key knowledge to achieve their strategic objectives.

Results: Chi square Test:

			Allocate Resources To KM Activities		Total
			No	Yes	
Identify Key Knowledge	1	Count	0	4	4
		Expected Count	2.7	1.3	4.0
	2	Count	12	12	24
		Expected Count	16.0	8.0	24.0
	3	Count	20	2	22
		Expected Count	14.7	7.3	22.0
	4	Count	3	0	3
		Expected Count	2.0	1.0	3.0
	5	Count	1	0	1
		Expected Count	.7	.3	1.0
Total		Count	36	18	54
		Expected Count	36.0	18.0	54.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 51: Contingency for Relationship 6

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.818(a)	4	.001
Likelihood Ratio	22.068	4	.000
Linear-by-Linear Association	15.953	1	.000
N of Valid Cases	54		

a 6 cells (60.0%) have expected count less than 5. The minimum expected count is .33.

Table 52: Statistics for Relationship 6

	Value	Approx. Sig.
Nominal by Phi	.590	.001
Nominal Cramer's V	.590	.001
Number of valid cases	54	

Table 53: Strength of Association for Relationship 6

Key findings (Table 14, 15 & 16):

1. $\chi^2 = 18.818$; df = 4; p = 0.001 [Chi-square Test]
2. $\phi = 0.590$ [Phi-co-efficient]; Cramer's V= 0.590 [Cramer's V]

Relationship 6: KM Strategy and Continuous Mapping or Identification of Knowledge

Question 11:

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Question 14:

Our organisation continuously maps or identifies its knowledge?

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 O	2 O	3 O	4 O	5 O

Hypothesis 1: SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.

Hypothesis 2: SMEs which 'disagree' and 'strongly disagree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.

Summary Key Findings

1. 64.7% of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.
2. 87.5% of SMEs which 'disagree' and 'strongly disagree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.
3. $p < 0.05$ (0.016; Chi-square Test); $\phi = 0.478$ [Phi-co-efficient]; $V = 0.478$ [Cramer's V]

Results: Cross-tabulation:

		Continuous Mapping of Knowledge					Total
		1	2	3	4	5	
Formal KM Strategy	Yes	2	4	0	2	0	8
	No	1	10	20	12	2	45
Total		3	14	20	14	2	53

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 54: Cross-tabulation for Relationship 7

Key findings (Table 22):

1. 64.7% of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.
2. 35.3% of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, have a formal KM strategy.
3. 100.0% of SMEs, which 'neither agree nor disagree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.
4. 87.5% of SMEs which 'disagree' and 'strongly disagree' that they continuously map knowledge within their organisation, do not have a formal KM strategy.
5. 12.5% of SMEs which 'disagree' and 'strongly disagree' that they continuously map knowledge within their organisation, have a formal KM strategy.

Results: Chi square Test:

			Formal KM Strategy		Total
			No	Yes	
Continuous Mapping of Knowledge	1	Count	1	2	3
		Expected Count	2.5	.5	3.0
	2	Count	10	4	14
		Expected Count	11.9	2.1	14.0
	3	Count	20	0	20
		Expected Count	17.0	3.0	20.0
	4	Count	12	2	14
		Expected Count	11.9	2.1	14.0
	5	Count	2	0	2
		Expected Count	1.7	.3	2.0
Total		Count	45	8	53
		Expected Count	45.0	8.0	53.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 55: Contingency For Relationship 7

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.128(a)	4	.016
Likelihood Ratio	12.926	4	.012
Linear-by-Linear Association	5.187	1	.023
N of Valid Cases	53		

a 7 cells (70.0%) have expected count less than 5. The minimum expected count is .30.

Table 56: Statistics for Relationship 7

	Value	Approx. Sig.
Nominal by Phi	.478	.016
Nominal Cramer's V	.478	.016
Number of valid cases	53	

Table 57: Strength of Association for Relationship 7

Key findings (Table 23, 24 & 25):

1. $\chi^2 = 12.128$; df = 4; p = 0.016 [Chi-square Test]

2. $\phi = 0.478$ [Phi-co-efficient]; Cramer's V= 0.478 [Cramer's V]

Relationship 7: KM Activities and KM Awareness

Question 7:

Have you ever heard of knowledge management?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which implement Knowledge Development, Knowledge Acquisition, Knowledge Embodiment, Knowledge Sharing and Dissemination, Knowledge Revision and Knowledge Use activities, have heard of KM

Summary of Key Findings:

1. Knowledge Development: SMEs which have heard of KM implement 11 of the 19 Knowledge Development activities; 0 out of these 11 had $p < 0.05$.
2. Knowledge Acquisition: SMEs which have heard of KM implement 6 out of the 10 Knowledge Acquisition Activities; 1 out of these 6 had $p < 0.05$.
3. Knowledge Embodiment: SMEs which have heard of KM implement 14 out of the 17 Knowledge Embodiment Activities; 4 out of these 14 had $p < 0.05$.
4. Knowledge Sharing and Dissemination: SMEs which have heard of KM implement 16 out of the 25 Knowledge Sharing & Dissemination Activities; 2 out of these 16 had $p < 0.05$.
5. Knowledge Use and Revision: SMEs which have heard of KM implement 9 out of the 17 Knowledge Use & Revision Activities; 2 out of these 9 had $p < 0.05$.

The following tables summarises the KM activities which showed a statistically significant relationship with Question 7 for the above KM processes – see Appendix 10 for statistically insignificant findings:

KM Activity	Category	Heard of KM		Frequency	p-value
		Yes	No		
Employ specifically qualified personnel [8]	Knowledge Acquisition	16	11	27	0.02
Capture repeatable practices [3]	Knowledge Embodiment	11	6	17	0.035
Manage the product portfolio [6]	Knowledge Embodiment	17	8	25	0.001
Maintain project files [7]	Knowledge Embodiment	21	17	39	0.009
Record decisions and their evidence [13]	Knowledge Embodiment	14	6	20	0.003
Develop an innovation culture [2]	Knowledge Sharing & Dissemination	11	4	15	0.007
Mentoring [10]	Knowledge Sharing & Dissemination	7	2	9	0.045 [FET]
Project evaluations [3]	Knowledge Use & Revision	16	7	23	0.003
Supportive environment for applying ideas and knowledge [11]	Knowledge Use & Revision	14	8	22	0.035

Table 58: Summary of Findings for Relationship 7

Relationship 8: KM activities and Allocation of Resources to KM Activities

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which implement Knowledge Development, Knowledge Acquisition, Knowledge Embodiment, Knowledge Sharing and Dissemination, Knowledge Revision and Knowledge Use activities, allocate resources to KM.

Summary of Key Findings:

1. Knowledge Development: SMEs which allocate resources to KM implement 8 out of the 19 Knowledge Development Activities; 4 out of these 8 had $p < 0.05$.
2. Knowledge Acquisition: SMEs which allocate resources to KM implement 4 out of the 10 Knowledge Acquisition Activities; 0 out of these 4 had $p < 0.05$.
3. Knowledge Embodiment: SMEs which allocate resources to KM implement 6 out of the 17 Knowledge Embodiment Activities; 4 out of these 6 had $p < 0.05$.
4. Knowledge Sharing and Dissemination: SMEs which allocate resources to KM implement 9 out of the 25 Knowledge Sharing & Dissemination Activities; 4 out of these 9 had $p < 0.05$.
5. Knowledge Revision and Use: SMEs which allocate resources to KM implement 5 out of the 17 Knowledge Use & Revision Activities; 2 out of these 5 had $p < 0.05$.

The following table summarises the KM activities which showed a statistically significant relationship with Question 12 for the above KM processes – see Appendix 10 for statistically insignificant findings:

KM Activity	Category	Allocate Resources to KM		Frequency	p-value
		Yes	No		
Create organisational capabilities built around clients' needs [1]	Knowledge Development	15	19	34	0 03
R&D (in house) [3]	Knowledge Development	16	13	29	<0.001
Learn from previous project evaluations [9]	Knowledge Development	13	11	24	0 04
Develop management education and communication to help embed the value [18]	Knowledge Development	7	5	12	0 044 [FET]
Develop processes to capture intellectual capital [19]	Knowledge Development	5	2	7	0 034 [FET]
Capture repeatable practices [3]	Knowledge Embodiment	9	8	17	0 038
Knowledge Management System [12]	Knowledge Embodiment	5	2	7	0 034 [FET]
Provide an appropriate information architecture [15]	Knowledge Embodiment	5	0	5	0 003 [FET]
Maintain Customer Relationship Management processes [16]	Knowledge Embodiment	12	12	24	0 02
Share information with clients [6]	Knowledge Sharing & Dissemination	12	10	22	0 004
Internal secondment [12]	Knowledge Sharing & Dissemination	5	2	7	0 033 [FET]
Direct knowledge sharing between projects [19]	Knowledge Sharing & Dissemination	11	10	21	0 014
Provide research and information to take appropriate actions [21]	Knowledge Sharing & Dissemination	7	5	12	0 041 [FET]
Project evaluations [3]	Knowledge Use & Revision	15	7	22	<0 001
Supportive environment for applying ideas and knowledge [11]	Knowledge Use & Revision	11	11	22	0 024

Table 59: Summary of Findings for Relationship 8

Relationship 9: KM activities and Formal KM Strategy

Question 11:

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which implement Knowledge Development, Knowledge Acquisition, Knowledge Embodiment, Knowledge Sharing and Dissemination, Knowledge Revision and Knowledge Use activities, do not have a formal KM strategy

Summary of Key Findings:

1. Knowledge Development: Majority of SMEs which do not have a formal KM strategy implement 19 out of the 19 Knowledge Development Activities; 4 out of these 19 activities have $p < 0.05$.
2. Knowledge Acquisition: Majority of SMEs which do not have a formal KM strategy implement 9 out of the 10 Knowledge Acquisition Activities; 1 out of these 10 activities (Company Takeovers) was implemented with a formal Km strategy and had $p < 0.05$.
3. Knowledge Embodiment: Majority of SMEs which do not have a formal KM strategy implement 17 out of the 17 Knowledge Embodiment Activities; 7 out of these 17 activities have $p < 0.05$.
4. Knowledge Sharing and Dissemination: Majority of SMEs which do not have a formal KM strategy implement 25 out of the 25 Knowledge Sharing and Dissemination Activities; 4 out of these 25 activities have $p < 0.05$.
5. Knowledge Revision and Use: Majority of SMEs which do not have a formal KM strategy implement 17 out of the 17 Knowledge Use and Revision Activities; 2 out of these 17 activities have $p < 0.05$.

KM Activity	Category	Formal KM Strategy		Frequency	p-value
		Yes	No		
R&D (in house) [3]	Knowledge Development	7	21	28	0 033 [FET]
Develop active listening skills throughout the organisation [13]	Knowledge Development	7	13	20	0 003 [FET]
Enable distance learning [16]	Knowledge Development	4	6	10	0 031 [FET]
Develop management education and communication to help embed the value [18]	Knowledge Development	5	7	12	0 010 [FET]
Develop processes to capture intellectual capital [19]	Knowledge Development	3	3	6	0 036 [FET]
Company takeovers [5]	Knowledge Acquisition	3	3	6	0 036 [FET]
Capture repeatable practices [3]	Knowledge Embodiment	6	10	16	0 006 [FET]
Capture and share performance data [4]	Knowledge Embodiment	6	11	17	0.009 [FET]
Knowledge Management System [12]	Knowledge Embodiment	4	3	7	0 006 [FET]
Information portals [14]	Knowledge Embodiment	2	0	2	0 020 [FET]
Provide an appropriate information architecture [15]	Knowledge Embodiment	3	2	5	0 019 [FET]
Maintain Customer Relationship Management processes [16]	Knowledge Embodiment	7	18	25	0 014 [FET]
Develop location tools for internal and external expertise to help solve problems [17]	Knowledge Embodiment	4	6	10	0 031 [FET]
Share information with clients [6]	Knowledge Sharing & Dissemination	6	16	22	0 029 [FET]
Make product information easily available to employees and customers [20]	Knowledge Sharing & Dissemination	7	22	29	0 021 [FET]
Provide research and information to take appropriate actions [21]	Knowledge Sharing & Dissemination	5	7	12	0 007 [FET]
Develop processes for sharing ideas with suppliers and partners [22]	Knowledge Sharing & Dissemination	4	7	11	0 039 [FET]
Project evaluations [3]	Knowledge Use & Revision	7	15	22	0 002 [FET]
Supportive environment for applying ideas and knowledge [11]	Knowledge Use & Revision	6	15	25	0 021 [FET]

Table 60: Summary of Findings for Relationship 9

5.3.4 Section 2: Innovation

The following table provides a summary of the key findings from this section:

Theoretical Proposition - Innovation Relationships	Questionnaire Reference	Discrepany with Initial Expectation (Y/N)	Significance
Relationship 10: Systems and Processes to facilitate ideas from discovery to implementation and Innovation strategy: Majority of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to implementation, have a formal innovation strategy.	Q15 & Q17	Y	$p < 0.05$
Relationship 11: Allocation of Resources to Innovation Activities and Systems and Processes to facilitate ideas from discovery to implementation: Majority of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.	Q16 & Q17	N	$p < 0.05$
Relationship 12: Innovation Strategy and Organisational Improvements: Strategy - Majority of SMEs, which have made improvements in their corporate strategy, have a formal innovation strategy; Market - Majority of SMEs, which have significantly changed their organisation's marketing concepts or strategies, have a formal innovation strategy; Structure - Majority of SMEs, which have implemented new or significantly changed organisational structures, have a formal innovation strategy; Management - Majority of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy; Management - Majority of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy; Operations - Majority of SMEs, which have implemented new or significantly changed internal processes, have a formal innovation strategy.	Q15 & Q18	Y	See Table X
Relationship 13: Introduction of new or improved products and services and Innovation Strategy: Introduction of new or improved products or services - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME, do not have a formal innovation strategy; Introduction of new or improved products or services developed by a third party - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME (and developed by a third party), have a formal innovation strategy; Introduction of new or improved products or services developed with a third party - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME and developed with a third party, have a formal innovation strategy; Introduction of new or improved products or services developed on own - Majority of SMEs, which introduce products and/or services onto the market which are improved or new to the SME (and developed on its own), have a formal innovation strategy.	Q15 & Q19	Y	See Table X
Relationship 14: Allocation of Resources to Innovation activities and Organisational improvements: Strategy - Majority of SMEs, which implement new or significantly changed corporate strategies, allocate resources to innovation activities; Market - Majority of SMEs, which significantly change their marketing concepts or strategies, allocate resources to innovation activities; Structure - Majority of SMEs, which implement new or significantly changed organisational structures, allocate resources to innovation activities; Management - Majority of SMEs, which implement new or advanced management techniques, allocate resources to innovation activities; Operations - Majority of SMEs, which implement new or significantly changed internal processes, allocate	Q16 & Q18	N	See Table X

resources to innovation activities.			
Relationship 16: Allocation of Resources to Innovation Activities and Introduction of New or Improved Products or Services: Introduction of new or improved products or services - Majority of SMEs, which allocate resources to innovation activities, introduce products and/or services onto the market.	Q16 & Q19	N	$p < 0.05$
Relationship 18: Innovation Strategy and Allocation of Resources to Innovation Activities: Majority of SMEs, which allocate resources to innovation activities, have a formal innovation strategy.	Q15 & Q16	Y	$p < 0.05$
Relationship 19: Allocation of Resources to Innovation Activities and Innovation activities: Ideas - The majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Ideas"; Tacit Knowledge - Majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Tacit Knowledge"; Explicit Knowledge - Majority of SMEs which allocate resources to innovation implement the majority of activities associated with "Explicit Knowledge".	Q16 & Q21-Q30	Y	See Table X
Relationship 20: Innovation activities and Formal Innovation Strategy: Ideas - Majority of SMEs, which implement activities associated with "Ideas", have a formal innovation strategy; Tacit Knowledge - Majority of SMEs, which implement activities associated with "Explicit Knowledge", have a formal innovation strategy; Explicit Knowledge - Majority of SMEs, which implement activities associated with "Explicit Knowledge", have a formal innovation strategy.	Q19 & Q21-Q30	Y	See Table X

Table 61: Summary of Findings for the Key Theoretical Propositions for Innovation

The following sections present the findings for each of the key theoretical propositions above.

Relationship 10: Systems and Processes to facilitate ideas from discovery to implementation and Innovation strategy

Question 15:

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Question 17:

Please indicate, by ticking the appropriate box, how far you agree or disagree with the following statement.

Our organisation has systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 ○	2 ○	3 ○	4 ○	5 ○

Hypothesis 1: SMEs which 'strongly agree' and 'agree' that they have systems and processes to facilitate ideas from discovery to implementation have a formal innovation strategy.

Summary of Key Findings

1. 64.3% of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to implementation, do not have a formal innovation strategy.
2. $p < 0.05$ (0.010; Chi-square Test); $\phi = 0.502$ [Phi-co-efficient]; V= 0.502 [Cramer's V]

Results: Cross-tabulation:

		Systems and Process for Idea Discovery to Implementation					Total
		1	2	3	4	5	
Formal Innovation Strategy	Yes	3	7	0	0	0	10
	No	2	16	15	9	1	43
Total		5	23	15	9	1	53

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 62: Cross-tabulation for Relationship 8

Key findings (Table 26):

1. 100.0% of SMEs, which 'disagree' and 'strongly disagree' that they have systems and processes which facilitate ideas from discovery to implementation, do not have a formal innovation strategy.

2. 100.0% of SMEs, which 'neither agree nor disagree' that they have systems and processes which facilitate ideas from discovery to implementation, do not have a formal innovation strategy.
3. 64.3% of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to implementation, do not have a formal innovation strategy.
4. 35.7% of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to implementation, have a formal innovation strategy.

Results: Chi square Test:

			Systems and Process for Idea Discovery to Implementation					Total
			1	2	3	4	5	
Formal Innovation Strategy	Yes	Count	3	7	0	0	0	10
		Expected Count	.9	4.3	2.8	1.7	.2	10.0
	No	Count	2	16	15	9	1	43
		Expected Count	4.1	18.7	12.2	7.3	.8	43.0
Total		Count	5	23	15	9	1	53
		Expected Count	5.0	23.0	15.0	9.0	1.0	53.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 63: Contingency for Relationship 8

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.350(a)	4	.010
Likelihood Ratio	16.339	4	.003
Linear-by-Linear Association	10.709	1	.001
N of Valid Cases	53		

a 7 cells (70.0%) have expected count less than 5. The minimum expected count is .19.

Table 64: Statistics for Relationship 8

	Value	Approx. Sig.
Nominal by Phi	.502	.010
Nominal Cramer's V	.502	.010
Number of valid cases	53	

Table 65: Strength of Association for Relationship 8

Key findings (Table 23, 24 & 25):

1. $\chi^2 = 13.350$; df = 4; p = 0.010 [Chi-square Test]

2. $\phi = 0.502$ [Phi-co-efficient]; Cramer's V= 0.502 [Cramer's V]

Relationship 11: Allocation of Resources to Innovation Activities and Systems and Processes to facilitate ideas from discovery to implementation

Question 16:

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Question 17:

Please indicate, by ticking the appropriate box, how far you agree or disagree with the following statement.

Our organisation has systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 ○	2 ○	3 ○	4 ○	5 ○

Hypothesis 1: SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.

Summary of Key Findings

1. 85.7% of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.
2. $p < 0.001$ [Chi-square Test]; $\phi = 0.644$ [Phi-co-efficient]; $V = 0.644$ [Cramer's V]

Results: Cross-tabulation:

		Systems and Process for Idea Discovery to Implementation					Total
		1	2	3	4	5	
Allocate Resources to Innovation	Yes	5	19	3	3	0	30
	No	0	4	12	7	1	24
Total		5	23	15	10	1	54

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 66: Cross-tabulation for Relationship 9

Key findings (Table 30):

1. 27.3% of SMEs, which 'strongly disagree' and 'disagree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.

2. 72.7% of SMEs, which 'strongly disagree' and 'disagree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, do not allocate resources to innovation activities.

3. 85.7% of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities.

4. 14.3% of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, do not allocate resources to innovation activities.

5. 80.0% of SMEs, which allocate resources to innovation activities, 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation.

6. 10.0% of SMEs, which allocate resources to innovation activities, 'neither agree nor disagree' that they have systems and processes in place to facilitate idea generation to application.

7. 10.0% of SMEs, which allocate resources to innovation activities, 'disagree' that they have systems and processes in place to facilitate idea generation to application.

8. 50.0% of SMEs, which do not allocate resources to innovation activities, 'neither agree nor disagree' that they have systems and processes in place to facilitate idea generation to application.

9. 33.3% of SMEs, which do not allocate resources to innovation activities, 'disagree' [and 'strongly disagree' in one case] that they systems and processes in place to facilitate idea generation to application.

10. 16.7% of SMEs, which don't allocate resources to innovation activities, 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation.

Results: Chi square Test:

			Allocate Resources To Innovation Activities		Total
			Yes	No	
Systems and Process for Idea Discovery to Implementation	1	Count	5	0	5
		Expected Count	2.8	2.2	5.0
	2	Count	19	4	23
		Expected Count	12.8	10.2	23.0
	3	Count	3	12	15
		Expected Count	8.3	6.7	15.0
	4	Count	3	7	10
		Expected Count	5.6	4.4	10.0
	5	Count	0	1	1
		Expected Count	.6	.4	1.0
Total		Count	30	24	54
		Expected Count	30.0	24.0	54.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 67: Contingency for Relationship 9

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.392(a)	4	.000
Likelihood Ratio	25.709	4	.000
Linear-by-Linear Association	16.723	1	.000
N of Valid Cases	54		

a 5 cells (50.0%) have expected count less than 5. The minimum expected count is .44.

Table 68: Statistics for Relationship 9

	Value	Approx. Sig.
Nominal by Phi	.644	.000
Nominal Cramer's V	.644	.000
Number of valid cases	54	

Table 69: Strenfth of Association for Relationship 9

Key findings (Table 23, 24 & 25):

1. $\chi^2 = 22.392$; df = 4; p <0.0001 [Chi-square Test]
2. $\phi = 0.644$ [Phi-co-efficient]; Cramer's V= 0.644 [Cramer's V]

Relationship 12: Innovation Strategy and Organisational Improvements

Question 15:

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Question 18:

Please indicate, by ticking any of the appropriate boxes, if your organisation has undertaken any improvements in the following areas?

Strategy:

Implementation of new or significantly changed corporate strategies ☐ 1

Market:

Changing significantly your organisation's marketing concepts or strategies ☐ 2

Structure:

Implementation of new or significantly changed organisational structures ☐ 3

Management:

Implementation of new advanced management techniques ☐ 4

Operations:

Implementation of new or significantly changed internal processes ☐ 5

Hypothesis 1: SMEs which have implemented new or significantly improved corporate strategies have a formal innovation strategy.

Hypothesis 2: SMEs have significantly changed their marketing concepts or strategies have a formal innovation strategy.

Hypothesis 3: SMEs which have implemented new or significantly changed organisational structures have a formal innovation strategy.

Hypothesis 4: SMEs have implemented new advanced management techniques have a formal innovation strategy.

Hypothesis 5: SMEs have implemented new or significantly changed internal processes have a formal innovation strategy.

Summary of Key Findings

Strategy:

1. 73.3% of SMEs, which have made improvements in their corporate strategy, do not have a formal innovation strategy.
2. $p > 0.05$ (0.083; FET)

Market

1. 75.0% of SMEs, which have significantly changed their organisation's marketing concepts or strategies, do not have a formal innovation strategy.

2. p >0.05 (0.081; FET)

Structure

1. 87.0% of SMEs, which have implemented new or significantly changed organisational structures, do not have a formal innovation strategy.

2. p >0.05 (0.299; FET)

Management

1. 57.1% of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy.

2. p <0.05 (0.017; FET)

Operations

1. 73.3% of SMEs, which have implemented new or significantly changed internal processes, do not have a formal innovation strategy.

2. p > 0.05 (0.083; FET)

Results: Cross-tabulation

Management

		Improvements in Management		Total
		Yes	No	
Formal Innovation Strategy	Yes	4	6	10
	No	3	41	44
Total		7	47	54

Table 70: Cross-tabulation for Relationship 10 (Hypothesis 3)

Key findings (Table 37):

1. 57.1% of SMEs, which have implemented new advanced management techniques, have a formal innovation strategy.

2. 42.9% of SMEs, which have implemented new advanced management techniques, do not have a formal innovation strategy.

Results: FET:

Management

			Choice		Total
			Management (1)	Management (2)	
Group	Q15 (1)	Count	4	6	10
		Expected Count	1.3	8.7	10.0
	Q15 (2)	Count	3	41	44
		Expected Count	5.7	38.3	44.0
Total		Count	7	47	54
		Expected Count	7.0	47.0	54.0

1 = Yes; 2 = No

Table 71: Contingency for Relationship 10 (Hypothesis 4)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.952(b)	1	.005		
Continuity Correction(a)	5.282	1	.022		
Likelihood Ratio	6.289	1	.012		
Fisher's Exact Test				.017	.017
Linear-by-Linear Association	7.804	1	.005		
N of Valid Cases	54				

Table 72: Statistics for Relationship 10 (Hypothesis 4)

Key findings (Table 45 & 46):

1. $p<0.05$ (0.017; FET)

Relationship 13: Innovation Strategy and Introduction of new or improved products and services

Question 15:

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Question 19:

Has your organisation introduced products and /or services onto the market, which were improved or new to your organisation?

1 ☐ Yes 2 ☐ No

If yes, please tick the appropriate box below:

Developed mainly by a third party	☐	1
Developed together with a third party	☐	2
Developed mainly by your own organisation	☐	3

Hypothesis 1: SMEs which have introduced new or improved products and services have a formal innovation strategy

Hypothesis 2: SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation, developed by a third party, have a formal innovation strategy.

Hypothesis 3: SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation, together with a third party, have a formal innovation strategy.

Hypothesis 4: SMEs which have introduced products and /or services onto the market which were improved or new to your organisation, developed on own, have a formal innovation strategy.

Summary of Key Findings

Introduction of Innovation:

1. 77.8% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation, do not have a formal innovation strategy.
2. $p > 0.05$ (0.133; FET)

Innovation developed mainly by a third party:

1. 88.9% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (developed by a third party), do not have a formal innovation strategy.
2. $p > 0.05$ (0.467; FET)

Innovation developed together with a third party:

1. 90.0% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (together with a third party), do not have a formal innovation strategy.

2. p >0.05 (0.339; FET)

Innovation developed on own:

1. 68.9% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (developed on own), do not have a formal innovation strategy.

2. p <0.05 (0.008; FET).

Results: Cross-tabulation:

Innovation developed on own:

		Developed by own organisation		Total
		Yes	No	
Formal Innovation Strategy	Yes	9	1	10
	No	19	25	44
Total		28	26	54

Table 73: Cross-tabulation for Relationship 11 (Hypothesis 2)

Key findings (Table 52):

1. 68.9% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (developed on own), do not have a formal innovation strategy.

2. 32.1% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (developed on own), have a formal innovation strategy.

Results: Chi square Test & FET:

Innovation developed on own:

			Choice		Total
			Developed by own (Yes)	Developed by own (No)	
Group	Q15 (1)	Count	9	1	10
		Expected Count	5.2	4.8	10.0
	Q15 (2)	Count	19	25	44
		Expected Count	22.8	21.2	44.0
Total		Count	28	26	54
		Expected Count	28.0	26.0	54.0

Table 74: Contingency for Relationship 11 (Hypothesis 3)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.154(b)	1	.007		
Continuity Correction(a)	5.402	1	.020		
Likelihood Ratio	8.108	1	.004		
Fisher's Exact Test				.012	.008
Linear-by-Linear Association	7.021	1	.008		
N of Valid Cases	54				

Table 75: Statistics for Relationship 11 (Hypothesis 3)

Key findings (Tables 59 & 60):

1. $p < 0.05$ (0.008; FET).

Relationship 14: Allocation of Resources to Innovation activities and Organisational improvements

Question 16:

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Question 18:

Please indicate, by ticking any of the appropriate boxes, if your organisation has undertaken any improvements in the following areas?

Strategy:

Implementation of new or significantly changed corporate strategies ☐ 1

Market:

Changing significantly your organisation's marketing concepts or strategies ☐ 2

Structure:

Implementation of new or significantly changed organisational structures ☐ 3

Management:

Implementation of new advanced management techniques ☐ 4

Operations:

Implementation of new or significantly changed internal processes ☐ 5

Hypothesis 1: SMEs which have implemented new or significantly changed corporate strategies allocate resources to innovation activities.

Hypothesis 2: SMEs which have significantly changed their marketing concepts or strategies allocate resources to innovation activities.

Hypothesis 3: SMEs which have implemented new or significantly changed organisational structures, allocate resources to innovation activities.

Hypothesis 4: SMEs which have implemented new or advanced management techniques allocate resources to innovation activities.

Hypothesis 4: SMEs which implement new or significantly changed internal processes allocate resources to innovation activities.

Summary of Key Findings

Strategy:

1. 66.7% of SMEs, which have implemented new or significantly changed corporate strategies, allocate resources to innovation activities.
2. $p < 0.05$ (0.048; Chi-square Test); $\phi = 0.267$ [Phi-co-efficient]

Market

1. 64.9% of SMEs, which have significantly changed their marketing concepts or strategies, allocate resources to innovation activities.

2. $p < 0.05$ (0.028; Chi-square Test); $\phi = 0.297$ [Phi-co-efficient]

Structure

1. 58.3% of SMEs, which have implemented new or significantly changed organisational structures, allocate resources to innovation activities.

2. $p > 0.05$ (0.620; Chi-square Test)

Management

1. 75.0% of SMEs, which implement new or advanced management techniques. allocate resources to innovation activities.

2. $p > 0.05$ (0.193; FET)

Operations

1. 63.3% of SMEs, which implement new or significantly changed internal processes, allocate resources to innovation activities.

2. $p > 0.05$ (0.152; Chi-square Test); $\phi = 0.193$ [Phi-co-efficient]

Results: Cross-tabulation:

Strategy:

		Strategy		Total
		Yes	No	
Allocate Resources to Innovation	Yes	20	10	30
	No	10	15	25
Total		30	25	55

Table 76: Cross-tabulation for Relationship 13 (Hypothesis 1)

Key findings (Tables 73):

1. 66.7% of SMEs, which have implemented new or significantly changed corporate strategies, allocate resources to innovation activities.

2. 33.3% of SMEs, which have implemented new or significantly changed corporate strategies, do not allocate resources to innovation activities.

Market

		Market		Total
		Yes	No	
Allocate Resources to Innovation	Yes	24	6	30
	No	13	12	25
Total		37	18	55

Table 77: Cross-tabulation for Relationship 13 (Hypothesis 2)

Key findings (Tables 74):

1. 64.9% of SMEs, which have significantly changed their marketing concepts or strategies, allocate resources to innovation activities.
2. 35.1% of SMEs, which have significantly changed their marketing concepts or strategies, do not allocate resources to innovation activities.

Chi square Test & FET:

Strategy:

Tables 78, 79 and 80 show the chi-square results for Q16 & Q18B1:

			Choice		Total
			Strategy (1)	Strategy (2)	
Group	Q16 (1)	Count	20	10	30
		Expected Count	16.4	13.6	30.0
	Q16 (2)	Count	10	15	25
		Expected Count	13.6	11.4	25.0
Total		Count	30	25	55
		Expected Count	30.0	25.0	55.0

1 = Yes; 2 = No

Table 78: Contingency for Relationship 13 (Hypothesis 1)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.911(b)	1	.048		
Continuity Correction(a)	2.910	1	.088		
Likelihood Ratio	3.950	1	.047		
Fisher's Exact Test				.061	.044
Linear-by-Linear Association	3.840	1	.050		
N of Valid Cases	55				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.36.

Table 79: Statistics for Relationship 12 (Hypothesis 1)

	Value	Approx. Sig.
Nominal by Phi	.267	.048
Nominal Cramer's V	.267	.048
Number of valid cases	55	

Table 80: Strength of Association for Relationship 13

Key findings (Tables 78, 79 & 80):

1. $\chi^2 = 3.911$; df = 1; p = 0.048 [Chi-square Test]

2. $\phi = 0.267$ [Phi-co-efficient]; V= 0.267 [Cramer's V]

Market

			Choice		Total
			Market (1)	Market (2)	
Group	Q16 (1)	Count	24	6	30
		Expected Count	20.2	9.8	30.0
	Q16 (2)	Count	13	12	25
		Expected Count	16.8	8.2	25.0
Total		Count	37	18	55
		Expected Count	37.0	18.0	55.0

Table 81: Contingency table for Relationship 13 (hypothesis 2)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.856(b)	1	.028		
Continuity Correction(a)	3.667	1	.055		
Likelihood Ratio	4.904	1	.027		
Fisher's Exact Test				.043	.028
Linear-by-Linear Association	4.768	1	.029		
N of Valid Cases	55				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.18.

Table 82: Statistics for Relationship 13

	Value	Approx. Sig.
Nominal by Phi	.297	.028
Nominal Cramer's V	.297	.028
Number of valid cases	55	

Table 83: Strength of Association for Relationship 12

Key findings (Tables 78, 79 & 80):

1. $\chi^2 = 4.856$; df = 1; p = 0.028 [Chi-square Test]

2. $\phi = 0.297$ [Phi-co-efficient]; V= 0.297 [Cramer's V]

Relationship 16: Allocation of Resources to Innovation Activities and Introduction of New or Improved Products or Services

Question 16:

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Question 19:

Has your organisation introduced products and /or services onto the market, which were improved or new to your organisation?

1 ☐ Yes 2 ☐ No

If yes, please tick the appropriate box below:

Developed mainly by a third party	☐	1
Developed together with a third party	☐	2
Developed mainly by your own organisation	☐	3

Hypothesis 1: SMEs which allocate resources to innovation activities, have introduced products and /or services onto the market, which were improved or new to your organisation.

Hypothesis 2: SMEs which allocate resources to innovation activities, have introduced products and /or services onto the market, not developed by a third party.

Hypothesis 3: SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market which were improved or new to your organisation, not developed with a third party.

Hypothesis 4: SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market which were improved or new to your organisation, developed on their own.

Summary of Key Findings

Introduction of Innovation:

1. 93.3% of SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market, which were improved or new to your organisation.
2. $p < 0.05$ (0.018; FET)

Developed by a Third Party:

1. 90.0% of SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market, not developed by a third party.

2. p >0.05 (0.151; FET)

Developed together with a Third party:

1. 78.8% of SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market which were improved or new to your organisation, not developed with a third party.

2. p >0.05 (0.540; FET)

Developed on own:

1. 66.7% of SMEs, which allocate resources to innovation activities, have introduced products and /or services onto the market which were improved or new to your organisation, developed on their own.

2. p <0.05 (0.009; FET)

Results: Cross-tabulation:

Introduction of Innovation:

		Q19		Total
		Yes	No	
Allocate Resources to Innovation	Yes	28	2	30
	No	17	8	25
Total		45	10	55

Table 84: Cross-tabulation for Relationship 14 (Hypothesis 1)

Key findings (Table 93):

1. 62.2% of SMEs, which have introduced products and /or services onto the market, which were improved or new to your organisation, allocate resources to innovation activities.

2. 37.8% of SMEs, which have introduced products and /or services onto the market, which were improved or new to your organisation, do not allocate resources to innovation activities.

Innovation developed on own:

		Developed mainly by own organisation		Total
		Yes	No	
Allocate Resources to Innovation	Yes	22	11	33
	No	8	17	25
Total		30	28	58

Table 85: Cross-tabulation for Relationship 14 (Hypothesis 3)

Key findings (Table 96):

1. 73.3% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation (developed on their own), allocate resources to innovation activities.
2. 26.7% of SMEs, which have introduced products and /or services onto the market which were improved or new to your organisation, developed on their own, do not allocate resources to innovation activities.

Results: Chi square Test & FET:

Introduction of Innovation:

			Choice		Total
			Q19 (1)	Q19 (2)	
Group	Q16 (1)	Count	28	2	30
		Expected Count	24.5	5.5	30.0
	Q16 (2)	Count	17	8	25
		Expected Count	20.5	4.5	25.0
Total		Count	45	10	55
		Expected Count	45.0	10.0	55.0

1 = Yes; 2 = No

Table 86: Contingency table for Relationship 14 (Hypothesis 1)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.883(b)	1	.015		
Continuity Correction(a)	4.303	1	.038		
Likelihood Ratio	6.116	1	.013		
Fisher's Exact Test				.032	.018
Linear-by-Linear Association	5.776	1	.016		
N of Valid Cases	55				

a Computed only for a 2x2 table

b 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.55.

Table 87: Statistics for Relationship 14 (Hypothesis 3)

Key findings (Table 97 & 98):

1. p = 0.018 [FET]

Innovation developed on own:

			Choice		Total
			Developed mainly by own organisation (Yes)	Developed mainly by own organisation (No)	
Group	Q16 (1)	Count	22	11	33
		Expected Count	17.1	15.9	33.0
	Q16 (2)	Count	8	17	25
		Expected Count	12.9	12.1	25.0
Total		Count	30	28	58
		Expected Count	30.0	28.0	58.0

1 = Yes; 2 = No

Table 88: Contingency table for Relationship 14

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.846(b)	1	.009		
Continuity Correction(a)	5.528	1	.019		
Likelihood Ratio	6.983	1	.008		
Fisher's Exact Test				.016	.009
Linear-by-Linear Association	6.728	1	.009		
N of Valid Cases	58				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.07.

Table 89: Statistics for Relationship 14

	Value	Approx. Sig.
Nominal by Phi	.344	.009
Nominal Cramer's V	.344	.009
Number of valid cases	58	

Table 90:Strength of Association for Relatiop 14

Key findings (Table 104, 105 & 106):

1. $\chi^2 = 6.846$; df = 1; p = 0.009 [Chi-square Test]
2. $\phi = 0.344$ [Phi-co-efficient]; V= 0.344 [Cramer's V]

Relationship 18: Innovation Strategy and Allocation of Resources to Innovation Activities

Question 15:

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Question 16:

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which allocate resources to innovation activities have a formal innovation strategy.

Summary of Key Findings

1. 66.7% of SMEs, which allocate resources to innovation activities, do not have a formal innovation strategy.
2. p = 0.001 [FET]

Results: Cross-tabulation:

		Allocate Resources to Innovation		Total
		Yes	No	
Formal Innovation Strategy	Yes	10	0	10
	No	20	24	44
Total		30	24	54

Table 91: Cross-tabulation for Relationship 16

Key findings - Table 121:

1. 66.7% of SMEs, which allocate resources to innovation activities, do not have a formal innovation strategy.
2. 33.3% of SMEs, which allocate resources to innovation activities, have a formal innovation strategy.

Results: FET:

			Choice		Total
			Q16 (1)	Q16 (2)	
Group	Q15 (1)	Count	10	0	10
		Expected Count	5.6	4.4	10.0
	Q15 (2)	Count	20	24	44
		Expected Count	24.4	19.6	44.0
Total		Count	30	24	54
		Expected Count	30.0	24.0	54.0

1 = Yes; 2 = No

Table 92: Contingency for Relationship 16

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	9.818	1	.002		
Continuity Correction(a)	7.733	1	.005		
Likelihood Ratio	13.559	1	.000		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	9.636	1	.002		
N of Valid Cases	54				

Table 93: Statistics for Relationship 16

Key findings - Table 122 & 123:

1. p = 0.001 [FET]

Relationship 19: Innovation activities and Allocation of Resources to Innovation Activities

Hypothesis: SMEs which implement Idea, Tacit Knowledge, and Explicit Knowledge activities allocate resources to innovation

Summary of Key Findings:

1. Idea activities: Majority of SMEs which allocate resources to innovation implement 10 out of the 11 Idea Activities; 3 out of these 10 activities have $p < 0.05$.
2. Tacit Knowledge: Majority of SMEs which allocate resources to innovation implement 10 out of the 11 'Tacit Knowledge' Activities; 0 out of these 9 activities have $p < 0.05$.
3. Explicit Knowledge: Majority of SMEs which allocate resources to innovation implement all 'Explicit Knowledge' Activities; 1 out of these 13 activities have $p < 0.05$.

The following table summarises the KM activities which showed a statistically significant relationship with Question 12 for the above KM processes – see Appendix 10 for statistically insignificant findings:

Innovation Activity	Category	Allocate resources to Innovation Activities		Frequency	p-value
		Yes	No		
Stimulate and reward new product ideas [3]	Ideas	10	1	11	0.007
Organise processes for idea application [6]	Ideas	9	2	11	0.042
Develop an innovation culture [7]	Ideas	15	0	15	<0.001
Share information with clients [7]	Explicit Knowledge	17	6	23	0.026

Table 94: Summary of Findings for Relationship 19

Relationship 20: Innovation activities and Formal Innovation Strategy

Hypothesis: SMEs which implement Idea, Tacit Knowledge and Explicit Knowledge activities have a formal innovation strategy

Summary of Key Findings:

1. Idea activities: SMEs, which implement 10/11 activities associated with "Ideas", do not have a formal innovation strategy; 1 out of these 11 'Idea' Activities was implemented with a formal innovation strategy; this 1 activity has $p < 0.05$ (innovative culture' [7]).
2. Tacit Knowledge activities: SMEs implement all (11/11) activities associated with "Tacit Knowledge" without a formal innovation strategy.
3. Explicit Knowledge: SMEs which implement 14 out of the 14 activities associated with "Explicit Knowledge" do not have a formal innovation strategy; 0 out of these 14 activities have $p < 0.05$.

The following table summarises the KM activities which showed a statistically significant relationship with Question 12 for the above KM processes – see Appendix 10 for statistically insignificant findings:

Innovation Activity	Category	Formal innovation strategy		Frequency	p-value
		Yes	No		
Develop an innovation culture [7]	Ideas	8	7	15	<0.001 [FET]
Enable flexible solutions rather than off-the-shelf products [8]	Tacit Knowledge	2	26	28	0.024 [FET]

Table 95: Summary of Findings for Relationship 20

5.3.5 Section 3: Knowledge Management & Innovation

The following table provides a summary of the key findings from this section:

Theoretical Proposition - KM & Innovation Relationships	Questionnaire Reference	Discrepany with Initial Expectation (Y/N)	Significance
Relationship 21: KM Strategy and Innovation Strategy: Majority of SMEs, which have a formal KM strategy, have a formal innovation strategy.	Q11 & Q15	Y	$p < 0.05$
Relationship 22: Allocation of resources to KM activities and Allocation of resources to innovation activities: Majority of SMEs, which allocate resources to knowledge management activities, allocate resources to innovation activities.	Q12 & Q16	N	$p < 0.05$
Relationship 23: Allocation of Resources to KM Activities and Systems and processes to facilitate ideas from discovery to implementation: Majority of SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.	Q12 & Q17	N	$p < 0.05$
Relationship 24: Allocation of resources to KM activities and Organisational improvements: Strategy - Majority of SMEs, which implement new or significantly changed corporate strategies, do not allocate resources to KM activities; Marketing - Majority of SMEs, which significantly change their marketing concepts or strategies, allocate resources to KM activities; Structure - Majority of SMEs, which implement new or significantly changed organisational structures, do not allocate resources to KM activities; Management - Majority of SMEs, which implement new advanced management techniques, allocate resources to KM activities; Operations - Majority of SMEs, which implement new or significantly changed internal processes, allocate resources to KM activities.	Q12 & Q18	Y	See Table X

Table 96: Summary of Findings for the Key Theoretical Propositions for KM & Innovation

The following sections present the findings for each of the key theoretical propositions above.

Relationship 21: KM Strategy and Innovation Strategy

Question 11:

Does your organisation have a formal knowledge management strategy?

1 ☐ Yes 2 ☐ No

Question 15:

Does your organisation have a formal innovation strategy?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which a formal KM strategy also implement a formal innovation strategy

Summary of Key Findings

1. 50.0% of SMEs, which have a formal KM strategy, have a formal innovation strategy.
2. $p < 0.05$ (0.021; FET)

Results: Cross-tabulation:

		Formal Innovation Strategy		Total
		Yes	No	
Formal KM Strategy	Yes	4	4	8
	No	5	40	45
Total		9	44	53

Table 97: Cross-tabulation for Relationship 19

Key findings - Table 124:

1. 50.0% of SMEs, which have a formal KM strategy, have a formal innovation strategy.
2. 50.0% of SMEs, which have a formal KM strategy, do not have a formal innovation strategy.

Results: FET:

			Choice		Total
			Q15 (1)	Q15 (2)	
Group	Q11 (1)	Count	4	4	8
		Expected Count	1.4	6.6	8.0
	Q11 (2)	Count	5	40	45
		Expected Count	7.6	37.4	45.0
Total		Count	9	44	53
		Expected Count	9.0	44.0	53.0

Table 98: Contingency for Relationship 19

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.287(b)	1	.007		
Continuity Correction(a)	4.789	1	.029		
Likelihood Ratio	5.807	1	.016		
Fisher's Exact Test				.021	.021
Linear-by-Linear Association	7.149	1	.007		
N of Valid Cases	53				

Table 99: Statistics for Relationship 19

Key findings - Tables 125 & 126)

1. p <0.05 (0.021; FET)

Relationship 22: Allocation of resources to KM activities and Allocation of resources to innovation activities

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Question 16:

Has your organisation allocated resources to its innovation activities?

1 ☐ Yes 2 ☐ No

Hypothesis: SMEs which allocate resources to KM activities also allocate resources to innovation activities

Summary of Key Findings

1. 83.3% of SMEs, which allocate resources to knowledge management activities, allocate resources to innovation activities.
2. $p < 0.05$ (0.004; FET)

Results: Cross-tabulation:

		Allocate Resources to Innovation		Total
		Yes	No	
Allocate resources to KM	Yes	15	3	18
	No	15	21	36
Total		30	24	54

Table 100: Cross-tabulation for Relationship 20

Key findings - Table 127:

1. 83.3% of SMEs, which allocate resources to knowledge management activities, allocate resources to innovation activities.
2. 16.7% of SMEs, which allocate resources to knowledge management activities, do not allocate resources to innovation activities.

Results: FET:

			Choice		Total
			Q16 (1)	Q16 (2)	
Group	Q12 (1)	Count	15	3	18
		Expected Count	10.0	8.0	18.0
	Q12 (2)	Count	15	21	36
		Expected Count	20.0	16.0	36.0
Total		Count	30	24	54
		Expected Count	30.0	24.0	54.0

Table 101: Contingency table for Relationship 20

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.438(b)	1	.004		
Continuity Correction(a)	6.834	1	.009		
Likelihood Ratio	9.070	1	.003		
Fisher's Exact Test				.004	.004
Linear-by-Linear Association	8.281	1	.004		
N of Valid Cases	54				

Table 102: Statistics for Relationship 20

Key findings (tables 128 & 129)

1. p = 0.004 [FET].

Relationship 23: Allocation of Resources to KM Activities and Systems and processes to facilitate ideas from discovery to implementation

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Question 17:

Please indicate, by ticking the appropriate box, how far you agree or disagree with the following statement.

Our organisation has systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
1 O	2 O	3 O	4 O	5 O

Hypothesis: SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Summary of Key Findings

1. 100.0% of SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.
2. $p < 0.001$

Results: Cross-tabulation:

		Q17					Total
		1	2	3	4	5	
Allocate Resources to KM	Yes	4	13	0	0	0	17
	No	1	10	15	9	1	36
Total		5	23	15	9	1	53

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 103: Cross-tabulation for Relationship 21

Key findings (Table 130):

1. 100.0% of SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

2. 41.7% of SMEs, which do not allocate resources to KM activities, 'neither agree nor disagree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

3. 30.6% of SMEs, which do not allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

4. 27.8% of SMEs, which do not allocate resources to KM activities, 'disagree' and 'strongly disagree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea.

Results: FET:

			Allocate Resources KM		Total
			Yes	No	
Ideas To Market	1	Count	4	1	5
		Expected Count	1.6	3.4	5.0
	2	Count	13	10	23
		Expected Count	7.4	15.6	23.0
	3	Count	0	15	15
		Expected Count	4.8	10.2	15.0
	4	Count	0	9	9
		Expected Count	2.9	6.1	9.0
	5	Count	0	1	1
		Expected Count	.3	.7	1.0
Total		Count	17	36	53
		Expected Count	17.0	36.0	53.0

1 = Strongly Agree; 2 = Agree; 3 = Unsure; 4 = Disagree; 5 = Strongly Disagree

Table 104 Contingency for Relationship 21

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.385(a)	4	.000
Likelihood Ratio	30.012	4	.000
Linear-by-Linear Association	18.681	1	.000
N of Valid Cases	53		

a 6 cells (60.0%) have expected count less than 5. The minimum expected count is .32.

Table 105: Statistics for Relationship 21

Key findings (Tables 131 & 132):

1. p <0.001 [FET]

Relationship 24: Allocation of resources to KM activities and Organisational improvements

Question 12:

Has your organisation allocated resources to its knowledge management activities?

1 ☐ Yes 2 ☐ No

Question 18:

Please indicate, by ticking any of the appropriate boxes, if your organisation has undertaken any improvements in the following areas?

Strategy:

Implementation of new or significantly changed corporate strategies ☐ 1

Market:

Changing significantly your organisation's marketing concepts or strategies ☐ 2

Structure:

Implementation of new or significantly changed organisational structures ☐ 3

Management:

Implementation of new advanced management techniques ☐ 4

Operations:

Implementation of new or significantly changed internal processes ☐ 5

Hypothesis 1: SMEs, which have implemented new or significantly changed corporate strategies, do not allocate resources to KM activities.

Hypothesis 2: SMEs, which have significantly changed their marketing concepts or strategies, allocate resources to KM activities.

Hypothesis 3: SMEs, which have implemented new or significantly changed organisational structures, do not allocate resources to KM activities.

Hypothesis 4: SMEs, which have implemented new advanced management techniques, allocate resources to KM activities.

Hypothesis 5: SMEs, which implemented new or significantly changed internal processes, do not allocate resources to KM activities.

Summary of Key Findings

Strategy:

1. 51.7% of SMEs, which have implemented new or significantly changed corporate strategies, do not allocate resources to KM activities.
2. $p < 0.05$ (0.0121; FET)

Market:

1. 63.9% of SMEs, which have significantly changed their marketing concepts or strategies, allocate resources to KM activities.
2. p >0.05 (0.384; FET)

Structure:

1. 56.5% of SMEs, which have implemented new or significantly changed organisational structures, do not allocate resources to KM activities.
2. p >0.05 (0.142; FET)

Management:

1. 57.1% of SMEs, which have implemented new advanced management techniques, allocated resources to KM activities.
2. p >0.05 (0.158; FET)

Operations:

1. 63.3% of SMEs, which implemented new or significantly changed internal processes, do not allocate resources to KM activities.
2. p >0.05 (0.387; FET)

Results: Cross-tabulations:

Strategy:

		Strategy		Total
		Yes	No	
Allocate Resources to KM	Yes	14	4	18
	No	15	21	36
Total		29	25	54

Table 106: Cross-tabulation for Relationship 22

Key findings (Table 133):

1. 48.3% of SMEs, which have implemented new or significantly changed corporate strategies, allocate resources to KM activities.
2. 51.7% of SMEs, which have implemented new or significantly changed corporate strategies, do not allocate resources to KM activities.

Results: Chi-square & FET:

Strategy:

			Choice		Total
			Strategy (1)	Strategy (2)	
Group	Q12 (1)	Count	14	4	18
		Expected Count	9.7	8.3	18.0
	Q12 (2)	Count	15	21	36
		Expected Count	19.3	16.7	36.0
Total		Count	29	25	54
		Expected Count	29.0	25.0	54.0

Table 107: Contingency for Relationship 22

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.294(b)	1	.012		
Continuity Correction(a)	4.925	1	.026		
Likelihood Ratio	6.592	1	.010		
Fisher's Exact Test				.020	.012
Linear-by-Linear Association	6.177	1	.013		
N of Valid Cases	54				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.33.

Table 108: Statistics for Relationship 22

		Value	Approx. Sig.
Nominal by Nominal	Phi	.341	.012
	Cramer's V	.341	.012
N of Valid Cases		54	

a Not assuming the null hypothesis.

b Using the asymptotic standard error assuming the null hypothesis.

Table 109: Strength of Association for Relationship 22

Key findings (Tables 138-140):

1. $\chi^2 = 6.294$; df = 1; p = 0.012 [Chi-square Test]

2. $\phi = 0.341$ [Phi-co-efficient]; V= 0.341 [Cramer's V]

Chapter 6: Discussion Summary

6.1 Introduction

Several researchers have emphasised the pivotal role of the management of knowledge, particularly in creating an internal working environment that supports creativity and fosters innovation This chapter explores the literature to elicit information and studies conducted in relation to KM and Innovation, more specifically with regards to how these two concepts are related in organisations.

In order to respond to the research question and the different concerns raised in the literature review, two theoretical models were devised: the Innovation Model; and the Knowledge Management for Organisational Learning (KMOL) Cycle. These models were then merged to form the Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle. This chapter discusses the aforementioned models in the following sections:

The first section discusses the importance of knowledge in the process of innovation. The second section proposes the 'Innovation Model' and discusses its components. The third section proposes the 'Knowledge Management for Organisational Learning (KMOL) Cycle' and discusses its components namely the KM and Organisational Learning components. Finally, the third section proposes the 'Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle' and discusses how it was merged.

Furthermore, the key findings and discussion points from the previous chapter to inform the conclusions and future work. In all cases further exploration is required to verify and further qualify these initial interpretations. The summaries are divided into three areas related to each of the research objectives.

6.2 KM and Innovation

6.2.1 Knowledge essential for Innovation

Several researchers have emphasised the pivotal role of the management of knowledge, particularly in creating an internal working environment that supports creativity and fosters innovation (Amabile et al., 1996; Carnegie and Butlin, 1993; Soderquist et al., 1997; Brand, 1998; Madhavan and Grover,

1998; Johannessen et el., 1999; Carneiro, 2000). As discussed in Section 4 (Innovation) a growing body of literature has attempted to understand innovation but the literature shows definite gaps in the investigation of the relationships between KM processes and innovation (Gloet and Terziovski, 2004). Furthermore, Darroch and McNaughton (2002) argue the need to offer managers more direction to identify, manage and develop intangible assets such as knowledge in order to enhance firm value. In addition, as far as the author is aware, there is scant literature conducted in the SME setting.

Knowledge for innovation comes from a variety of sources rather than from a single knowledge base, it is transferred in a variety of ways, and transfer is complicated, interactive process involving the exchange of information rather than just its one-way flow from those who know to those who know not (Swan et al., 1999; Macdonald et al., 2001). Innovation can, therefore, be broadly described as the use of knowledge for both discoveries and inventions and the process by which new outcomes, whether products, systems or processes, come into being (Williams, 1999). Furthermore, Nonaka and Takeuchi (1995) argue that it is natural to assume that the process of innovation depend heavily on knowledge, particularly since knowledge represents a realm far deeper than simply that of data, information and conventional logic; indeed, the power of knowledge lies in subjectivity, underlying values and assumptions that underpin the learning process. Consequently, given the nature of knowledge for innovation, this poses new challenges for firms in pursuit of innovation in terms of creating, sharing and managing knowledge. Moreover, given the resource constraints of SMEs, this poses further challenges for a SME to utilise knowledge for its ongoing pursuit of innovation.

As Brand (1998) argues that effective KM has parallels with effective innovation. For innovation to take place, a company needs a knowledge sharing culture and creativity to turn ideas into practical products and services. Subsequently, the various KM processes have a key role in creating, storing, updating and utilising knowledge for innovation. Yet, it is precisely the sharing of knowledge across functional or organizational boundaries, through using cross-functional and inter-organizational, inter-disciplinary and inter-organizational teams, that is seen as the key to the effective use of knowledge for innovation (Gibbons, 1994).

Furthermore, Scarborough et al., (1999) argue that finding the correct balance of technology and people-related processes in the organisational context is key for effective KM in the process of innovation.

Given the various KM processes, namely Knowledge Acquisition and Development, Knowledge Storage or Embodiment, and Knowledge Use, Darroach and McNaughton (2002) argue that the literature shows a variety of findings indicating the need to further explore the relationship between KM and innovation in order to enhance the understanding of these two constructs. Studies linking aspects of knowledge dissemination and innovation have provided mixed results. For example, inter-functional coordination and human resource practices were found to positively affect innovation (Abbey, 1983; Ittner and Larcker, 1997; Li and Calantone, 1998; Sethi, 2000; Song and Parry, 1997; Tang, 1999). However, encouraging work group behaviour that supports innovation and allowing people the time for innovation yielded mixed results (Abbey, 1983; Amabile et al., 1996; Anderson and West, 1996; Hurley and Hult, 1998; Kitchell, 1995; Tang, 1999). Lastly, codifying or making knowledge explicit in databases or organisational memories was generally found to not affect innovation (Abbey, 1983; Moorman and Miner, 1997; Tang, 1999). The component of knowledge use was found to positively affect innovation in one study (Kitchell, 1995). Therefore, it is fair to conclude that the relationship between KM and innovation is not well understood. Nevertheless, there is little or no mention of how the processes of Knowledge Gap and Knowledge Revision affect innovation. This study will attempt to further shed light on this relationship.

Furthermore, Forcadell and Guadamillas (2002) argue that a critical aspect of business management is the successful creation of processes which drive the development of a continuous flow of knowledge for innovation, to give a basis for competitive advantage. To reach this goal, the establishing of a KM and Innovation strategy may be considered the best way to channel the organization's efforts to this end. The literature shows a scarcity of literature exploring how KM and Innovation strategy could be aligned with the business strategy to realise strategic goals and objectives, even more so for SMEs. This study aims to contribute to the phenomenon.

In order to investigate this relationship between KM and Innovation in SMEs a conceptual model was formulated. The following section presents the KMOLI Cycle and explains how it was formulated.

6.3 Theoretical Framework: Knowledge Management for Organisational Learning and Innovation (KMOLI) Cycle - A Conceptual Proposition for Integrating Knowledge and Innovation Activities in SMEs

6.3.1 Innovation Model

Since this research is attempting to link innovation with KM processes, the first step that was taken to represent this link was to develop an abstract representation (a model) of innovation in organisations in general and SMEs in particular. The innovation model developed and proposed in this project was adapted from Oxbrow and Hart (2002) see Figure 1, whom in turn utilised and expanded on the framework developed by Treacy and Wiersema (1996). Oxbrow and Hart (2002) suggest a framework to drive continuous innovation for organisations of all types and sizes. This framework is based on the belief that the critical success factors for continuous innovation include effective, imaginative and consistent application of expertise, information and ideas. This is based on Treacy and Wiersema's (1996) assumption that the balance and flow between ideas, expertise and information is in fact the main driver for continuous innovation.

Why was this model selected? This model for innovation was preferred due to its simplicity and applicability to organisations of all sizes. However, the innovation model proposed and adapted by Oxbrow and Hart (2002) is limited in scope as it does not consider how the innovative idea is commercialised. Furthermore, this model assumes that the initial stage of innovation is alike regardless of organisation size and type. Nevertheless, the focus of this model is to show how the KM processes of SMEs based in the UK energy sector relate to the initial stages of the innovation phase – the idea generation. The questionnaire further ascertains information from the SME with regards to the remaining systems and processes in realising its innovative ideas – see Questionnaire for more details.

The relationship between the three components (ideas, information and expertise) of the innovation model is dynamic and inter-related. Ideas are identified for innovation through SME business practices, internal processes and environmental pressures (e.g. contact with customers, efforts to respond

to competition, pressure from suppliers, etc.). Triggers for these ideas may come either from information being made available from SMEs daily activities or from the expertise of their staff. Ideally, it is when expertise meets appropriate information, in order to face challenges posed to the organisation, that innovative ideas are enabled. Therefore, ideas, information and expertise are the key underlying factors which drive continuous innovation in SMEs.

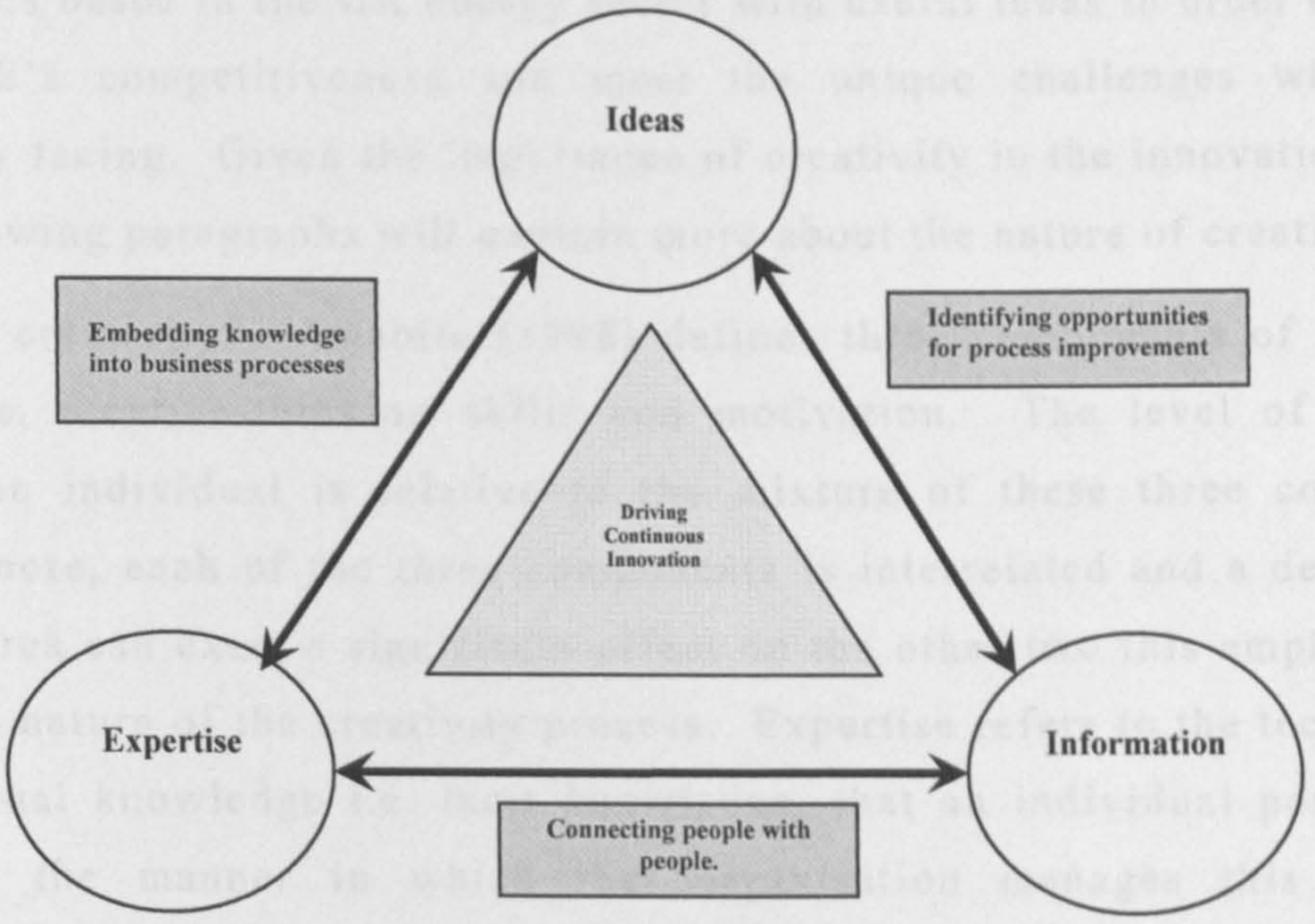

Figure 40 The Continuous Innovation Model, adapted from Oxbrow and Hart (2002).

The following sections discuss the components of the 'Innovation Model' proposed in Figure 1 and subsequent modifications for the purpose of this study. In short, two modifications were made to the Innovation Model in Figure 1: the term 'expertise' was modified to 'tacit knowledge'; and the term 'information' was modified to 'explicit knowledge'.

Ideas

As discussed earlier in Chapter 4 (Innovation), creativity is an essential precursor for innovation as it fuels the innovation process by generating ideas. Farid-Foad et al., (1993) explain creativity as that which "results in the generation of new and useful ideas or the combination of existing ideas into new and useful concepts to satisfy a need". In this regard, creativity would fuel SMEs based in the UK energy sector with useful ideas in order to enhance the SME's competitiveness and meet the unique challenges which it is currently facing. Given the importance of creativity in the innovation process the following paragraphs will explain more about the nature of creativity.

What is creativity? Amabile (1998) defines three components of creativity: expertise, creative-thinking skills and motivation. The level of creativity within an individual is relative to the mixture of these three components. Furthermore, each of the three components is interrelated and a development in one area can exert a significant effect on the other two this emphasises the dynamic nature of the creativity process. Expertise refers to the technical and intellectual knowledge i.e. tacit knowledge, that an individual possesses, as well as the manner in which that organisation manages this collective knowledge. Creative thinking refers to the individual's skills that facilitate imaginative problem solving. Furthermore, as Wreath (1998) explains, motivation refers to the intrinsic and extrinsic factors influencing an individual to be creative. Consequently, the environment can also contribute significantly to increasing expertise, creative thinking and motivation within an organisation and ultimately affect the creative output i.e. more ideas. In short, the effective management of these three components of creativity, together with developing an appropriate culture would increase an organisation's creative capability.

Similarly, Kao (1989), when discussing creativity, presents the view that creativity is the sum of the following functions: the creative person, the creative task and the organisational environment (i.e. culture). Therefore all these elements need to be considered in order to enhance creativity.

Furthermore, Ahmed (1999) argues the benefits of creating, maintaining and enhancing a creative culture facilitates the implementation of innovation strategies and systems in organisations. Clearly, the culture of the organisation is an important component of this model. However, the focus of this project is on how these three components are directly affected by the KM processes which will be discussed in the following section.

Oxbrow and Hart (2002) proposed a number of activities which organisations should be implementing to sustain the 'Idea' component of continuous innovation see Appendix 1. Furthermore, these activities were incorporated into the Questionnaire to ascertain relevance to SMEs, which will be discussed further in the subsequent chapters.

Expertise

As mentioned in the section above, 'Expertise' in the form of tacit knowledge is an essential component of creativity, this emphasises the dynamic relationship between these two components as explained by Treacy and Wiersma (1996).

As Augier and Vendelo (1999) explain the issue of tacit knowledge has been dealt with within many disciplines and by many authors. Nevertheless, for this study we refer to Polanyi (1958), for example, sees tacit knowledge as a personal form of knowledge, which individuals can only obtain from direct experience in a given domain. Consequently, expertise is a source tacit knowledge. Given the importance of tacit knowledge in the process of creativity and innovation, the 'expertise' component of the Innovation Model was modified to 'tacit knowledge' which is a more specific term and relevant to both KM and innovation processes as discussed in the literature review.

How does 'tacit knowledge' interact with 'explicit knowledge'?

The transfer of tacit knowledge (previously 'expertise) to explicit knowledge (previously 'information') is a more complex one compared to the transfer of explicit knowledge to tacit knowledge. The latter is explained further in the following section (Information). We might assess the tacitness of knowledge by measuring its level of codification (Zander and Kogut, 1995), describing the level of codification as the degree to which the knowledge is expressed in writing at the time of its transfer. Wilson (2002) calls this 'expressible but previously unexpressed' or implicit knowledge. The remaining tacit knowledge which is unexpressed remains with the individual such knowledge is typically believed to be hard to articulate and can solely be acquired through experience. Consequently, individuals or firms might choose to keep their knowledge tacit in order to prevent its transfer and diffusion, and thereby, maintain a competitive advantage.

Oxbrow and Hart (2002) identify a list of activities associated with 'expertise' (Appendix 1). Despite the change of terms we believe the activities are still

relevant with tacit knowledge. Similarly to the 'Idea' component of the Innovation Model, the 'tacit knowledge' activities were incorporated into the Questionnaire.

Information

In this section the interaction between 'explicit knowledge' (previously 'information') and 'tacit knowledge' and then with 'idea' is discussed.

As discussed in Chapter 3 (KM) there is a clear relationship between the terms 'information' and explicit knowledge. As Duffy (2000) explains "...explicit knowledge is documented and public; structured, and externalised" it is packaged in the form of information for organisational use. In contrast to tacit knowledge, explicit knowledge is that which has been articulated, codified and formalised in some electronic or physical form e.g. information. (Wong and Aspinwall, 2006). Furthermore, explicit knowledge could then be used in a specific context to enhance an individual's tacit knowledge.

There is much debate between the terms tacit knowledge and explicit knowledge and the transfer between one form to the other, as discussed in Chapter 3 (KM) and the previous section (Expertise). Nevertheless, for this study we quote Polanyi (1966) "...explicit knowledge requires tacit knowledge for its interpretation", hence underlining the importance both terms have in adding value in any particular context.

Although explicit knowledge plays an important role in the innovation process it is argued that it is tacit rather than explicit knowledge which will typically be of more value to innovation processes (Grant, 1996; Hall, 1993). Yet tacit knowledge is knowledge which cannot be communicated, understood or used without the ``knowing subject'' (Popper, 1972; Lam, 1998). This suggests that using only explicit forms of knowledge and neglecting tacit forms of knowledge will severely limit contribution to innovation. Furthermore, for instance, tacit knowledge is used to foster creativity and innovation and explicit knowledge is used to make the work environment predictable and guide the way tasks are organized (Brown and Dugid, 2000).

Due to the difficulty in defining knowledge the distinctions between data, information and knowledge have often been made in the literature (Alavi & Leidner, 2001; Beckman, 1999), as well as the tacit and explicit distinction discussed above. As Grover & Davenport (2001) explain data are merely raw objective facts, while information is considered as structured and organised data. Knowledge can be conceptualised as meaningful and value added

information which has been filtered by human minds. When they (i.e. data, information and knowledge) are arranged in a single continuum, knowledge has the highest value, the greatest relevance to decisions and actions, the greatest dependence on context, and requires the maximum amount of human involvement.

Nonetheless, the term 'explicit knowledge' is preferred over 'information' due to its importance in innovation and KM processes as discussed previously. Oxbrow and Hart (2002) proposed a list of activities for the 'Information' component of the 'Innovation Model' these activities were deemed relevant to 'explicit knowledge' and consequently incorporated into the Questionnaire as for the previous two components of the model.

In short, the balance and flow between ideas, tacit knowledge and explicit knowledge is in fact the main driver for continuous innovation. In addition, ideas are the outcome of the dynamic interaction between explicit and tacit knowledge within a specific context. Consequently, the Innovation Model proposed by Oxbrow and Hart (2002) in Figure 1 was revised and modified to produce Figure 2 below:

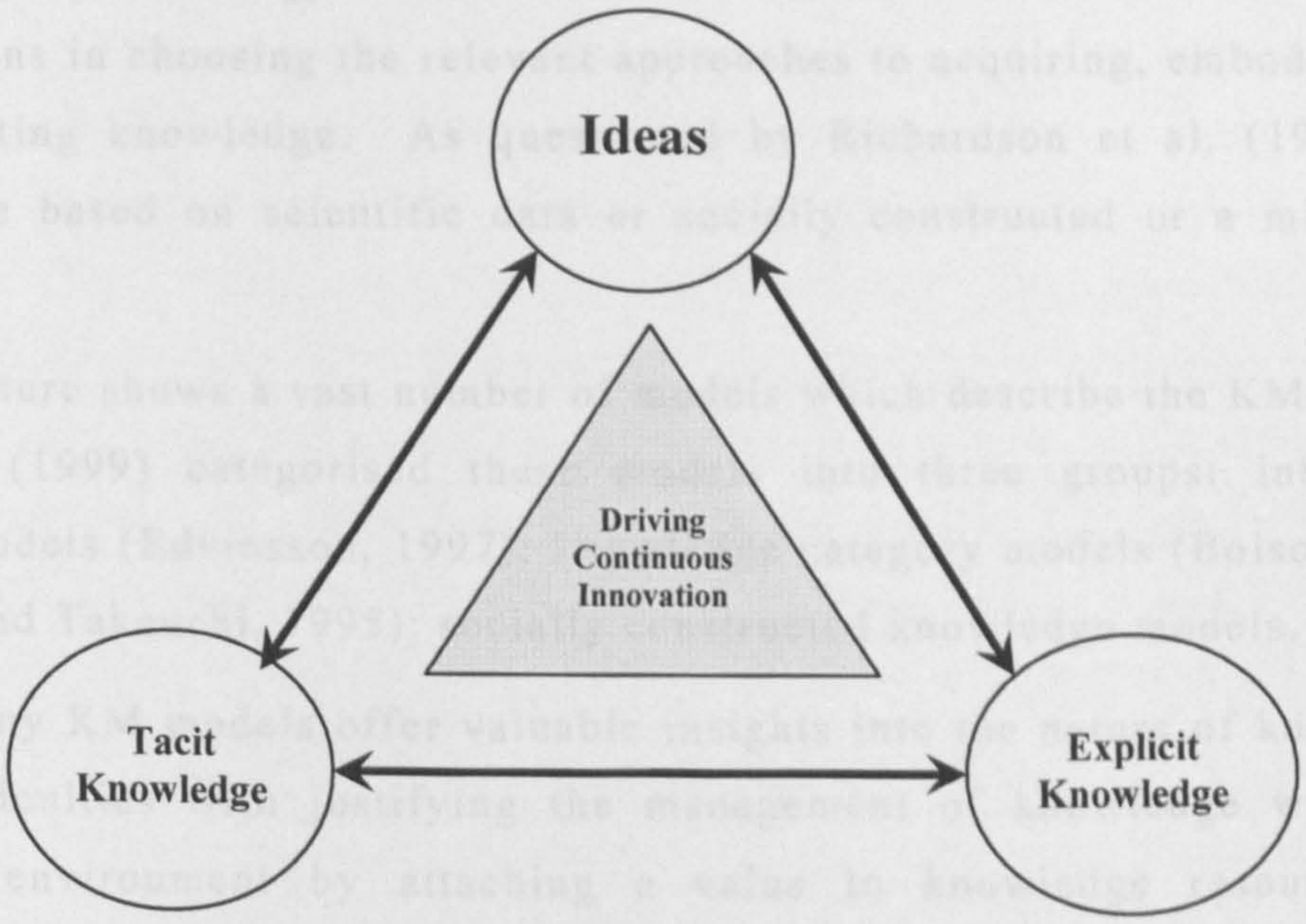

Figure 41: Modified 'Innovation Model' from Oxbrow and Hart (2002)

The following section discusses the formulation of the KM component of the KMOLI cycle called the Knowledge Management for Organisational Learning (KMOL) Cycle.

6.3.2 The Knowledge Management for Organisational Learning (KMOL) Cycle

This section discusses the components of the KMOL Cycle which comprises of KM and Organisational Learning concepts and practices. Firstly, the KM model component will proposed after a discussion of current KM Models. Secondly, the Organisational Learning component of the model will be discussed.

KM Models from previous studies

The steady interest in KM in academia and business communities from various disciplines and backgrounds has spawned many KM models that try to capture the inherent qualities as well as the dissemination and development characteristics of knowledge in order to assess the methods and techniques of managing knowledge in an organisational context (Earl, 1994; Martiny, 1998; Nonaka & Takeuchi, 1995; Pasternack & Viscio, 1998).

Nevertheless, for any organisation to implement KM effectively it must clearly define the following question – what is knowledge? Subsequently the underlying epistemology of KM must be clarified as it has far reaching implications in choosing the relevant approaches to acquiring, embodying and disseminating knowledge. As questioned by Richardson et al. (1987) - is knowledge based on scientific data or socially constructed or a mixture of both?

The literature shows a vast number of models which describe the KM process. McAdam (1999) categorised these models into three groups: intellectual capital models (Edvinsson, 1997); knowledge category models (Boisott, 1987; Nonaka and Takeuchi, 1995); socially constructed knowledge models.

While many KM models offer valuable insights into the nature of knowledge, their difficulties with justifying the management of knowledge within the business environment by attaching a value to knowledge resources and subsequently providing guidelines concerning the use of knowledge, is a point of constant criticism (Davenport and Marchand, 2001; Donahue, 2001).

Nevertheless, amongst the literature each KM model utilises a fundamental approach in analysing knowledge. Gebert et al., (2003) explain that the KM models either view an epistemological perspective i.e. knowledge as an entity with distinctive attributes that can be deconstructed and its details analyzed,

or an ontological perspective i.e. they view it as an integrated whole and focus on its relations with the surroundings.

Furthermore, it is argued that the intellectual capital and knowledge category models are mechanistic and therefore overlook the view that knowledge is constructed through social and learning processes (McAdam and McCreedy, 1999).

In addition, researchers argue that there is a large similarity between the socially constructed knowledge models and organisational learning or learning organisation models.

Knowledge category models

These types of model categorise knowledge into discrete elements. For example, Nonaka's model (Nonaka and Takeuchi, 1995) is an attempt at giving a high-level conceptual representation of KM and essentially considers KM as a knowledge creation process.

Nonaka's model considers knowledge as consisting of tacit and explicit elements. Tacit knowledge is defined by Polanyi (1962) as non-verbalised, intuitive and unarticulated. Explicit or articulated knowledge is specified as being in writing, drawings, computer programs etc. (Hedlund, 1994). McAdam and McCreedy (1999) question if it is appropriate to solely categorise knowledge in such a way? Where does the concept of P and Q knowledge (McLoughlin and Thorpe, 1993) fit with this view, where P is programmed knowledge and Q is knowledge gained by questioning insight as tacit knowledge does not exactly map onto Q, neither does explicit knowledge exactly map unto P. Thus P and Q represent a different categorisation of knowledge. Consequently, McAdam and McCreedy (1999) argue that from a critical standpoint Nonaka's categorisation of knowledge is perhaps limited or unidimensional.

Furthermore, McAdam and McCreedy (1999) argue that Nonaka's model assumes tacit knowledge can be transferred through a process of socialisation into tacit knowledge in others and that tacit knowledge can become explicit knowledge through a process of externalisation. Furthermore, the model also assumes that explicit knowledge can be transferred into tacit knowledge in others through a process of internalisation, and that explicit knowledge can be transferred to explicit knowledge in others through a process of combination. Therefore, the transforming processes are assumed to be socialisation (everyday comradeship), externalisation (formalising a body of knowledge),

internalisation (translating theory into practice) and combination (combining existing theories). Wilson (2002) explains that perhaps knowledge transfer in organisations is much more complicated and convoluted than Nonaka's simple matrix suggests, this is further supported by a number of researchers (Arrow ,1962; Von Hippel, 1995; Teece (1998). Given this, McAdam and McCreedy (1999) argue that Nonaka's model implies a mechanistic approach to knowledge categorisation.

Another example of a knowledge category model is that of Boisot (1987). Figure 3 shows Boisot's model which considers knowledge as either codified or uncodified, and as diffused or undiffused, within an organisation. Boisot uses the term ``codified'' to refer to knowledge that can be readily prepared for transmission purposes (e.g. financial data). The term ``uncodified'' refers to knowledge that cannot be easily prepared for transmission purposes (e.g. experience).

The term ``diffused'' refers to knowledge that is readily shared while ``undiffused'' refers to knowledge that is not readily shared.

If knowledge is categorised as both codified and undiffused, then the knowledge is referred to as propriety knowledge. In this case, knowledge is prepared for transmission but is deliberately restricted to a selectively small population, on a ``need to know'' basis (e.g. projected profits, share price issues). The bottom left quadrant covers knowledge that is relatively uncodified and undiffused, which is referred to as personal knowledge (e.g. perceptions, insights, experiences). The top right quadrant covers knowledge that is both codified and diffused and is referred to as public knowledge (e.g. journals, books, libraries). Finally, the bottom right quadrant refers to common sense knowledge which is relatively diffused but also uncodified. Such knowledge is considered by Boisot as being built up slowly by a process of socialisation, harbouring customs and intuition.

There are a number of parallels between Nonaka's model and that of Boisot. For example, Nonaka's categorisation of explicit and tacit knowledge has at least some degree of correspondence with Boisot's reference to codified and uncodified knowledge. Also, in both models the horizontal dimension relates to the spread or diffusion of knowledge across the organisation. Boisot's model suffers the same limitations as Nonaka's model in that codified and uncodified are but two discrete categories of knowledge. Also, the idea of diffused knowledge (less defined ontological axis than Nonaka's model) is

rather general and it is not clear if it includes incorporating knowledge within the organisation, as well as spreading it.

In summary, knowledge category models of KM involve knowledge transforming processes of socialisation. However, some of the categorisation of knowledge in these models is mechanistic. Furthermore, Gebert et al., (2003) categorise Nonaka's model as an "agent-oriented" KM models where the focus is on the characteristics of knowledge during its flow between individuals. These models analyze the variables that expedite or hinder the flow of knowledge in social networks. Further examples of agent-oriented KM models include Wenger (1997) and Enkel et al. (2000).

Intellectual capital models

A number of models in the literature represent KM as essentially intellectual capital (IC). A typical IC model is the Skandia IC model (Chase, 1997; and Roos and Roos, 1997).

The model assumes IC or KM can be segregated into human, customer, process and growth elements which are contained in two main categories of human capital and structural/organisation capital. Lank's (1997) account of the Skandia approach to KM is predicated on this type of model. The model assumes a very scientific approach to knowledge and assumes it can be commodified - hence the link with organisational capital. McAdam and McCreedy (1999) argue that this approach is consistent with a mechanistic approach. Skandia was the first company in the world to publish a supplement to its annual report on the company's intellectual capital philosophy and activities (Chase, 1997). However, this intellectual capital view of KM ignores the political and social aspects of KM. Also, like Nonaka's model, it assumes KM can be decomposed into objective elements rather than being a socio-political phenomenon. This mechanistic approach, can result in simplistic mechanised approaches to complex social-related issues (e.g. reward and recognition, power relations, empowerment etc.)

The Skandia example, as described by Lank gives a strong emphasis to measurement associated with each of these decomposed elements of KM assuming it can be tightly controlled, as is the case for tangible assets. Unfortunately this approach can result in attempts to fit objective measures to subjective elements.

In summary, intellectual capital models are mechanistic in nature, and assume that knowledge can be treated as an asset, similar to other assets.

Socially constructed models of KM

This group of models assumes a wide definition of knowledge and views knowledge as being intrinsically linked within the social and learning processes within the organisation. There is a large area of commonality between these types of models and those models seeking to represent the learning organisation and organisational learning (e.g. Burgoyne et al., 1994).

Demerest's (1997) adaptation of Clark and Staunton's (1989) model of KM, firstly, emphasises the construction of knowledge within the organisation. This construction is not limited to scientific inputs but is seen as including the social construction of knowledge. The model assumes that constructed knowledge is then embodied within the organisation, not just through explicit programmes but through a process of social interchange. Following embodiment there is a process of dissemination of the espoused knowledge throughout the organisation and its environs. Ultimately the knowledge is seen as being of economic use in regard to organisational outputs. The model is similar to that of Jordan and Jones (1997) who speak of knowledge acquisition, problem solving, dissemination, ownership and storage. There are also similarities with Kruizinga et al.'s (1997) model which includes knowledge policy, infrastructure and culture. There are also parallels with Scarborough's (1996) approach which covers strategic knowledge, structural and cultural knowledge, systems knowledge and communities of practice and routines. This model is attractive in that it does not assume any given definition of knowledge but rather invites a more holistic approach to knowledge construction.

The ``use'' box in the model is limited to organisational outputs and does not include emancipatory enhancements. These factors can be seen as complementary rather than mutually exclusive.

McAdam and McCreedy (1999) propose a slightly modified version of Demerest's model which seeks to address these limitations by explicitly showing the influence of both social and scientific paradigms of knowledge construction. The model also extends the ``use'' element to cover both business and employee benefits. If KM is to have the support and commitment of all stakeholders in an organisation then employee emancipation must be addressed along with the business benefits. These issues should not be seen as mutually exclusive but as complementary. Also more recursive arrows on the model show that KM is not seen as a simple sequential process. It is suggested that this model is a useful means for structuring further research

into the field of KM as it represents a balanced view of social and scientific paradigms. It allows KM to be associated with the emerging social paradigm while at the same time contributing to the current paradigm.

Furthermore, Gebert et al., (2003) categorises Demerest's model as a "process-oriented" KM model, where the focus is on the characteristics of knowledge during its life cycle. These models analyze the relationships and environmental variables that influence the development, dissemination, modification and use of knowledge processes. Further examples of process-oriented KM models include Probst et al. (1999) and Wiig (1995).

Based on the strengths and weaknesses of both model types, epistemology and ontology perspectives seem to have high synergy potentials. Though it is possible to analyze the structure of an entity and its relations separately; in trying to assess the business benefits of knowledge management, both the inherent characteristics and relevant relationship variables of knowledge must be taken into account.

Most KM models developed within the last decade therefore exhibit characteristics of both views with most models revealing their origins as based on an internal imbalance between the details of epistemological and ontological viewpoints. Nonaka integrated an agent ontological dimension in 1994 (Hedlund and Nonaka, 1993) and tried to bond both views in his concept of "ba" (Nonaka and Konno, 1998). By definition Demarest's process-oriented KM model focuses on the processing of explicated knowledge (Demarest, 1997). But a fully balanced model is yet to be created (McAdam and McCreedy, 1999).

Ontology-oriented models analyze links between knowledge and its environment. They can therefore evaluate knowledge based on a specific business context. However, the analysis ability of ontology-oriented knowledge management models is limited by their disregard of the inherent characteristics of knowledge.

6.3.3 Formulation of the KMOL Cycle

The following section describes the stages during the formulation of the KMOL Cycle.

Stage 1: Adoption of the Socially Constructed KM Model

Why was this model chosen? The socially constructed KM models provide a holistic understanding of knowledge and consequently the KM model proposed by McAdam and McCreedy (1999) was selected (see figure 1) below:

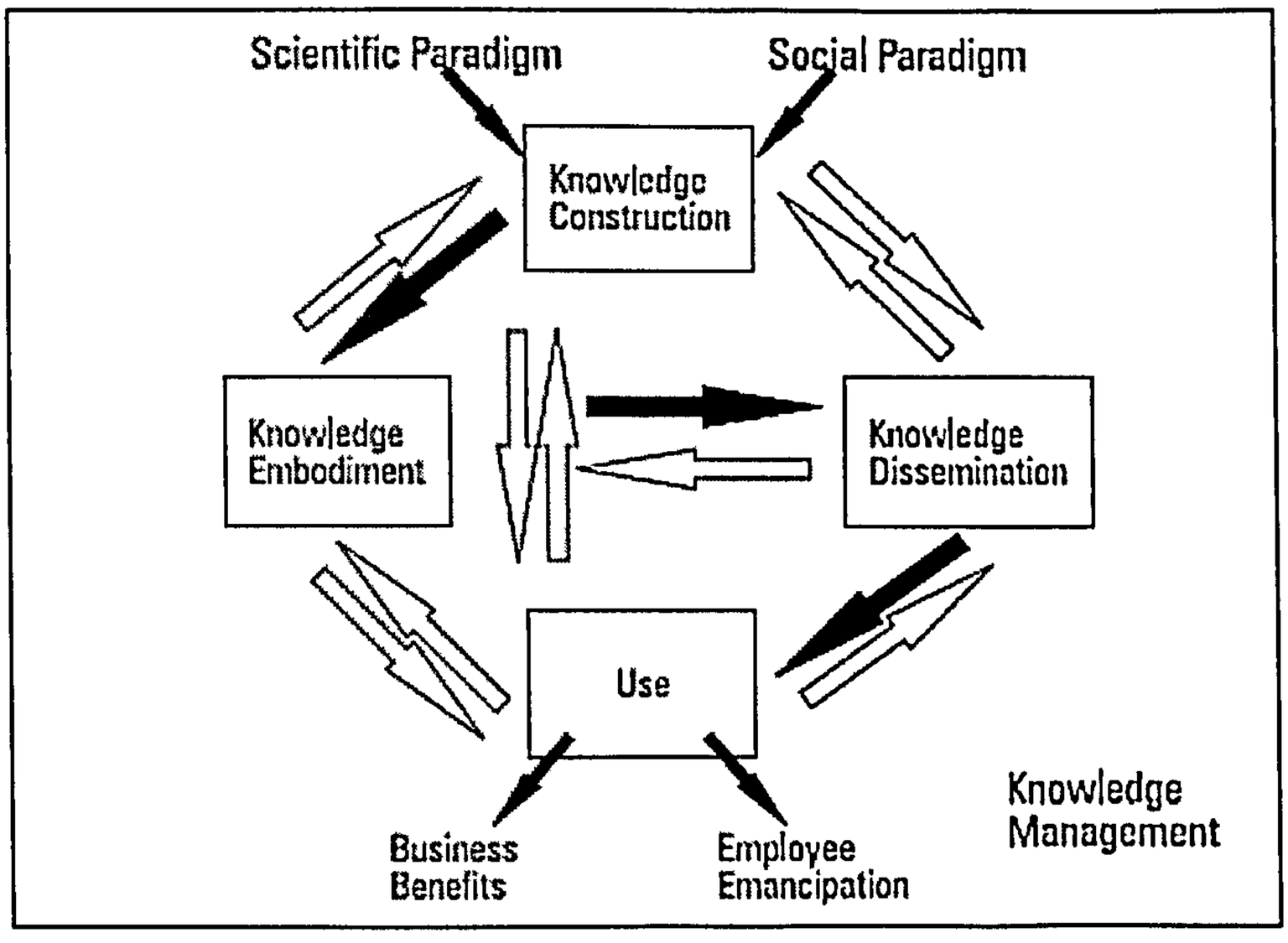

Figure 42: KM model proposed by McAdam and McCreedy (1999)

The model proposed by McAdam and McCreedy (1999) is a modified version of the KM model proposed by Demarest (1997). McAdam and McCreedy propose four processes: knowledge construction; knowledge embodiment; knowledge dissemination; and knowledge use. Demarest (1997) describes these processes as follows: knowledge construction is the process of discovering or structuring a kind of knowledge; knowledge Embodiment is the process of choosing a container for knowledge once it is constructed; knowledge Dissemination refers to the human processes and technical infrastructure that make embodied knowledge available to the people within the firm; and knowledge use refers to the ultimate objective of any knowledge management system. The dark arrows show the direction of the process from knowledge construction to knowledge use, while the white arrows show the interaction between the processes.

Nevertheless, the processes from the above model were used as a starting point and other processes and ideas were incorporated into this socially constructed KM model as described in the following sections.

Stage 2: Incorporation of Organisational Learning concepts

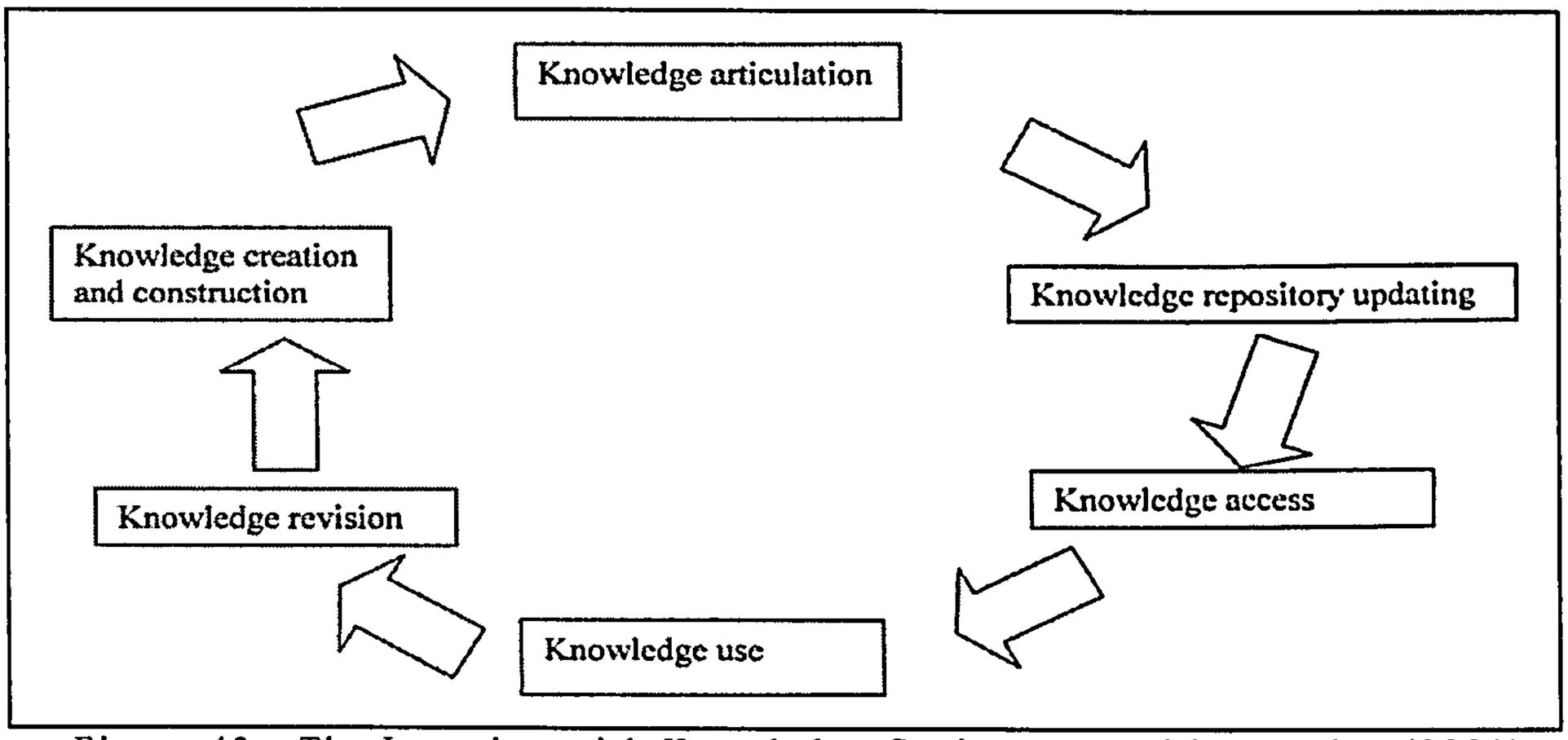

Figure 43: The Learning with Knowledge Cycle proposed by Rowley (2001)

The Learning with Knowledge Cycle by Rowley (2001) adapted the concepts from the socially constructed KM model proposed by McAdam and McCreedy (1999) and further incorporated concepts from the organisational learning literature.

As Rowley (2001) explains "..while it was possible to criticise the learning organisation literature for its lack of reference to what was learned (i.e. knowledge) (29), it is also true that much of the KM literature is remarkably devoid of the reference to learning". Consequently, the Learning Knowledge Cycle was proposed to reinforce KM with concepts from the Organisational Learning since the focus of organisational learning is on processes through which organisations acquire knowledge while KM focuses more on managing what is learnt (Argote, 2005). Therefore, organisational learning could complement KM and further provide a strengthened KM model.

Furthermore, Rowley (2001) reinforces that "....only recognition that all of the processes involved in knowledge management must be part of the learning cycle of the organisation will ensure that KM: is successfully embedded in the organisation and its processes, and owned by its communities; and facilitates the learning that is key to success in changing organisations and changing environments.

Why the learning organisation? The learning organisation is an organisation that facilitates the individual and organisational learning in such a way as to support success in responding to continuing change. The concept of learning

organisation was first transmitted in the early 1990s, Senge (1990) and subsequently Stata (1998), Saint-Onge (1993) and Ross (1992), made it known officially. Furthermore, the terms 'organisational learning' and 'learning organisation' are often use synonymously in the literature.

As Rowley (2001) explains both concepts of KM and Learning organisation are "...driven by the need to be able to respond effectively to changing business environments, changing business processes and changing personnel". The following section briefly describes the processes included in the Learning Knowledge Cycle:

(1) Knowledge acquisition, creation and construction: the processes through which knowledge is acquired or created in an organisation. Knowledge acquisition is associated with the contracting of knowledge from outside the company. This may include the appointment of people, the purchase of reports or licences, or the strategic alliances that involve exchange of knowledge and competence. Knowledge creation involves research and development activities that generate scientific and technical knowledge and market research that generates market knowledge. These are activities whose primary purpose is knowledge creation. Other knowledge creation processes are embedded in the delivery of the business activities and processes of the organisation.

(2) Knowledge articulation and sharing: the processes by which tacit knowledge is made explicit and becomes available for sharing.

(3) Updating knowledge repositories, which collect and organise knowledge. Knowledge repositories include both systems and people. For people as repositories, this stage may also be associated with the embodiment of knowledge within people's understanding, practices and awareness, or the creation of tacit knowledge repositories. Physical knowledge repositories, such as archives, databases and filing systems, need guidelines on what is to be included.

(4) Knowledge diffusion, access and dissemination: knowledge access may be initiated by the potential recipient when an individual seeks knowledge, either by searching a system, or by contacting others, or it may be initiated by some other agency, as when knowledge is disseminated to an individual or group. Training courses are one of several approaches to the dissemination of knowledge.

(5) Knowledge use: this part of the cycle is significant in terms of measurable outputs. Knowledge may be used as the basis for developing new knowledge through integration, creation, innovation and extension of existing knowledge and/or it may be used as the basis for actions or decisions. These actions or decisions impact on business performance. They not only justify organisational learning, but also form a basis for measuring the effectiveness of the organisational learning process and the knowledge management activities that contribute to that process.

(6) Knowledge revision will take place as a result of knowledge use and of reflection on the experience of actions and decisions. Such reflection drives individual learning that can form the basis of the creation of new knowledge, which may supplement or substitute for existing knowledge. Without this stage, the cycle is not completed and new knowledge is not created. Further, this stage is crucial to individual development and learning. Once individual learning has been undertaken, knowledge can be made explicit and shared with others through the knowledge repository.

As a result, additional processes were added to the initial model adopted from McAdam and McCreedy (1999) see figure below. The modifications included an emphasis on individual and organisational learning through the addition of the knowledge acquisition, creation and revision processes.

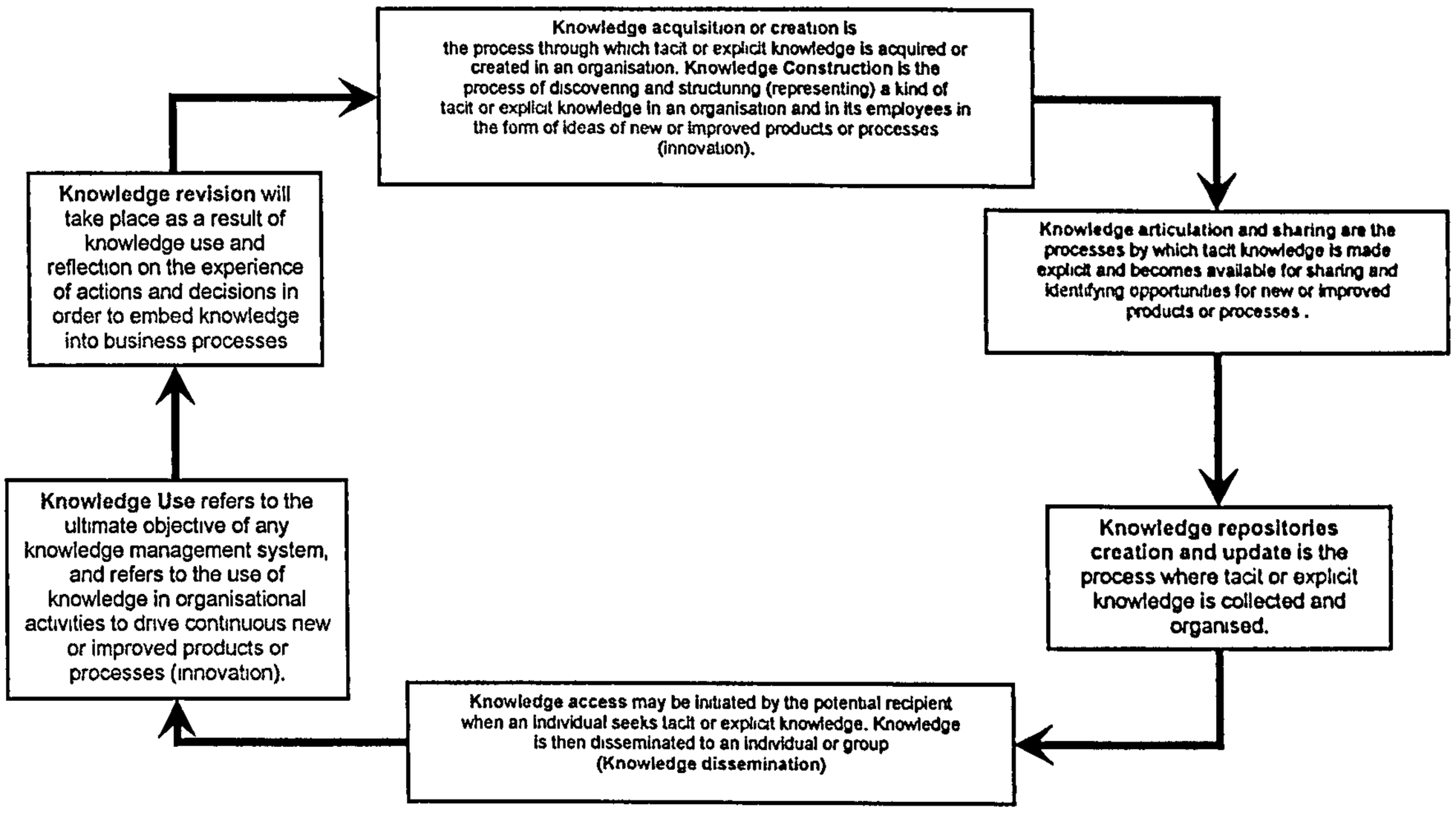

Figure 44: Stage 2 of KMOLI Cycle formulation

Stage 3: Incorporation of a Strategic dimension

Beijerse (1999) proposed the Knowledge Cycle, see figure 3 below, which adopted the nine knowledge streams explained by Weggerman (1997). The knowledge value chain developed by Weggeman (1997) consists of six operational processes: (1) the determination of the necessary knowledge; (2) taking stock of the available knowledge; (3) knowledge development; (4) knowledge sharing; (5) apply knowledge; and (6) evaluate knowledge.

The 'knowledge gap' process from Beijerse (1999) was added to the KM cycle proposed for this study, see figure below. This process adds a strategic perspective to the KM model by evaluating the knowledge necessary to drive the subsequent KM processes. This is explained further in the following KMOLI model section.

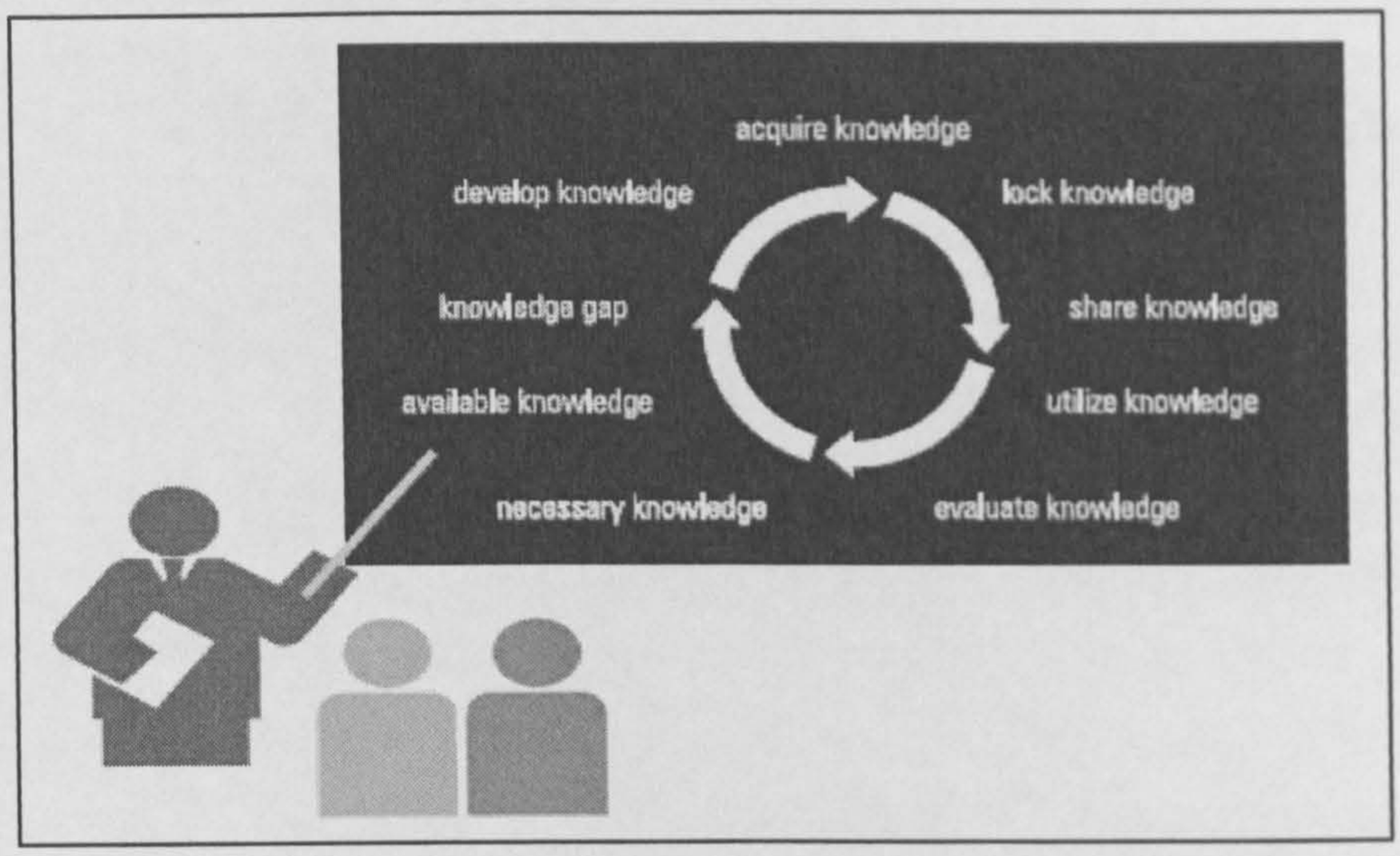

Figure 45: The Knowledge Cycle proposed by Beijerse (1999)

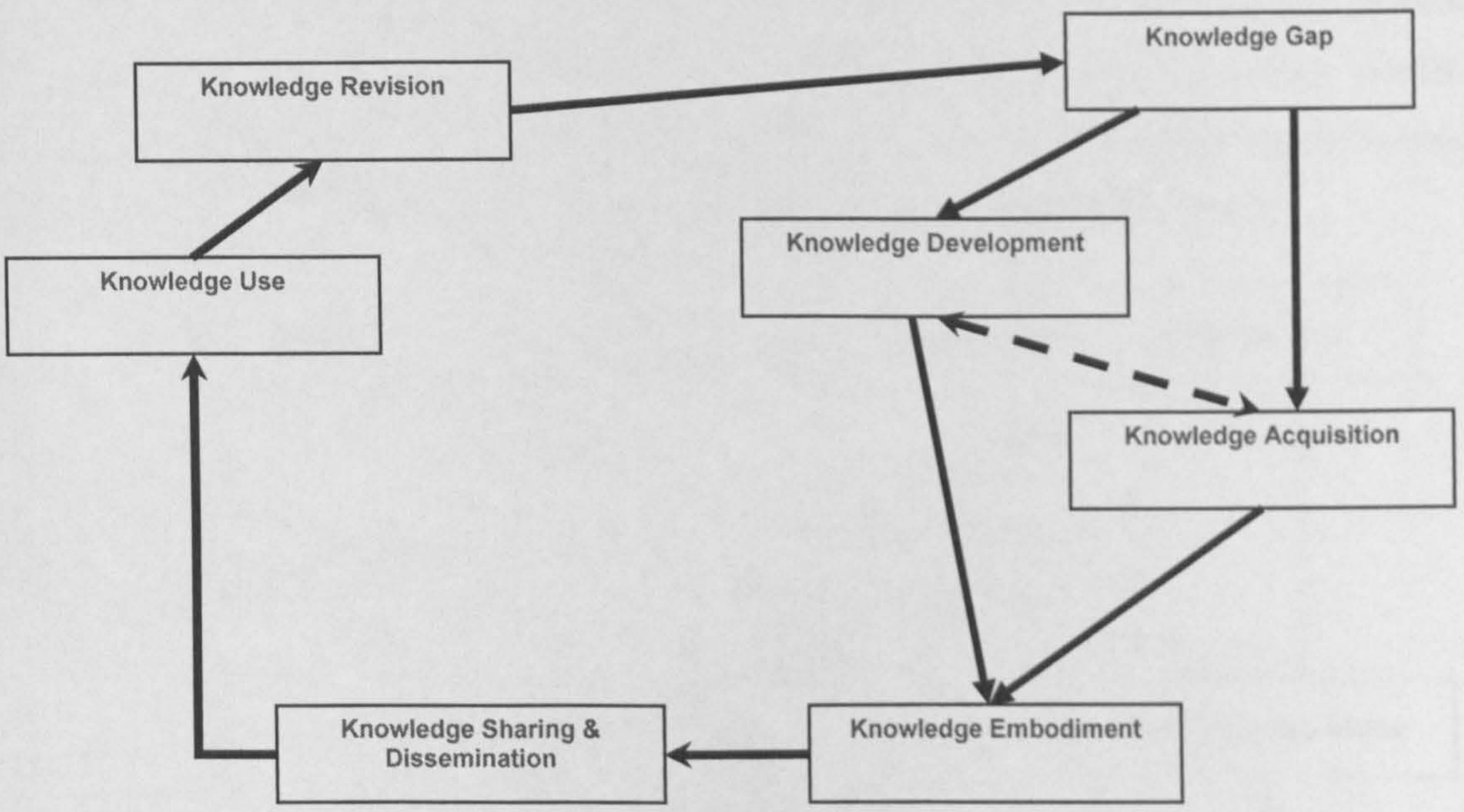

Figure 46: The KMOL Cycle – Stage 3 of KMOLI Cycle formulation

The following section will describe how the KMOL Cycle above was incorporated with the Innovation Model, which was proposed earlier, and an explanation of the processes.

6.3.4 KMOLI Cycle – Merging of the KMOL Cycle and Innovation Model

Each of the KM processes proposed in the KMOL cycle were assumed to have a relationship with innovation as described below. In addition, from the innovation literature review it is clear that the processes of knowledge acquisition and development have a significant relationship with innovation. However, an explicit relationship between each KM process and component of the Innovation Model was not the focal point of the study. The objective of the study was to determine if SMEs based in the UK energy sector perform the activities associated with each of the KM and innovation processes. Subsequently, an exploration into how each KM and innovation process, proposed in the KMOLI model, related with each innovation process would be a valuable additional project to this study and provide further understanding on the relationship between KM and innovation in the SME-context.

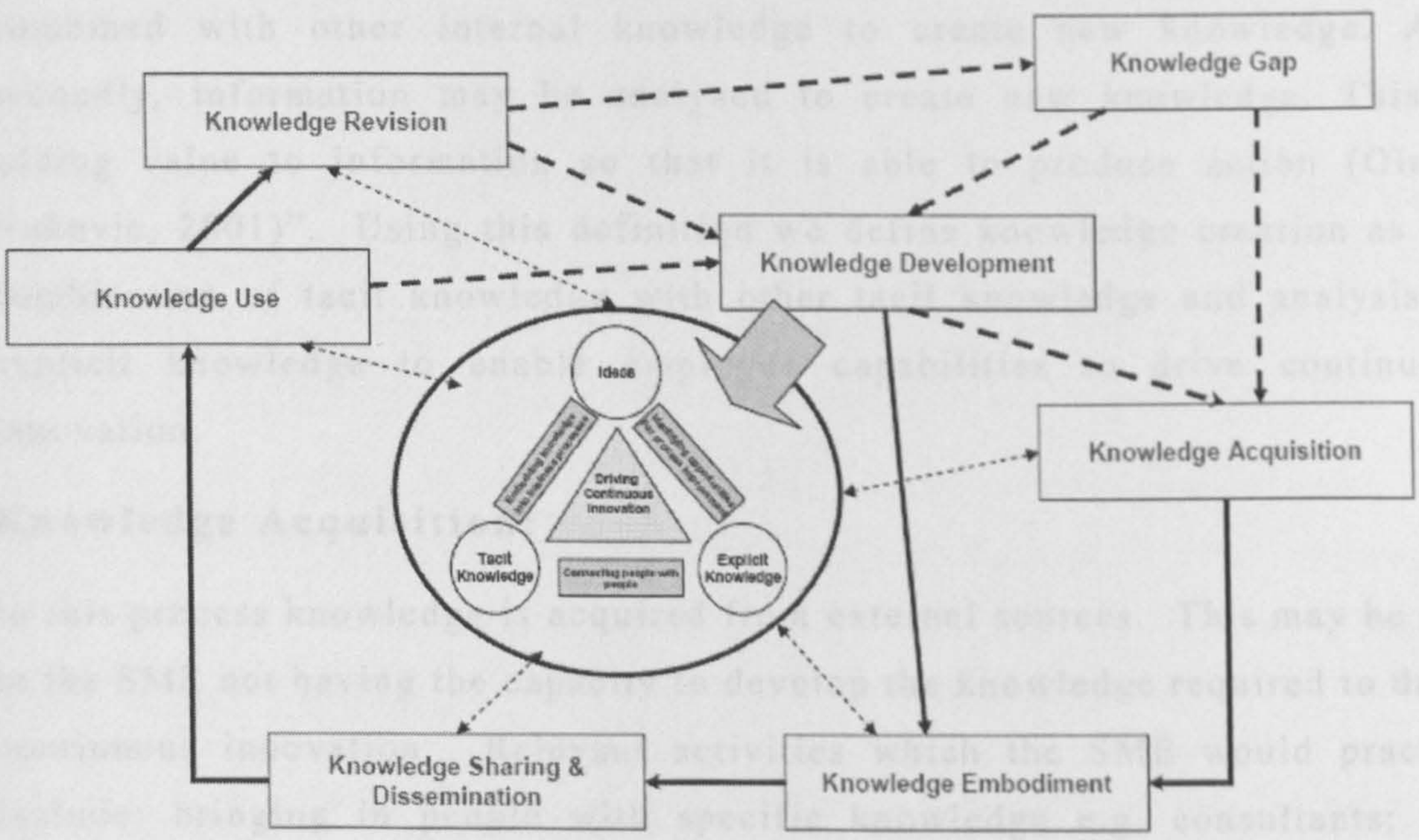

Figure 47 The Knowledge Management for Organisational Learning and Innovation Cycle (KMOLI)).

Overview of the KMOLI Cycle

The different stages of the KMOLI cycle can be described as follows:

Knowledge Gap:

The knowledge which the SME needs to drive continuous innovation is identified by assessing the knowledge available within the SME with the necessary knowledge to drive continuous innovation. Relevant activities

which the SME would practice include: brainstorming sessions; interviewing suppliers, customers or colleagues; (knowledge available) CV files; current best practices within the organisation.

Knowledge Development:

This process develops the knowledge of individuals or groups within the SME to drive continuous innovation. Relevant activities which the SME would practice include: R&D activities; education and training of employees.

What is knowledge construction? Using the following definition of knowledge construction "...the process of discovering or structuring a kind of knowledge" (Demarest, 1997), we define knowledge construction as the process of discovering or structuring knowledge within employees to drive continuous innovation.

What is knowledge creation? The following definition of knowledge creation is broken down into two sub-processes, "First, internal knowledge may be combined with other internal knowledge to create new knowledge. And secondly, information may be analyzed to create new knowledge. This is adding value to information so that it is able to produce action (Oluic-Vukovic, 2001)". Using this definition we define knowledge creation as the combination of tacit knowledge with other tacit knowledge and analysis of explicit knowledge to enable employee capabilities to drive continuous innovation.

Knowledge Acquisition:

In this process knowledge is acquired from external sources. This may be due to the SME not having the capacity to develop the knowledge required to drive continuous innovation. Relevant activities which the SME would practice include: bringing in people with specific knowledge e.g. consultants; and purchasing market research reports.

In this process knowledge is acquired from external sources. This may be due to the organisation not having the capacity to develop the knowledge required to drive continuous innovation.

Knowledge Embodiment:

This process collects, organises and updates knowledge available to individuals and groups within the organisation to drive continuous innovation. Relevant activities which the SME would practice include: maintaining project or activity files; intranet; expertise locators.

This process collects, organises and updates explicit and tacit knowledge available to individuals and groups within the organisation, to drive continuous innovation.

Knowledge Sharing & Dissemination:

Knowledge from the previous knowledge embodiment process is shared with individuals or groups by making knowledge accessible and disseminating knowledge to individuals or groups within the SME to drive continuous innovation. Relevant activities which the SME would practice include: forums (multi, intra and inter); publicising resources; and internal job rotation.

In this process explicit and tacit knowledge from the knowledge embodiment process is shared with individuals or groups by making knowledge accessible and disseminating knowledge to individuals or groups within the organisation to drive continuous innovation. "Knowledge access may be initiated by the potential recipient when an individual seeks knowledge" (Rowley, 2001); and "Knowledge is disseminated to an individual or group" (Rowley, 2001);

Knowledge Use:

This is the ultimate objective of all the knowledge management activities. The knowledge from all of the previous activities are utilised to drive continuous innovation. Knowledge use would include no tangible systems because it would depend on the culture and management style of the SME.

This is the ultimate objective of the knowledge management process. The knowledge from all of the previous processes is utilised to drive continuous innovation.

Knowledge Revision:

In this process the utilised knowledge is then evaluated and used to re-assess the knowledge gap required to drive continuous innovation. Relevant activities which the SME would practice include: project reviews or evaluations; audits; and interviewing customers (to determine satisfaction).

In this process the utilised knowledge is then evaluated and used to re-assess the knowledge gap required to drive continuous innovation.

In general terms, it is envisaged that SMEs will identify knowledge gaps during their day-to-day practices, performed by experts. These knowledge gaps can only be resolved by either generating new knowledge internally through innovation or through knowledge acquisition from external sources. Once innovation occurs, that is, new knowledge is developed and generated,

then this knowledge needs to be stored and documented, shared and disseminated throughout the organisation and ultimately used. This use of new knowledge will result in revision and evaluation of the new ideas and, if not adequate anymore, result in further knowledge gaps identification and triggering of the entire process again. This process of innovation is particularly important in SMEs due to their constant need for agility and adaptability to their business environment in order to remain competitive and survive. The energy sector in particular represents a very complex and volatile environment, susceptible to pressures from competitors, customers, legislation and governmental policies. Thus SMEs in this sector are particularly in need of understanding the role of KM in order to support innovation.

The following chapter discusses the questionnaire survey findings using descriptive and exploratory statistics.

6.3.5 Discussion Summary

What are the KM goals of SMEs based in the UK Energy sector?

Knowledge and KM

The findings show that the vast majority (83.3%) of SMEs acknowledge that knowledge is one of its most competitive factors. However, even though the vast majority of SMEs based in the UK Energy sector acknowledge the importance of knowledge, the majority (57.6%) of SMEs have not heard of KM. This may indicate that the publicity and marketing of KM has not penetrated the majority of the SME market in this sector. Furthermore, the majority (66.7%) of these SMEs claim not to allocate resources to KM activities, maybe as a result of the majority of SMEs not having heard of KM.

Given that the majority of SMEs have not heard of the term KM, a different term was used in the questionnaire to determine if SMEs implemented and benefited from KM related activity. Consequently, the findings showed that the majority (43.7%) of SMEs have: "....realised significant benefits from developing a knowledge-conscious style of management and from specific knowledge actions". This may indicate that the majority of SMEs do implement KM-related activities but do not term this activity as "KM".

KM and Strategy

From a strategic perspective, the findings show that the vast majority (85.2%) of SMEs do not have a formal KM strategy to potentially coordinate their KM-related activities. However, even though the majority of SMEs claim not to have a formal KM strategy, the findings show that the majority (50.9%) of SMEs claim to identify key knowledge it needs to realise its strategic goals and objectives. Furthermore, the majority (33.4%) of SMEs claim to continuously map or identify the knowledge within its organisation. This may indicate that the majority of SMEs in the UK Energy sector do practice elements of the formal KM strategy by identifying the key knowledge it needs to realise its strategic ambitions and sustains this activity through the continuous mapping or identification of its knowledge assets. However, SMEs maybe very unlikely to formulate a formal KM strategy to coordinate the

activities associated with identification of knowledge and its continuous mapping.

KM Activities

Even though, as discussed above, the majority of SMEs have not heard of KM, the findings show that SMEs do implement KM activities associated with each of the KM processes from the KMOLI model: Knowledge Development; Knowledge Acquisition; Knowledge Embodiment; Knowledge Sharing and Dissemination; and Knowledge Use and Revision. Furthermore, the findings show that these SMEs perform more Knowledge Development activities compared to the remaining KM processes.

Knowledge Acquisition

The findings show that the vast majority (89.1%) of SMEs claim to facilitate employees to acquire information and experience from within and/or outside the organisation. Consequently the majority of SMEs claim to implement 2/9 Knowledge Acquisition activities: Training (outsource) (58.2%); Purchase software (56.4%). SMEs also acknowledged the implementation of the remaining 7/9 Knowledge Acquisition but to a lesser extent i.e. less than 50.0%. This indicates that SMEs do implement KM activities associated with Knowledge Acquisition and maybe they are unsure or even unconvinced with regards to how these activities are associated with the term KM.

Knowledge Development

Furthermore, SMEs claim to implement 6/19 Knowledge Development activities: Create organisational capabilities built around clients' needs (63.6%); R&D (in house) (52.7%); Employee education (52.7%); Employee training (81.8%); Training (in house) (76.4%); Encourage learning and insight (50.9%); Ensure that staff can readily match customer problems with appropriate services (63.6%). Once again, this indicates that SMEs perform KM activities associated with Knowledge Development and maybe are uncertain with regards to how these activities are associated with KM. Furthermore, the findings show that these SMEs perform more Knowledge Development activities compared to the remaining KM processes.

Knowledge Embodiment

In addition, the majority of SMEs claim to implement 1/17 of the Knowledge Embodiment activities: Maintain project files (69.1%). This may indicate that

SMEs have a lesser focus or resources to expend on the organisation and collection of explicit knowledge.

Knowledge Sharing & Dissemination

With regards to Knowledge Sharing and Dissemination, the vast majority (85.4%) of respondents indicate that they make their employees aware of information and experience accessible to use for current projects or activities. Furthermore, SMEs implemented 2/25 Knowledge Sharing and Dissemination activities: Share knowledge with customers and partners (59.2%); Make product information easily available to employees and customers (61.2%). In addition, the vast majority (87.8%) of respondents indicate that they encourage their employees to disseminate information and experience which may be useful to other employees within the organisation. So, in general, the findings indicate that the SMEs acknowledge the importance of sharing and disseminating knowledge within its organisation. Even though, the majority of SMEs did not perform more of the listed activities associated with Knowledge Sharing and Dissemination, it maybe that these SMEs practice SME-specific activities which were not captured in this list of activities.

Knowledge Use and Revision

The findings show that the vast majority (79.1%) of respondents agree (and strongly agree) that they facilitate the use of information and experience from within the organisation for new or improved products/services/processes. This may indicate that SMEs acknowledge the importance of utilising the existing knowledge available in the organisation to further the SMEs goals and objectives.

Furthermore, SMEs implement 4/19 Knowledge Use and Revision activities: Internal or external audits (69.4%); Performance appraisals (61.2%); Enable flexible solutions rather than off-the-shelf products (57.1%); Ensure sales proposals build on previous successful approaches (57.1%). This indicates that SMEs implement activities associated with KM even though the findings show that the majority of SMEs have not heard of KM.

KM Relationships

This section summarises the key findings and discussion points with regards to the KM relationships used for the exploratory analysis to ascertain an association which was statistically significant. The findings show a mix of results, associations which were statistically significant and statistically

insignificant. The statistically insignificant findings require further exploration to determine a relationship which is statistically significant.

Knowledge and KM

The findings show that the majority (55.6%) of SMEs, which acknowledge that knowledge is one of their most competitive factors, have not heard of KM [$p > 0.05$; 0.639 – FET]. This may indicate that the majority of SMEs which acknowledge and utilise its knowledge assets do so without being aware of the concept and practice of KM.

Furthermore, even though the findings show that the majority of SMEs have not heard of KM, the majority (54.2%) of SMEs, which have heard of KM, allocate resources to KM activities [$p < 0.05$; 0.004 - Chi-square Test; $\phi = 0.395$ - Phi-co-efficient]. This indicates that the majority of SMEs which have encountered the concept and practice of KM subsequently pursue the realisation of KM in its organisational context through the allocation of resources towards KM activities which would help the SME utilise and develop its knowledge assets.

KM and Strategy

Nevertheless, from these SMEs which allocate resources to KM activities, the findings show that the majority (52.9%) of these respondents do not have a formal KM strategy [$p < 0.001$ - FET] to help coordinate these KM activities. However, the majority (74.1%) of SMEs, which 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives, do not have a formal KM strategy. This may indicate that SMEs do practice elements of a formal KM strategy to help guide their KM activities but do not use the term formal KM strategy. Furthermore, the vast majority (87.5%) of SMEs, which have a formal KM strategy, 'strongly agree' and 'agree' that they identify knowledge to achieve their strategic goals and objectives [$p <0.05$; 0.006 - Chi-square Test; $\phi = 0.515$ - Phi-co-efficient]. In addition, the vast majority (88.9%) of SMEs, which allocate resources to KM activities, 'strongly agree' and 'agree' that they identify key knowledge to achieve their strategic objectives [$p <0.05$; 0.001 - Chi-square Test; $\phi = 0.590$ - Phi-co-efficient].

In addition, the findings show that the majority (64.7%) of SMEs, which 'strongly agree' and 'agree' that they continuously map knowledge within their organisation, do not have a formal KM strategy [$p <0.05$; 0.016 - Chi-square Test; $\phi = 0.478$ - Phi-co-efficient]. This indicates that the majority of

SMEs sustain and maintain their knowledge assets by continuously mapping or identifying without the need of a formal KM strategy.

KM Activities

This section summarises the key findings in relation to the KM activities of SMEs based in the UK Energy sector to determine the affect of KM awareness and a formal KM strategy on the implementation of KM activities. The relationships provided a mix of results, associations which were statistically significant and statistically insignificant. The statistically insignificant findings require further exploration to determine a relationship which is statistically significant.

KM Activities and KM Awareness

As discussed in the previous section, the majority of SMEs implemented 6/19 activities associated with Knowledge Development. However, from the SMEs which have encountered the concept and practice of KM, the findings show that these SMEs implemented 11/19 of these Knowledge Development activities. The association between these activities and KM awareness was found to be statistically insignificant and subsequently requires further exploration to determine a relationship which is statistically significant.

Similarly, for the processes: Knowledge Acquisition (from 2/9 to 6/9; 1/6 was statistically significant); Knowledge Embodiment (from 1/17 to 14/17; 4/14 were statistically significant); Knowledge Sharing and Dissemination (from 2/25 to 16/25; 2/16 were statistically significant); and Knowledge Use and Revision (from 4/19 to 9/19; 2/9 were statistically significant).

Nonetheless, these findings may indicate by raising the awareness of the concept and practice of KM in the SME sector, more KM activities could be implemented by the SME hence helping the SME utilise and develop its knowledge assets.

KM Activities and Strategy

With regards to a formal KM strategy to coordinate the KM activities for the KM processes: Knowledge Development; Knowledge Acquisition; Knowledge Embodiment; Knowledge Sharing and Dissemination; Knowledge Use and Revision; the findings clearly show that SMEs which implement these KM activities do not have a formal KM strategy to coordinate the activities. SMEs, which implement 19 out of the 19 Knowledge Development Activities listed above, do not have a formal KM strategy (4/19 of these activities were

statistically significant). Also, Knowledge Acquisition activities (9/10; 0/9 were statistically significant); Knowledge Embodiment (17/17; 7/17 were statistically significant); Knowledge Sharing and Dissemination (25/25; 4/25 were statistically significant); Knowledge Use and Revision (17/17; 2/17 were statistically significant).

. This may indicate that SMEs which implement the KM activities associated with the KMOLI cycle do not acknowledge the use of a formal KM strategy and maybe the benefits of using a formal KM strategy to coordinate and manage these activities.

What are the innovation goals of SMEs based in the UK Energy sector?

With regards to innovation activity in SMEs, the findings show that the majority (53.6%) of respondents indicate that they allocate resources to innovation activities. This may indicate that SMEs acknowledge the importance of innovation and are actively in pursuit of realising its innovative potential by allocating resources towards innovation activities. However, the findings also show that the vast majority (81.5%) of respondents indicate that they do not have a formal innovation strategy. This may indicate that SMEs don't acknowledge the benefits of a formal innovation strategy to its innovative efforts.

Nonetheless, the findings clearly show the great deal of innovation activity within SMEs based in the UK Energy sector. For example, the majority (52.0%) of respondents indicate that they agree (and strongly agree) that they have systems and processes in place which facilitate ideas for new or improved products, services, processes from idea discovery to sustained implementation. This may indicate that SMEs acknowledge the importance of creativity in generating ideas and the use of systems and processes to identify innovative ideas for implementation. Furthermore, the majority (67.3%) of respondents indicate that they have made improvements in their marketing concepts or strategies; implemented new or significantly changed corporate strategies (54.5%); implemented new or significantly changed internal processes (54.5%).

However, the findings show that the majority (58.3%) of respondents, which have introduced products and/services onto the market, which were improved or new to your organisation, developed this on their own. This may indicate that the majority of improvements which SMEs develop and implement are based on their own resources. Given the finance and resource constraints which SMEs encounter in their innovation projects, as discussed in the literature review, it could be useful to ascertain the allocation of resources to these innovation projects and the subsequent return on investment.

Even though the vast majority (85.7%) of SMEs, which 'strongly agree' and 'agree' that they have systems and processes in-place to facilitate ideas from discovery to implementation, allocate resources to innovation activities [$p < 0.001$ - Chi-square Test; $\phi = 0.644$ - Phi-co-efficient], the findings show that the majority (64.3%) of SMEs, which 'agree' and 'strongly agree' that they have systems and processes which facilitate ideas from discovery to

implementation, do not have a formal innovation strategy [p <0.05; 0.010 - Chi-square Test; ϕ = 0.502 - Phi-co-efficient]. This may indicate that SMEs are effectively using systems and processes to generate and implement ideas without the use of a formal innovation strategy to coordinate these activities.

The majority (66.7%) of SMEs, which allocate resources to innovation activities, do not have a formal innovation strategy. p = 0.001 [FET].

Furthermore, the majority of SMEs acknowledge developing improvements in a number of areas within the SME without the use of a formal innovation strategy. For example, 73.3% of SMEs, which have made improvements in their corporate strategy, do not have a formal innovation strategy [p >0.05; 0.083 – FET]; 75.0% of SMEs, which have significantly changed their organisation's marketing concepts or strategies, do not have a formal innovation strategy [p >0.05; 0.081 – FET]; 87.0% of SMEs, which have implemented new or significantly changed organisational structures, do not have a formal innovation strategy [p >0.05; 0.299 – FET]. However, the findings show that the majority (57.1%) of SMEs, which have implemented new or improved management techniques, have a formal innovation strategy [p <0.05; 0.017 – FET]. This may indicate that a characteristic of SMEs, which have a formal innovation strategy in place, acknowledge and implement improvements to their management practices.

This is further reflected in SMEs, which have introduced products and /or services onto the market which were improved or new to their organisation [77.8%; p >0.05; 0.133 – FET]; innovations developed by a third party [88.9%; p >0.05; 0.467 – FET]; innovations developed together with a third party [90.0% p >0.05; 0.339 – FET]; and innovations developed by the SME without any third party [68.9%; p <0.05; 0.008 – FET]. This may indicate that SMEs are realising innovations without the use or need of a formal innovation strategy. However, further exploration will be required to verify and qualify these interpretations.

However, with regards to allocating resources to innovation activities, the majority of SMEs which have made improvements within the SME already allocate resources to innovation activities. This may indicate that SMEs do not need a formal innovation strategy to coordinate its innovation activities. For example, the majority (66.7%) of SMEs, which have implemented new or significantly changed corporate strategies, allocate resources to innovation activities [p <0.05; 0.048 - Chi-square Test; ϕ = 0.267 - Phi-co-efficient]; 64.9% of SMEs, which have significantly changed their marketing concepts or

strategies, allocate resources to innovation activities [p <0.05; 0.028 - Chi-square Test; ϕ = 0.297 - Phi-co-efficient]; 58.3% of SMEs, which have implemented new or significantly changed organisational structures, allocate resources to innovation activities [p >0.05; 0.620 - Chi-square Test]; 75.0% of SMEs, which implement new or advanced management techniques. allocate resources to innovation activities [p >0.05; 0.193 – FET]; 63.3% of SMEs, which implement new or significantly changed internal processes, allocate resources to innovation activities [p >0.05; 0.152 - Chi-square Test; ϕ = 0.193 - Phi-co-efficient].

Innovation activities

The innovation activities associated with the Innovation Model discussed previously in Chapter 5, has three components: Ideas; Tacit Knowledge; and Explicit Knowledge. A list of activities were designated for each of these activities by Oxbrow and Hart (2002) listed in Appendix 3. Subsequently, these activities were incorporated into the questionnaire to ascertain SMEs innovation activities with regards to the KMOLI Cycle. The following sections provide an overview of the key results.

Ideas

The findings show that the majority of SMEs did not implement any of the 11 activities associated with "Ideas". However, some SMEs did implement these activities (less than 50.0% of the respondents) subsequently this may indicate that SMEs use other activities to generate ideas which were not captured via the questionnaire survey. As a result, it could be valuable to further explore how SMEs generate ideas for innovation purposes. However, this is beyond the scope of this study.

Tacit Knowledge

SME implemented 4/11 activities associated with "Tacit Knowledge": Create organisational capabilities built around clients' needs (63.6%); Ensure that staff can readily match customer problems with appropriate services (63.6%); Enable flexible solutions rather than off-the-shelf products (57.1%); Ensure sales proposals build on previous successful approaches (57.1%). This indicates that SMEs acknowledge the importance and use of developing "Tacit Knowledge".

Explicit Knowledge

The findings also show that SMEs implement 1/14 activities associated with "Explicit Knowledge": Make product information easily available to employees and customers (61.2%).

Innovation Activities and Allocation of Resources to Innovation

The findings showed an increase in the implementation of innovation activities for SMEs which already allocate resources to innovation activities. This may indicate that SMEs, which acknowledge the importance of innovation by allocating resources towards it, may be more likely to drive continuous improvement. For example, SMEs, which allocate resources to innovation activities, implement 10 out of the 11 activities associated with "Ideas" (3 out of these 10 activities were statistically significant). However, originally the majority of SMEs were found not to implement these activities.

Similarly, SMEs, which allocate resources to innovation activities implement 10 out of the 11 activities associated with "Tacit Knowledge" (0 out of these 9 activities were statistically significant); and SMEs which allocate resources to innovation implement all activities associated with "Explicit Knowledge" (1 out of these 13 activities were statistically significant).

Innovation Activities and Innovation Strategy

The findings clearly show that the majority of SMEs which implement innovation activities do not use a formal innovation strategy. For example, the majority of SMEs which implement activities associated with "Tacit Knowledge" do not have a formal innovation strategy for all 11 activities. Similarly, SMEs which implement 14 out of the 14 activities associated with "Explicit Knowledge" do not have a formal innovation strategy; 0 out of these 14 activities have $p < 0.05$. Also, SMEs, which implement 10/11 activities associated with "Ideas", do not have a formal innovation strategy. However, 1 out of these 11 'Idea' Activities was implemented with a formal innovation strategy; this 1 activity has $p < 0.05$ (innovative culture' [7]). This may indicate that a characteristic of SMEs which have a formal innovation strategy in place is that they develop an innovative culture within the organisation

What are the relationships, processes, practices and understandings between KM and innovation in SMEs based in the UK Energy sector?

This section explains the findings and discussion points with regards to the relationship between KM and Innovation. It was originally intended to further explore these findings to ascertain if and how SMEs use KM to support innovation.

The findings show that 50.0% of SMEs, which have a formal KM strategy, have a formal innovation strategy [$p < 0.05$; 0.021 – FET]. This indicates that SMEs which have a formal KM strategy are equally likely to have or not have a formal innovation strategy to coordinate the organisations KM and innovation activities. Even though the findings have shown that SMEs are unlikely to have both KM and innovation strategies, it could be valuable to further explore if and how SMEs, which have a formal KM strategy, acknowledge a link between its formal KM and innovation strategies.

Nevertheless, the findings show that the vast majority (83.3%) of SMEs, which allocate resources to KM activities, also allocate resources to innovation activities [$p < 0.05$; 0.004 – FET]. This may indicate that these SMEs acknowledge an association between its KM and innovation activities in order to enhance the SME's competitiveness. Furthermore, all (100.0%) of SMEs, which allocate resources to KM activities, 'agree' and 'strongly agree' that they have systems and processes in place which facilitate ideas for new or improved products/services/processes from idea discovery to sustained implementation of the idea [$p < 0.001$ – FET].

However, the findings show a mixed response with regards to SME implementing improvement within the organisation and the allocation of resources to KM activities. For example, the majority (51.7%) of SMEs, which have implemented new or significantly changed corporate strategies, do not allocate resources to KM activities [$p < 0.05$; 0.0121 – FET]; and the majority (56.5%) of SMEs, which have implemented new or significantly changed organisational structures, do not allocate resources to KM activities [$p > 0.05$; 0.142 – FET]; and the majority (63.3%) of SMEs, which implemented new or significantly changed internal processes, do not allocate resources to KM activities [$p > 0.05$; 0.387 – FET]. Nevertheless, the majority (63.9%) of SMEs, which have significantly changed their marketing concepts or strategies, allocate resources to KM activities [$p > 0.05$; 0.384 – FET]; and

57.1% of SMEs, which have implemented new advanced management techniques, allocate resources to KM activities [p >0.05; 0.158 – FET]. This indicates that SMEs which make improvements to strategy, operations and structure do not acknowledge the importance of allocating resources to KM. On the other hand, SMEs which make improvements in marketing and management allocate resources to KM activities. It could be valuable to further explore these relationships to verify these responses.

The following section identifies the main discrepancies between the initial expectations and actual findings of this study in order to provide a platform for future work.

Summary:

The management of knowledge is critical in sustaining and developing innovation processes in organisations. The literature shows a scarcity of research conducted with investigating how KM supports the process of innovation and subsequently requires further exploration to further develop the understanding between KM and Innovation.

The KMOLI Cycle was formulated using socially-constructed KM models incorporating concepts from Organisational Learning. The innovation element of the KMOLI Cycle comprises of an Innovation Model adapted from Oxbrow and Hart (2002) whom formulated an innovation model for continuous improvement in organisations of all sizes. This adapted Innovation Model was incorporated into the KMOLI Cycle.

Chapter 7: Conclusions

7.1 Research Problem

The literature review showed a clear knowledge gap with regards to KM and innovation studies in the context of SMEs, even more so for SMEs in the UK energy sector. However, this knowledge gap has only recently been acknowledged following the launch of the Journal of Energy Sector Management which endeavours to close this gap in knowledge by focusing on a variety of management areas including KM and innovation in UK energy sector SMEs. In addition, one of the key stakeholders of this research project – a business consultancy firm based in Sheffield – further highlighted the need of KM and innovation studies for UK energy sector SMEs which resulted in the start of this collaborative research project with the University of Sheffield.

7.2 Contribution

This study adds to the knowledge of KM and Innovation practices and strategies of SMEs. However, the unique contribution of this study is its exclusive focus on the UK energy sector where the literature review showed a scarcity of literature exploring KM and Innovation in SMEs. Furthermore, an additional contribution of this study is its findings related to the KM and Innovation relationship within SMEs in the UK energy sector. The resulting questionnaire findings could be used to further explore this phenomena and cross-analyse with other relevant research areas.

In addition, this thesis presents the Knowledge Management for Organisational Learning and Innovation cycle which embodies a theoretical framework to realise innovation through KM for UK energy sector SMEs. This framework builds on previous KM and innovation frameworks, namely the socially-constructed KM model proposed by McAdam and Reid (2001) and the Continuous Innovation model proposed by Oxbrow and Hart (2002). The KMOLI model reviews and links these previous models together with key learnings from the Organisational Learning Life Cycle posited by Rowely (2001).

7.3 Key Discrepancies and Commonalities

It is widely acknowledged that the strategic element of KM is essential for successful KM implementation in any organisation (Zack, 1999; Drew, 1999). However, even though Biejerse (2000), in his study of Dutch SMEs, concluded that SMEs have many instruments or activities related to KM he also acknowledged the lack of a systematic approach to KM at both strategic and tactic levels. The findings of this study seem to confirm that assertion. However, and despite claiming that they did not implement KM, most SMEs are in fact implementing KM activities that were mapped against the KMOLI Cycle. That is, SMEs recognise the value of knowledge and allocate resources to KM activities, but do this implicitly and intuitively, rather then in a formalised manner. This means that SMEs do not implement systematically the totality of theoretical activities that could be expected, but rather use a flexible approach to KM, selecting those activities that they perceive as imperative at a particular moment in time. This may be due to finance and resource constraints. Nevertheless, SMEs could be termed as opportunistic users of KM rather then systematic and formal ones.

Similarly, with regards to innovation, SMEs also show a lack of a strategic approach to innovation, therefore confirming findings of other authors such as Humphreys et al. (2006). However, generally, SMEs are more innovation active rather than KM active. Furthermore, the findings seem to indicate that there is a close association between awareness of KM and awareness of innovation. It is clear that most SMEs do not adopt formal innovation and KM strategies. However, it seems equally conclusive that the adoption of KM and Innovation formal strategies is very closely associated to one another. This seems to show an evolution in SMEs strategic thinking towards an understanding that in order to gain from innovation opportunities there is a need to consider KM strategic components.

7.4 Recommendations

It is widely acknowledged in Business and Management literature that Innovation creates economic and social value through the generation, development and implementation of ideas. These new ideas are behind the production of new or significantly improved products and processes which enhance competitiveness. The process of innovation depends heavily on knowledge which is acquired, managed and disseminated through Knowledge Management (KM). Hence, the global interest in KM and the consensus that

KM is an ideal vehicle to enable innovation. As a result, the process of Knowledge Management is crucial in encouraging and sustaining competitive innovation processes that create economic and social value.

It is clear that SMEs have more finance and resource constraints compared to larger and well-financed organisations. Consequently, it is imperative for SMEs to prioritise and then manage their resources and projects on an ongoing basis. The introduction of a formal KM initiative would not only enhance the effective management of existing resources and innovation capabilities but provide a platform for sustainable growth.

In order to establish a KM approach inclusive of Innovation related principles and practices in SMEs, the following factors need to be taken into account.

7.4.1 Awareness and Applicability:

In the majority of cases respondents were not aware of KM and how this concept and practice could deliver business benefit.

Consequently, the design and execution of an initiative to raise KM awareness (including key KM concepts and terminology) and how the core KM principles and practices could deliver direct business benefit to each respondent organisation.

7.4.2 Strategic Components:

In the majority of cases respondents acknowledge the allocation of resources to innovation activities but lack strategy to drive innovation in their environment. In the majority of cases this would result in the inefficient and ineffective use of scarce and valuable resources on SME initiatives.

There is evidence to show the direct positive impact of KM and Innovation strategies on SME business competitiveness. A KM and Innovation strategy would provide an effective and resourceful approach in the allocation of resources to key KM and innovation related activities at any one given time.

Furthermore, the vast majority of respondents do not acknowledge a relationship between their KM and Innovation practices. There is evidence to show the direct positive impact of a clear strategy which aligns KM and Innovation activities on SME business competitiveness. Consequently, the design and execution of an impact study to show the positive impact of this strategy in the SME's context would provide a platform for a clear strategic KM initiative inclusive of Innovation principles and practices, by combining

the management of knowledge with the management of ideas to deliver business value.

7.4.3 Organisation Systems and Processes:

Furthermore, in the majority of cases the activities and instruments for each of the KM and Innovation processes depicted in this report were not acknowledged. It is imperative to have the relevant instruments and activities in the SME in order to realise the goal of enhancing business competitiveness through KM and Innovation.

As a result, at an operational and tactical level, the investigation of the applicability of each KM and Innovation process and their subsequent activities and instruments depicted in this report is highly recommended. Alternatively, a review of SME-specific activities to KM and innovation could be valuable.

Furthermore, the consideration and conveying of appropriate best practices in KM and Innovation (from the business and management literature and case studies) would provide flexibility in opting for the most appropriate activities and instruments to drive KM and Innovation strategies in order to add direct business value.

7.5 Future Work

The following discrepancies were identified and presented for future work. These discrepancies are divided into three areas: Knowledge Management; Innovation; Knowledge Management and Innovation:

7.5.1 Knowledge Management:

KM Awareness (Q7)

The majority of SMEs claimed not to have heard of Knowledge Management. Explore why the majority of SMEs have not heard of KM.

KM Strategy (Q11)

The majority of SMEs do not have a formal KM strategy. Explore why the majority of SMEs don't use a formal KM strategy. Is it because they have not heard of KM?

Allocation of resources to KM activities (Q12)

The majority of SMEs do not allocate resources to KM activities. Explore why the majority of SMEs do not allocate resources to KM activities.

Acknowledgement of Knowledge as a Competitive factor and KM Awareness (Relationship 1)

Explore why SMEs, which acknowledge that knowledge is one of their most competitive factors, have not heard of KM.

KM Strategy and Allocation of Resources to KM activities (Relationship 3)

Explore why SMEs which allocate resources to KM activities do not have a formal KM strategy

KM Strategy and Identification of Key Knowledge to achieve Strategic Goals and Objectives (Relationship 4)

Investigate why SMEs, which identify key knowledge to achieve strategic goals and objectives, do not use a formal KM strategy.

KM Strategy and Continuous Mapping or Identification of Knowledge (Relationship 6)

Investigate why SMEs, which continuously map or identify their knowledge, don't use a formal KM strategy

KM activities and Allocation of Resources to KM Activities (Relationship 8)

Investigate why SMEs, which implement KM activities, do not allocate resources to KM activities.

KM activities and Formal KM Strategy (Relationship 9)

Explore why SMEs, which implement KM activities, don't use a formal KM strategy.

7.5.2 Innovation:

Innovation Strategy (Q15)

The majority of SMEs don't have a formal innovation strategy. Explore why the majority of SMEs don't have a formal innovation strategy.

Systems and Processes to facilitate ideas from discovery to implementation and Innovation strategy (Relationship 10)

Investigate why SMEs, which have systems and processes for idea discovery to implementation, do not have a formal innovation strategy.

Innovation Strategy and Organisational Improvements (Relationship 12)

Explore why SMEs, which have made improvements, not have a formal innovation strategy.

Innovation Strategy and Introduction of new or improved products and services (Relationship 13)

Explore why SMEs, which have introduced new or improved products or services, not have a formal innovation strategy

Innovation Strategy and Allocation of Resources to Innovation Activities (Relationship 18)

Investigate why SMEs, which allocate resources to innovation activities, don't have a formal innovation strategy.

Innovation activities and Formal Innovation Strategy (Relationship 20)

Investigate why SMEs, which implement the innovation activities associated with the KMOLI Cycle, do't have a formal innovation strategy.

7.5.3 Knowledge Management and Innovation:

KM Strategy and Innovation Strategy (Relationship 21)

Investigate why SMEs, which have a formal KM strategy, do not have a formal innovation strategy/

Allocation of resources to KM activities and Organisational improvements (Relationship 24)

Explore why SMEs, which have made improvements, not allocate resources to KM activities.

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Appendices