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Knowledge management styles and  
performance: a knowledge space model  
from both theoretical and empirical  
perspectives

Maen Al-Hawari  
University of Wollongong

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**Knowledge Management Styles and Performance: a  
Knowledge Space Model from both Theoretical and  
Empirical Perspectives**

**A thesis submitted in fulfilment of the  
requirements for the award of the degree of**

**DOCTOR OF PHILOSOPHY**

**from**

**THE UNIVERSITY OF WOLLONGONG**

**by**

**MAEN AL-HAWARI**

**MIS  
High. Dip IS  
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**INFORMATION SYSTEMS**

**2004**

## **CERTIFICATION**

I, Maen Al-hawari, declare that this dissertation, submitted in fulfilment of the requirements for the award of Doctor of Philosophy in Information Systems, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Maen Al-hawari

August 2004

## **ABSTRACT**

This thesis describes post-positivist research in the field of information systems, more specifically, in knowledge management. For company managers, deploying large-scale information systems such as knowledge management systems, the selection of an appropriate style for knowledge management initiatives are recognised as a dilemma. The study aims at helping to improve information systems applications for knowledge management in complex, technology-oriented organisations. The research addresses this dilemma by studying the relationships between organisational performance, knowledge availability, knowledge codification, knowledge application and knowledge management styles.

From an extensive study of the literature, an innovative knowledge space (K-space) model of organisational knowledge is developed as the first stage of the research. This leads to the identification of four knowledge management styles and a framework that relates these styles to knowledge creation and improved organisational performance.

The K-space model is adapted from the I-space framework (Boisot, 1995, 1998) with its three dimensions of diffusion, codification and abstraction, to bring into play three corresponding knowledge dimensions of availability, codification, and application. Knowledge is viewed as an object in K-space so that knowledge processes are forces that act to move the knowledge objects within the three dimensions of K-space. The four traditional knowledge conversion processes of Nonaka and Takeuchi, (1995) socialisation, combination, internalisation and externalisation (SECI), map onto two-dimensional planes in K-space. Taking advantage of the three dimensions of K-space, four new dynamic knowledge conversion process are identified, namely Adoption, Standardisation, Systemisation and Articulation. These are used to define the four knowledge management styles.

The research framework suggests that knowledge creation, in terms of knowledge availability and codifiability, mediates the relationship between the four knowledge management styles and organisational performance. In addition knowledge application moderates the relationship between these knowledge creation processes. A set of hypotheses is generated from the framework and a survey instrument constructed to empirically test the hypotheses.

A pilot study involving 45 managers was used to check the reliability and validity of the constructs in the questionnaire. The resulting questionnaire was mailed to 338 organisations around Australia in different industries. Confirmatory analyses were used to check the constructs and multiple linear regression, simple linear regression and MANOVA analysis were used to test the set of hypotheses.

The results confirm that an organisation can improve its performance through better management of its knowledge capabilities. There is a particular benefit of deploying a balanced of knowledge management styles combining the human and technology perspectives. Knowledge management styles are shown to contribute positively to both knowledge codification and availability. Knowledge applicability is confirmed as a moderator factor between knowledge availability, as well as knowledge codification, and organisational performance. Using a MANOVA analysis, the four knowledge management styles are found to be deployed in significantly different ways by organisations in different industry types.

The findings demonstrate that the K-space model provides the basis for a new way of conceptualising knowledge creation processes within organisations. They underline the importance of continuing research that adds to the understanding of knowledge management capabilities in an organisation. Therefore, this study makes a significant

contribution to a burgeoning topic that is of increasing importance to both the academic literature and the organisational practice of knowledge management.



## PUBLICATION FROM THE RESEARCH

The following papers and publications have been produced from the research reported in this thesis.

1. Al-hawari, M., and Hasan, H. (2004). Knowledge Creation Processes as Management styles for Organisational Performance. *Proceeding of CISTM Conference. Transforming Business Performance through Knowledge Management. Alexandria, Egypt, 2004*
2. Al-hawari, M., and Hasan, H. (2004). Organisational Culture and Knowledge Creation Processes. *Proceeding of the 2004 International Business Information Management Conference. Amman, Jordan, 2004*
3. Al-hawari, M., and Hasan, H. (2004). Knowledge Creation Processes and the Effect of the Culture. *Accepted for the Fourth International Conference on Knowledge, Culture and Change in Organisations. University of Greenwich , London, 2004*
4. Al-hawari, M., and Hasan, H (2004). Knowledge Management Styles and Organisational Performance: An empirical study in a K-Space Framework. *Journal of Information and Knowledge Management (JIKM). Submitted*
5. Al-hawari, M., and Hasan, H (2004). An integrated Framework for the Study of Knowledge Management: An Exploratory Study. *Unpublished manuscript. Wollongong, Australia: University of Wollongong.*
6. Al-hawari, M., and Hasan, H. (2004). The Importance of the Four Knowledge Management Styles to the industry: Using HSD. Post Hoc Test. *Unpublished manuscript. Wollongong, Australia: University of Wollongong.*
7. Hasan H., Al-hawari M. (2003). Management styles and performance: A Knowledge Space Framework. *Journal of Knowledge Management*, Vol. 7 No. 4, pp. 15-28
8. Al-hawari, M., and Hasan, H. (2002). Evaluating the Knowledge Assets of Innovative Companies. *Australian Journal of Information Systems*, Vol. 10 No. 1, pp.88-99
9. Al-hawari, M., and Hasan, H. (2002). Evaluating the Knowledge Assets of Innovative Companies. *Proceeding of SME in global economy conference Wollongong university, Australia*
10. Al-hawari, M. (2002). The Development and Evaluation of a K-Space Framework for the Study of Knowledge Management. *PhD Proposal Presented in Consortium Doctoral day at ACIS 2002, and Published in the Proceedings of the Conference, Melbourne, Australia.*

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A respect and very special appreciation goes to my parents, for encouraging and supporting me. I cannot forget to thank my brother Mohammad who has believed in my ability to achieve my goals. I also would like to thank my brothers; Mahmood and Moaen, and sisters; Manal, Muna, Eiman, Anwar, niece and nephews, who have believed in my ability and patiently waited for me.

Finally, I dedicate this dissertation to my dearest people father and mother, who have always inspired me to challenge myself.

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## ACRONYMS

AC	Absorptive capacity
CKO	Chief Knowledge Officer
CRCC	Create the Right Context Cycle
GLKC	Globalise Local Knowledge Cycle
IKVC	Instill Knowledge Vision Cycle
I-Space	Information Space
KC	Knowledge creation
KM	Knowledge management
KMS	Knowledge Management Style
K-Space	Knowledge Space
MANOVA	Multiple Analysis of Variance
MCC	Manage Conversations Cycle
MKAC	Mobilise Knowledge Activists Cycle
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
SECI	Nonaka's SECI Model
SME	Small and Medium Enterprise

# **CHAPTER 1 INTRODUCTION**

## **1.1 Aims and Motivation for the Research**

This introductory chapter explains the need to ask the research questions and take the approach described in this thesis in terms of the limited and fragmented nature of the literature on knowledge management (KM). Not only is knowledge management research fragmented across a variety of disciplines, but it is also fragmented conceptually, particularly with respect to those knowledge concepts identified as significant for organisations, such as diffusion, codification and application, as well as their relationship to management strategies and organisational performance. Knowledge diffusion, codification and application are recognised in knowledge-based view approach, the source of superior performance( Decarolis & Deeds, 1999; Spender, 1996; Grant, 1996; Nonaka, 1994; Demtsetz, 1991). Consideration of each of these various concepts and the relationships between them is necessary for a comprehensive understanding of knowledge management in organisations.

From both research and applied perspectives there are few large-scale studies published on this topic. There is a need to combine and concentrate the efforts of academic researchers and organisational managers in a holistic approach to practical knowledge management. There is a limited understanding of what determines the most effective knowledge management strategies and there is currently no tested framework that unifies all relevant concepts in an easy to understand and practical way. As such, one of the principal goals of this study is to develop an integrated framework, which can explain and guide the successful management of knowledge in organisations. Such a framework would benefit research in knowledge management and also help to eliminate

confusion as to where an organisation should focus its knowledge management efforts for optimum organisational performance.

The two reasons motivating the study presented in this thesis are as follows. Firstly, knowledge management strategies include both human strategies and technological strategies. Managers face a dilemma in selecting the most effective combination of strategies to manage their knowledge and to solve organisational problems. Both selecting and deploying the most effective strategies is a complex task and considerable effort may be needed to implement the best activity, or set of strategies. Such implementation may involve hiring people who have the ability to run and manage the activity or set of strategies in the organisation to achieve the required improvement in performance. What contributes to organisational performance differs from one organisation to another and from one industry to another, but there is no doubt that both effort and a willingness to achieve define the level of performance in an organisation.

Secondly, there is a lack of substantial empirical studies in knowledge management (Leech & Sutton, 2002), as the majority of studies reported in the literature come from single cases to small sample sizes where the generality of the results is significantly reduced (Gold, 2001). Rigorous development of a model of the salient issues is warranted, especially if it leads to a means of measurement of relevant constructs.

In recent times, much has been written and many theories have been offered regarding the phenomenon of knowledge management and its implementation. However, little empirical research has been conducted to support these theories. Based on the domain definitions grounded in the literature, this research represents original work from an



empirically focus, knowledge application perspective. The research method develops an integrative framework, which is utilised in the derivation of survey instruments. An exploratory approach is undertaken to build the instruments of the constructs followed by a confirmatory analysis. The development of the framework, the constructs of the survey and its empirical evaluation are the main strengths of the work presented in this thesis.

In addition to the value in this research, organisational managers could also use the survey instruments to gauge gaps in the application of organisational knowledge, as this is a particular focus at the whole organisational domain. There is a lack of empirical support for the effectiveness and importance of practical knowledge management strategies. Many managers sink billions of dollars into technology rather than focusing on developing their own integrated strategies to manage their organisational knowledge. The research presented here aims to provide empirical evidence in this area of knowledge management.

An auxiliary goal of the research is to concentrate the efforts of both academic researchers and managers on the elements of which organisational knowledge is constructed, such as its diffusion, codification and application in a variety of forms. Both academic researchers and managers spend considerable time looking for the best definition of knowledge and knowledge management. It is the contention of the author that this effort would be better spent on investigating ways to determine how much knowledge is diffused, codified and applied at various levels of an organisation. Relating these results to the organisational performance would further knowledge

management research and help managers to improve organisational performance by identifying gaps in their knowledge management approach.

Before the precise research problem is discussed, research questions and approach are articulated, and historical view of knowledge management is presented followed by an overview to some relevant KM concepts in order to place them in perspective.

## **1.2 Historical Glimpse of Knowledge Management (KM)**

Until recently, organisations have taken knowledge for granted and not paid much direct attention to knowledge as a manageable asset or resource. The field of knowledge management is changing this, generating a new set of values for strategically managing organisational knowledge. The managers' perspective in a KM-intensive organisation is shifting from just controlling the source of knowledge to managing the process through which people are able to apply their knowledge, creating networks of internal and external knowledge. However, there are no easy or well-established rules for planning KM strategies or conducting KM strategies. Initial attempts may fall far short of achieving the desired goals. In addition, it is difficult to measure success or determine the monetary advantages of the investment in knowledge assets and resources.

Today, terms such as organisational performance, knowledge, knowledge management, knowledge creation, knowledge management styles, innovation, knowledge strategies have become popular buzzwords in organisational development.

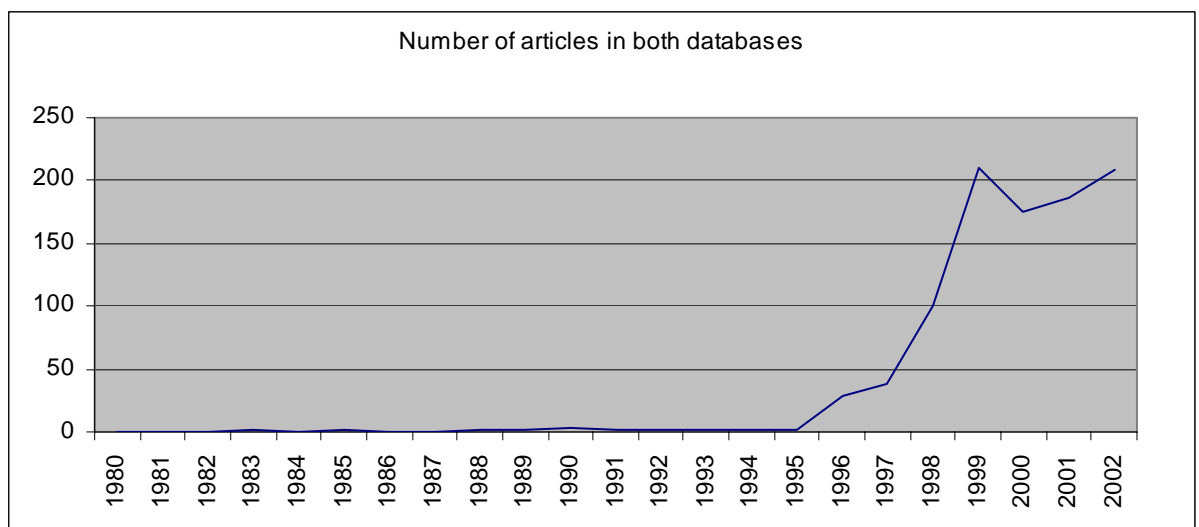
Knowledge management, as a concept, has changed over time. The investigation results of literature from 1980 to the present time reveals some important facts about the evolution of the knowledge management concept. These are shown in Table 1.1. It is significant that the number of journals dealing with the subject of KM has increased significantly from 1996 to 2002. The goal of this simple investigation is to give an overview of the increasing interest in knowledge management and its application in the business.

Data comes from academic databases such as Science Direct and Proquest. The search criteria used the term “knowledge management” in the abstract, title and keywords.

**Table (1.1): A short Survey of the KM Concept in the Literature from 1980-2002**

Year	Number of articles in both databases
1980	0
1981	0
1982	0
1983	1
1984	0
1985	1
1986	0
1987	0
1988	2
1989	2
1990	3
1991	1
1992	1
1993	2
1994	1
1995	1
1996	29
1997	38
1998	100
1999	210
2000	175
2001	186
2002	208

**Figure (1.1): Represents the Survey Result in Table 1.1**



The investigation shown in Table 1.1 reveals some facts on how people in different time periods thought about knowledge management. The following summarises important issues related to knowledge management over time.

### **1980-1985: Sense of Knowledge Management**

- Knowledge is different to either information or data. Further, it should be a base to support management decisions in order to take action (Martin, 1983).
- Knowledge management should reflect the immediate and long-term objectives of a business (Ibid).
- It is important to understand the technique that will be used to collect information. Managers must identify the exact information they need (Ibid).
- Knowledge management techniques, such as expert systems and knowledge base systems, should integrate with other applications in an organisation such as decision-making and planning systems (Donald, 1985).

### **1986-1990: Knowledge Management Technology**

- The firms were classified by the role played by technology in decision-making. Firms with high grades have knowledge technology and a sense of knowledge management in their strategies and planning (Alain, 1988).
- Knowledge management has been enabled through technologies such as databases, special catalogues and e-mail (Cronin & Davenport, 1990).
- Knowledge management technologies affect the way that corporate memory is used, resulting in increases in customer satisfaction, better use of time and job enrichment (Ibid).

- In the late 90s, people started to talk about the difficulties that face firms in integrating their technology tools and other applications such as databases (Strapko, 1990).

### **1991-1996: The need to integrate Knowledge Management Strategies and Technologies**

- With the ability of organisations to produce different data forms such as bitmaps, icons, text, sound and video in addition to basic alphanumeric, the need for knowledge management systems has escalated to deal with different forms of data and information (Stonebraker & Kemntz, 1991).
- Knowledge management technology, database management systems and communication technology have been integrated using different models to achieve different goals (Ram et al, 1992).
- Integration is not only shown in making knowledge management technologies work together, but is also shown in the balance of using different knowledge management strategies, whether involving technology, or human issues, or both (Nonaka & Takeuchi, 1995).
- Intellectual assets are given wider recognition within knowledge management strategies, since a greater recognition of intellectual assets leads to success (Petrash, 1996; Liloyd, 1996; Mullin, 1996).

### **1997- Present**

The theory of knowledge management is developed and studied from different perspectives such as philosophy, culture and technology.

## **1.3 Significant Aspects of Knowledge Management:**

### **1.3.1 Knowledge Management and Organisational Performance**

The investigation of knowledge and knowledge management history reveals some issues that imply the existence of a positive relationship between knowledge management and organisational functions such as innovation, profit and time saving. This provides greater motivation for knowledge management in organisation.

### **1.3.2 Knowledge Creation**

In general, creativity is connected to the innovation process and labelled, “idea generation” (Majaro, 1988). Heap (1989) defines creativity as the “synthesis of new ideas and concepts where innovation is the implementation of creativity”. Further, Titus (2000) defines creativity as “the birth of imaginative new ideas”. Knowledge creation is relatively similar to these definitions of creativity. Davenport et al (1998) defines knowledge creation as, “Chaotic, unstructured and unsystematic”, while Marakas (1999) defines knowledge creation as “the ability to originate novel and useful ideas”. To Bhatt (2000), knowledge creation occurs “when a firm acquires and adopts knowledge from others, it modifies knowledge to make it suitable”.

Knowledge creation has been recognised by some researchers as a cognitive activity (eg. Nonaka & Takeuchi, 1995; Kidd, 1998; Dretske, 1981). Kidd (1998) defines knowledge creation as, “Schemata, mental models and beliefs, a perception which reflects our image and reality and our vision of the future and what ought to be”. Dretske (1981) defines it as, “beliefs based on information”.

In the cognitive approach, knowledge can be developed from machine based logical information processing. According to Madhavan and Grover, (1998) cognition is more than “the property of solitary individual... the emerging pattern cognition is distributed across team members”. In the team-based knowledge creation, they added: “the individual brings his/her repertoire skills and strategies, which affect and are affected by the situation”. Team-based distributed cognition can be extended to organisational-based distributed cognition, where groups bring their repertoire skills and strategies; these effect and are affected by the situation.

The cognitive approach to knowledge creation reveals the ability to develop knowledge from processing information in a machine-like way. This demonstrates the capability of codifying knowledge. Further, when knowledge is ready to be used in a situation by an individual, group or whole organisation, knowledge must be available (Lexico Publishing Group, 2002).

### **1.3.3 Effectiveness of Knowledge Diffusion and Availability**

When knowledge is diffused it means that knowledge is available (Boisot, 1998); knowledge transferred within an organisation is thought as the process by which an organisation makes knowledge available (Kalling, 2003). The availability of knowledge will increase the ability of people to search, recognise and present a problem as well as assimilate and use new knowledge for problem solving (Caloghirou et al, 2002).



The primary role for the organisation is not just acquiring and diffusing knowledge but applying the existing knowledge toward the production of goods and services (Kogut & Zander, 1992; Cohen & Levinthal, 1990). When knowledge is available to whole organisation, the focus will be on the outcomes, such as the productivity and profitability of the organisation (Argot et al, 2000). Consequently, the success of knowledge diffusion is associated with how much the whole organisation applies and assimilates the available knowledge. Success can be measured in financial performance or non-financial performance.

#### **1.3.4 Knowledge Codification**

The codification process should facilitate large numbers of operations such as knowledge diffusion (Zollo & Winter, 2000) and increase the availability of knowledge (Salisbury, 2001). It is also possible to make use of an employee's skill and shared knowledge, since "employees knowledge without documentation can be a kiss of death to owners and stakeholders" (Loomis, 2000).

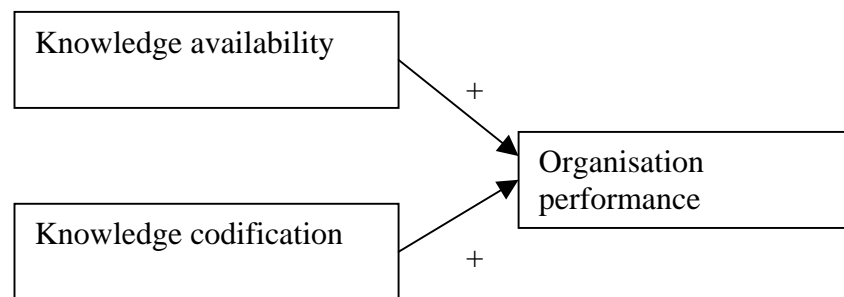
The role of knowledge codification is particularly significant to organisational innovation (Sorensen & Snis, 2001) and organisational performance (Zollo & Winter, 2002). Codification will not be deemed successful until the codified knowledge is applied. An important obstacle to success of using codified knowledge is in the difficulty of assuring that the codified knowledge is both adequate and actually implemented (Zollo & Winter, 2002). Moreover, there is an indirect cost of inappropriate application of knowledge if the codification is

poorly performed. Such issues add to the general increase in difficulties due to the formalisation and structuring of knowledge (Ibid).

### **1.3.5 Organisational Performance: Knowledge Codification and Knowledge Availability**

The basic framework that has been built up at this stage in the literature is the suggestion of a positive relationship between knowledge codification and organisational performance on one side, and a positive relationship between knowledge availability and organisational performance on the other side.

**Figure (1.2): Basic Model for Organisational Performance**



Many companies are interested in the implementation of knowledge management strategies. These strategies affect organisational performance if they are used effectively (Choi & Lee, 2003). According to Nonaka, these strategies will be more effective if they are almost used in balance (Nonaka & Takeuchi, 1995). Choi and Lee have pointed to these strategies as four groups, according to the level of tacit oriented and explicit oriented knowledge involved (Choi & Lee, 2003). According to the basic model of organisational performance and because of the positive effect of these strategies on organisational performance, these strategies can also be mapped according to knowledge availability and knowledge codification.

The effect of knowledge application to the whole organisational domain has not yet been tested against organisational performance according to knowledge management strategies, availability and codification. One of the main knowledge related problems found in organisations is that there is insufficient knowledge at the point of action (Wiig, 1995).

## **1.4 Statement of the Problem**

As indicated above, it is the view of the author that knowledge is a substantial yet diffuse resource for organisational success and that there are many ways to study knowledge management strategies. Organisations can develop a variety of strategies to leverage knowledge for improved performance (Lee & Choi, 2003). However, a problem for both managers and researchers is to understand the effectiveness of these strategies and their links to organisational improvements.

The various approaches to knowledge management in an organisation can affect the performance of the organisation in different ways (Corso & Paolucci, 2001). The dependence on the way knowledge is handled is different in different industries and cultures (Birchfield, 2001). Knowledge management strategies, therefore, vary from organisation to organisation, and from industry to industry, and more needs to be understood about how these strategies can be studied within organisations in these different settings. However, there is a scarcity of research into the effectiveness of the range of knowledge management strategies on the organisation in terms of organisational performance.

It is proposed that the relationship between knowledge management strategies and organisational performance might not be the most valid assumption on which to develop a comprehensive framework. According to Choi and Lee (2003), knowledge management investigates the best strategies that can be used to create, diffuse, codify, and apply knowledge.

Knowledge creation has been studied through the field of knowledge management. As mentioned in section 1.3.2, that knowledge creation in a cognitive approach is the ability of an organisation to make knowledge available through knowledge diffusion and codifiable through knowledge codification. The ability of an organisation to use its best strategies in order to make knowledge available and codifiable is a knowledge management style as described in Chapter 3, is a more appropriate independent variable to relate to organisational performance. It is assumed that the relationship between knowledge management style and organisational performance is not a direct one; rather, there are many factors that may mediate this relationship. There is a whole range of candidate intermediate factors suggested in the literature such as knowledge satisfaction (Becerra-Farnandez & Sabherwal, 2001), organisational creativity (Lee & Choi, 2003) and in particular, knowledge creation in terms of availability and codifiability. Intermediate knowledge creation outcomes may influence different aspects of organisational performance, both financially and non-financially.

In order to test the mediating effect of knowledge creation, the procedure of Baron and Kenny (1986) is adopted as used by (Lee & Choi, 2003). These will be discussed in detail in chapters 2 and 3. In summary, the proposed outline for the general framework that will be developed and tested in this research is seen in Figure 1.3.

**Figure (1.3): Knowledge Creation Mediates the Relationship between Knowledge Management Styles and Organisational Performance.**

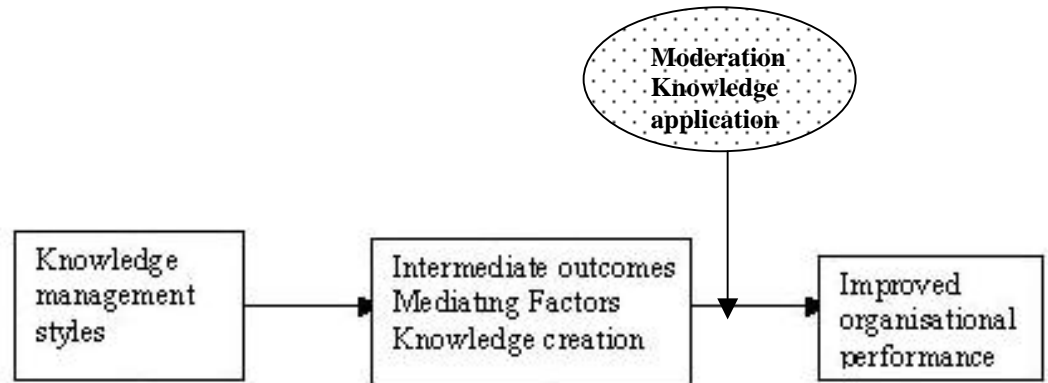


Figure 1.3 depicts the main statement of the problem. An important aspect of the problem is whether organisational performance is improved if the organisation uses predominantly one knowledge management style or a more balanced selection of styles. The latter proposition is adopted from Nonaka and Takeuchi (1995), who claim that using all four different knowledge creation modes in a balanced way best enables innovation. Nonaka defines balance as the ability to use equally different strategies that reflect the different modes of knowledge conversion (Nonaka & Takeuchi, 1995). In addition, Graham and Pizzo defined this balance as the ability to make knowledge management strategies central to organisation strategies (Graham & Pizzo, 1996). The level of balance can be determined by the standard deviation of knowledge management activity values across the different knowledge management styles, since the standard deviation is a measure of how widely values are dispersed from the average value (the mean). Therefore, less dispersed means more balance, because the value will be closer to the mean of all strategies across the different knowledge management styles.

## **1.5 The Research Questions and Approach**

To examine the points previously discussed and address the issues raised, the primary research questions are:

- How do knowledge management styles contribute to knowledge creation and organisational performance?
- Is knowledge application a fundamental dimension when analysing the relationships between KM styles and organisational performance?
- Does the industry type make a significant difference among these knowledge management styles?

As theory related to this problem is in an early stage of development, an exploratory approach is undertaken to answering these questions, followed by a confirmatory analysis. There are two phases in this approach:

- Phase 1: The development of a conceptual model and integrative framework based on the literature.
- Phase 2: An empirical evaluation of the validity of the framework from phase one.

The methodology used for the empirical phase of the study will involve the development and administration of a survey. A questionnaire will be developed and subjected to a pilot study. The main study will be the administration of the survey to a large group of managers in various industries. Survey data will be analysed; this will be described in Chapters 7 and 8.

## **1.6 The Research Design**

The research described in this thesis began with a literature review leading to the development of a conceptual model of knowledge space, “K-Space”, and which has been published as, “Evaluating the Knowledge Assets of Innovative Companies” (Al-hawari & Hasan, 2002). A further discussion on the research model is also published under the title, “Management Styles and Performance: a Knowledge Space Framework” (Hasan & Al-hawari, 2003). The K-Space model helps in both the classification of knowledge processes and in studying their effect on organisational performance.

The research then proposes four generic knowledge management styles as a viable conceptual link between context-specific knowledge processes and the success of the organisation in which they are employed. The research presented is concerned with the identification of these four knowledge management styles based on the dimensions of K-Space and how organisations can use them to leverage knowledge for improved performance.

A set of hypotheses is proposed base on an integrative research framework relating the dimensions of K-Space, the KM styles and organisational performance. The research uses an empirical investigation into the relationship between KM styles and organisational performance. The result of the empirical study and hypotheses testing are presented and explained. Finally, the limitations of the research and suggestions for further research are given.

## **1.7 Practical and Theoretical Value of This Research**

The main purpose of this research is to provide a context for better understanding of knowledge management strategies and how knowledge application and assimilation is necessary for organisational performance.

Many managers are facing difficulties in employing knowledge management strategies, because it is not clear to them how these strategies affect organisation performance and which of them are most effective. This study will help managers and organisations to define their knowledge management strategies more effectively. This study endeavours to find a conceptual model that joins and classifies these strategies, unifying them with knowledge availability, codifiability, applicability and organisational performance. This will unveil the gap between insufficient knowledge and knowledge in action. Both academics and managers will have a theory and practical base to understand knowledge management strategies through its effect on knowledge application, assimilation and organisational performance. Also, the model will be empirically tested through an integrative framework, joined with the above concepts and analysed in the context of real organisations. The framework will extend knowledge management from theory to the actual use of knowledge management theory effectively in an organisation.



## **1.8 An Overview of the Thesis**

This thesis is divided into nine chapters: This first chapter is devoted to a discussion of the gap that exists in knowledge management theory and its application in organisation. The second chapter presents the literature review leading to the development of knowledge space (K-Space), as a base on which to study knowledge management in three dimensions: knowledge diffusion, knowledge codification and knowledge application. This chapter introduces the idea of the existence of different knowledge management strategies and the ability to classify them into four groups, as a set of knowledge management strategies affect the dimension of knowledge space. Further, this chapter exploits the importance of knowledge enabler cycles to define a set of different strategies that will help the organisation to manage its knowledge.

The third chapter will introduce the four knowledge management styles in relation to the K-Space model. In this chapter, organisational performance will be discussed in terms of the knowledge management styles and the three dimensions of K-Space. The research questions and the research hypotheses will also be discussed. The methodology and sampling strategy will be discussed in the fourth chapter. The questionnaire and scale development will be introduced in chapter five. The pilot study result and design will be discussed in chapter six. Chapter seven will report on the data collection used to test the research hypotheses, discuss response rates and descriptive statistics of the main data sample. The eighth chapter will discuss the result of the main study in terms of the research hypotheses. The ninth chapter will develop the discussions, conclusions, and limitations and make suggestions for future research.

## **CHAPTER 2. THE LITERATURE REVIEW**

### **2.1 Introduction**

From a strategic perspective, the most valuable assets in any organisation are its intellectual capital and knowledge. Knowledge management involves the implementation of formal and informal activities and structures that facilitate knowledge processes such as codification, distribution, and understanding, in order to achieve acceptable performance. Knowledge management is a relatively new phenomenon and only recently has much research within this discipline has been published.

As indicated in the previous chapter, the overall aim of this study is to investigate the most effective styles for managing organisational knowledge, so as to improve organisational performance. Accordingly, the purpose of this chapter is to critically review the existing literature in order to present what is already known about this phenomenon and to identify any gaps or problems. The review on concept of knowledge management is extended to a consideration of literature of information management; in particular, the concept of I-Space offers useful insights into the development a K-Space conceptual model that is useful in defining the four prominent knowledge management styles. This chapter concludes by describing the development of a K-Space model that will be the theoretical base of the research.

This chapter shows how both researchers and academics study knowledge management in those areas relevant to this thesis. Definitions of knowledge are introduced in the Second Section, following this introduction. Correspondingly, definition of

management is introduced in the Third Section so that the knowledge management definitions are introduced in the Fourth Section. Knowledge Codification, Diffusion and Application literature is introduced in the Fifth section. Knowledge management schools and the five knowledge enabler cycles are introduced in Sections Six and Seven respectively. The components of these cycles will be used in this research to build the survey instruments for the knowledge management styles. The concept of knowledge creation is re-introduced from Chapter one in Section Eight and leads to a discussion of Nonaka's well-known four modes of knowledge conversion. The Information Space, or "I-Space" model, is introduced in the Ninth Section. This is extended in the Tenth Section, which introduces economic value within I-Space while the Eleventh Section presents some examples of I-Space implementations. This sets a foundation for the development of the K-Space model in Chapter Three. This model forms the basis of the empirical research, which follows in the thesis.

The chapter concludes with Section Twelve with a review the literature on Knowledge Management Styles. The implications of K-Space will be used to determine those styles that form the basis of the analysis in this research.

## **2.2 Definitions of Knowledge**

The discourse of knowledge has a rich and diverse set of meanings.

The literature reveals useful definitions of individual and organisational knowledge.

- Knowledge is organised information applicable to problem solving (Woolf, 1990).
- Knowledge is information that has been organised and analysed to make it understandable and applicable to problem solving or decision making (Turban, 1992).

- Knowledge encompasses the implicit and explicit restrictions placed upon objects (entities), operations, relationships, general and specific heuristics as well as inference procedures involved in the modelled (Sowa, 1984).
- Knowledge consists of truth and beliefs, perspectives, concepts, judgments, expectations, methodologies and ‘know-how’ (Wiig, 1993).
- Knowledge is a whole set of insights, experiences and procedures that are considered correct, and guide the thoughts, behaviours and communication of people (Van der Spek & Spijkervet, 1997).
- Knowledge is reasoning about information to actively guide task-execution, problem-solving and decision-making, in order to perform, learn and teach (Beckman, 1997).
- Organisational knowledge is processed information embedded in routines and processes that enable action. It is also knowledge captured by an organisation’s systems, processes, products, rules and culture (Myers, 1996).
- Organisational knowledge is the collective sum of market assets, infrastructure, intellectual property and human-centred assets (Brooking, 1996).

It is the position of the author of this thesis that organisational knowledge, as an object, should be codified, distributed, understood and applied in order to achieve a set of goals, such as decision-making, problem -solving, and performance. Further, knowledge can be acquired and captured from different resources, such as human and organisation systems.

## **2.3 Defining Management**

Because of its diversity, Roelof and Beijerse (1999) apply four central elements to the definition of management:

- The first function of management is the formulation of an ethical strategy functions.
- The second function of management is making sure that this strategy is realised.
- The third element is that the organisation is a tool in fulfilling these two functions.
- The fourth element in management is the people who manage and are managed.

Combining these diverse sets of meanings, (Roelof & Beijerse, 1999) define management as the strategy-driven motivation and facilitation of people, aimed at reaching an organisation's set goals. The set of goals cannot be achieved until there are a set of facilities and strategies. When knowledge is managed successfully, the organisational goals are achieved.

## **2.4 Knowledge Management Definitions**

Knowledge management is an emerging and controversial term and so it has many different definitions. Which definition applies in context depends on how knowledge and management are defined. The following are alternative definitions of knowledge management put together by the author to include the different views of knowledge and management:

- **Definition 1**

A set of strategies and facilitations that help employees to organise the information existing inside or outside the organisation's borders, in order to reach their goals.

- **Definition 2**

A set of strategies and facilitations that help employees to organise and analyse information in order to make it understandable. In doing so, they reach their goals by problem-solving or decision-making.

- **Definition 3**

A set of strategies and facilitations that help employees to surround implicit and explicit restrictions, in order to model the operations, procedures and relationships that help reach their goals.

- **Definition 4**

A set of strategies and facilitations that help employees analyse concepts and search for the most useful methodologies to solve specific problems.

- **Definition 5**

A set of strategies based on a set of insights, experiences and procedures supported by facilitations that guide the thoughts, behaviours and communications of people to reach a goals.

- **Definition 6**

A set of goals achieved by relying on reasoning about information, as well as strategies supported by facilities in order to execute tasks, solve problems and make decisions.

- **Definition 7**

A set of strategies based upon processed information embedded in routines and processes captured, retrieved and disseminated by facilitations, such as systems, processes, products, rules and culture, in order reach goals.

- **Definition 8**

A set of strategies prepared and supported by employees to embrace intellectual properties and offer them a set of infrastructure facilitations to achieve a set of market goals.

The knowledge-based view of organisation is a recent approach to understanding the relationship between organisational capabilities and organisational performance.

Specifically, this approach suggests that knowledge creation, diffusion, codification and application are the source of superior performance (Decarolis & Deeds, 1999; Demtsetz, 1991; Grant, 1996; Nonaka, 1994; Spender, 1996).

In summary, it is the supposition of the author of this thesis that knowledge management include a set of strategies and facilities that enable knowledge codification, diffusion, and application in order to achieve a set of goals. These strategies and facilities are based on both processed information embedded in systems and human intellectual properties. Due to the existence of knowledge in systems and employees, the strategies and facilities used to manage knowledge is varied in their effects on knowledge codification, diffusion and application in an organisation. Strategies that act with human knowledge have a different effect on knowledge codification, diffusion and application as much as strategies that act with knowledge in a system. Therefore, an organisation does not achieve its goals till knowledge is codified, diffused and applied.

## **2.5 Knowledge Codification, Diffusion and Application**

Decarolis and Deeds (1999) point to the importance of Research & Development intensity to measure knowledge application in organisations. They find that the R & D does not always have a positive effect on organisational performance. Because of this finding, they suggest an examination of this relationship on organisation performance under various industry conditions.

Park and Kim (1999) study knowledge flows within different industries. Knowledge flows through two major channels, the disembodied and embodied channels. The disembodied is where knowledge spreads through human mobility and research spillover; knowledge is tacit. The embodied is the process whereby knowledge is disseminated through the purchase of machinery and equipments; knowledge is explicit. They classify different industries based on an in-flow and out-flow of both explicit and tacit knowledge. The results from their research are summarised:

- High out-flow of tacit and explicit. High in-flow tacit: Chemical Industries, Electronic Equipments Industry and Precision Equipments Industry.
- High in-flow tacit and explicit. High out-flow tacit: Household Electrical Equipment Industry, Semi-Conductor & Electronic Components industry and Motor Vehicles all Equipments Industry.
- High in-flow tacit and explicit. Low out-flows tacit and explicit. Farcical Metal Products Industry.
- High in-flow and out-flow tacit. Telecommunication Equipment Industry.
- High out-flow tacit. High in-flow explicit. Textile Industry.
- High out-flow explicit: Explosives & Adhesives Industry, Rubber products Industry and Glass Products Industry.



- High out-flow tacit: Plastic Products Industry, Nonferrous Metals Industry, Fabrication Machine Industry, Computer & Office equipments Industry and Transportation Equipment Industry.
- High in-flow tacit: Boilers & Turbines Industry and Shipbuilding Industry.
- High in-flow explicit: Food & Beverages Industry.
- Neither has in-flow nor out-flows of any types of knowledge (Isolated Industries): Wood & Furniture Industry, Paper & Printing Industry, Agricultural Chemicals Industry, Toiletry Cleansers Industry, Petroleum Extracting & Refining Industry, Mining Industry, Porcelain & Earthenware Cements Industry, Stove & Clay Products Industry and Ferrous Metal Industry.

Schulz and Jobe (2001) explore the performance implications of organisational knowledge codification. In their study, codification is treated as a multidimensional construct. The focus on three different forms of codification. They can be aligned along a continuum of abstractness. Knowledge encoded in codes and figures are the most abstract form. Knowledge encoded in words and texts are less abstract form. Knowledge encoded in pictures and images are the least abstract form. They find that the effect of knowledge codification on organisational performance is moderated by a strategic context. Further, they suggest to study knowledge diffusion's effect on organisational performance.

Spender (2002) explains that later industrialisers such as Japan depend on the acquisition of knowledge from abroad. Further, the Japanese organisations continue to designate employees to scan internationally for technological knowledge. The researcher finds in a survey through scientific reports that Japanese organisations do not

share less explicit knowledge than U.S.A organisations. The researcher suggests that further empirical research must explore this possibility in other industry settings, and should extend this inquiry to include tacit knowledge.

Madsen et al (2002) examine the effect of variation or change in the retention of strategies on knowledge creation. More specifically, how do these strategies affect the flow of tacit knowledge and skill into an organisation?. Managers basically select these strategies. The selection is guided by various evaluation or control mechanisms that stem from the organisation's social norms and administrative structure. The main focus of their research is to investigate how retention strategies in tacit knowledge affects an organisation's future stock of tacit knowledge and skills. Therefore, the organisation can save a cost of hiring new skills or experiences. Consequently, that affects positively the organisational profit. The data of their study is collected from the banks industry. The result of the study shows that organisations that retain past knowledge restrict how much human capital an organisation will import in the future. Furthermore, inflows of tacit knowledge tend to decline with recent experience of change. Because of the last result, the researchers highlight the following implication of their study. The inflow of tacit knowledge is more important in one industry than another. For example, in the Silicon Valley where the most organisations are technology-based, organisations continually change their strategies in order to maintain their competitive advantage position. Therefore, if these organisations rely heavy on the strategies that support knowledge creation through tacit knowledge, there will be a high risk for them.

Kankahalli et al (2003) analyse the variation of organisational capability to codify its knowledge based on two dimensions: Low-Volatility context and High-Volatility

context within two industries; Product and Service-based industries. Low- Volatility context knowledge is less time-sensitive, and stored knowledge tends to be useful over along time span without updates. On the other hand, Knowledge in High-Volatility context is time sensitive. Stored knowledge needs to be refreshed continuously. Further, researchers define codification level in both Service and Product-based organisations in regards to Low-Volatility and High-Volatility contexts. The codification level is high in Service-based industries when Low-Volatility context. Whereas codification level is low in Service-based industry when High-Volatility context. In Product-based industry, codification is high when organisations are in a High-Volatility context. Whereas codification is Low when an organisation is in a Low-Volatility context.

Ardichvilli et al (2003) study knowledge sharing in manufacturing-based organisations. They find that employees view their knowledge as belonging not to them individuals, but to the whole organisation.

Bontis et al (2003) discuss e-mail usage within the four modes of Nonaka model. They state that e-mail has a capability of playing a significant role in Externalisation, Combination and Internalisation. However, it can be used within the Socialisation process to transfer tacit knowledge from person to person. Knowledge transferring is related to the ability of e-mail to flows knowledge to individuals, departments and the whole organisation from inside and outside the organisation. In Externalisation, e-mail helps to convert redundant information into explicit knowledge. In Combination, it facilitates the diffusion of explicit knowledge. In Internalisation, it represents the cogitation of other conversion modes when it expands acquisition of tacit knowledge through helping individuals internalise what they experiences, thus enriching their tacit

knowledge. Mapping these processes to knowledge flow, it should be thought as this way; using the e-mail within an organisation is likely Combination or Socialisation processes. Using it to flow knowledge out of the organisation is Externalisation process. Since when knowledge is explicit, it easier to transfer it outside an organisation. Using it to flow knowledge into an organisation from outside is Internalisation process. Considering this mapping, the researchers find the following:

- In general, high technology companies, where the study has been done heavily internalise their knowledge rather than externalising it. The number of e-mails that has been sent outside the organisation is 2,419, the number of e-mails that has been received from outside the organisation is 5,639.
- The organisation heavily diffuses its own knowledge using the Combination process. 7,125 e-mails have interchanged inter and intra-departments.
- They compare the flow of knowledge among four different departments; Finance, Market & Sales, Silicon Operations, and Test Operations. The Market & Sales department is always relying on knowledge internalisation rather than knowledge externalisation.

The literature about knowledge codification, diffusion and application reveal some issues that need to be reviewed.

- Strategies that facilitate knowledge codification and diffusion are different. The industry and the manager's perspectives toward his/her organisation knowledge capability can determine this role. The industry difference is discussed under knowledge management schools. A manager's perspective is discussed under the five knowledge enabler cycles.

- The four modes of knowledge conversion need to be specified in more detail when explaining knowledge flow in an organisation. This gap is discussed within knowledge creation.
- Organisational performance is not direct implication of knowledge codification and diffusion. Organisational performance is not a direct implication of Research & Development; knowledge application may affect this relationship. Knowledge diffusion aligning along a continuum of abstractness effect has not been tested on organisational performance. The diffusion aligning along a continuum of abstractness, codification and application, and Research and development are discussed in the I-Space (Information Space).

## **2.6 Knowledge Management Schools**

According to Earl (2001), knowledge management is studied through different schools, namely: Technocratic, Commercial and Behavioural schools. There are five attributes used to study knowledge management according to these schools:

- Definition of knowledge
- Technologies that support exchange
- Knowledge ownership
- Knowledge leverage
- Primary outcomes

### **2.6.1 Technocratic**

This school recognises technology as a base to manage knowledge and process information. The strategies and facilitations based upon technology to achieve a commercial or industrial objective.

- **Definition of Knowledge**

Knowledge is processed information embedded in routines and processes, which enables action. It is also captured by the organisation's systems, processes, products, rules and culture (Myers, 1996).

This explicit information is more on the system-bound side. Knowledge in this school is often converted into codes and procedures then kept in electronic storage.

- **Technologies that support exchange**

Examples include Hard-Drives, Cassettes, CDs and DVDs. Knowledge is managed by different electronic tools, such as Management Data Base System MDBS, Voice Recognition System VRS, Intelligent Search Engine, Knowledge Bases, and Knowledge Directories.

- **Knowledge ownership**

In this school, knowledge is owned by the organisation's electronic memories (Wasko & Faraj, 2000). Ownership of knowledge is crucial for an organisation's growth and retention. Due to this, knowledge is owned and controlled by the organisation. Employees can codify and share that knowledge.

- **Knowledge leverage**

An organisation can improve knowledge by finding new solutions and services. Since knowledge in this school is codified, knowledge leverage enhances and develops technologies that support codified knowledge. Technology development should be in Hardware and Software.

- **Primary outcomes**

The primary outcomes of knowledge management in this school is capturing as much knowledge as possible via the following strategies:

- Mapping organisation knowledge.
- Updating cases files.
- Standardisation and re-cycling knowledge (Swan et al, 1999).
- Packaged knowledge given to the user in the course of interacting with the system (Binney, 2001).
- Knowledge is created by means of “doing business” (Binney, 2001), and captured through second-by-second transactional data from different systems (Earl, 1994).

## **2.6.2 Commercial or Economic School**

Classical economists divide economic resources into three categories: land, labour and capital (Jackson, 1982). They treat knowledge as a “disturbance” category (Nonaka & Takeuchi, 1995), predicting the positive effect of knowledge on an organisation. Economists look for these resources as assets to any organisation. In the new economy, knowledge becomes the new asset for organisations (Strassmann, 1999).

- **Definition of knowledge**

Today’s economists are looking for knowledge as an important recourse for productivity (Gatrell, 2001; Dallago, 2000; Vicer, 2000). Economic resources are called factors of production. Knowledge in this school can be defined by the way that other resources such as land, capital and labour are defined. For instance, knowledge is a good or service that can be bought, sold and priced.

- **Technologies that support exchange**

Most followers of this school look to IT as a tool to support an organisation’s knowledge. However, Strassmann (1999) shows that there is no relationship between IT expenditure and company performance. The reason for this may be that

many executive managers do not understand the difference between information and knowledge and that the result of processing information.

- **Knowledge ownership**

In this school, knowledge is considered the fourth production factor after land, labour and capital; all of them are owned by the organisation. The difference between a classic economy and new economy is that the former's quantity of output is a function of quantity of labour and capital (Jackson, 1982), while in the latter that function is extended to quantity of knowledge.

- **Knowledge leveraging**

A key to sustaining a comparative advantage is in an organisation's ability to protect and leverage its main resource (Woods & Cortada, 2000). Moreover, the company leverages its knowledge by deploying strategies that capture the knowledge of competitors, customers and suppliers.

- **Primary outcomes**

The nature of knowledge as the fourth factor of production means that its purpose is to increase the profitability, market share and return on investment in an organisation.

### **2.6.3 Behavioural School**

In this school, employees are the main knowledge resource, and the controller of an organisation's knowledge. According to Bontis and Fitz-enz (2002), "people, not cash, buildings or equipment, are the critical differentiators of business enterprise". Employees' knowledge is not only glorified, it is recognised as the critical differentiators of the enterprises. In addition, in a turbulent economic environment, the main source for filtration of information into knowledge is the employees (Ibid).



- **Definition of knowledge**

In this school, knowledge is defined as the interpretation of stock information, i.e., individuals' skills, experiences, beliefs and memories (Beveren, 2002). Individuals posit their own tacit knowledge; information and data flow among networks of nodes and links. Their ability to do this shows the degree to which tacit knowledge characterises the human capital of an organisation (Bontis, 1999). An organisation is mainly made up of human social capital, because of the whole range of human abilities, potentials, and the networks of relationships that constitute human capital (Carter & Scarbrough, 2001).

- **Technologies that support exchange**

Knowledge in this school is based on a range of interrelationships, skills and potentials. In a firm, highly embedded roles and interrelationships are easily transferred to a set of higher-ordered organisational patterns. Overtime, these patterns are stored in a firm's memory (Madsen et al, 2002). A firm's memories, or knowledge repositories, are used to accelerate and broaden knowledge sharing, transferring the cultural, ritual and organisational routines (Veng Seng et al, 2002). The value of building highly-structured communication is in emanating important information from employees, who engage with the organisation's external environment. For example, between the customers and the employees new information is created (Beveren, 2002). The above values and innovations are the target of any new technology and communication development in such a school.

- **Knowledge ownership**

Knowledge exists in employees, unlike information and data that exist outside of them (Beveren, 2002). Knowledge is solely the province of human ownership, while information and data exist elsewhere, inside and outside an organisation. Knowledge

production is crucial to a firm that uses members with tacit knowledge and skills (Madsen et al, 2002). Knowledge management involves an accumulation of knowledge, so that it is no longer the sole exclusive property of individuals or groups (Carter & Scarbrough, 2001).

- **Knowledge leverage**

The firm leverages its new and past knowledge across space and time through knowledge dispersion within its subunits (Madsen et al, 2002). Knowledge dispersion broadens tacit knowledge, skill and human capital across space and time through the movement of individuals. This is widely encouraged as a strategy in an organisation (Ibid). Human capital and employees' tacit knowledge and skill are affected if there is a reasonable investment in employee training programmes (De Pablos, 2002). A reasonable investment in employee training establishes the environment or culture where knowledge sharing and transferring among employees is common. This gives managers the opportunity to plan strategies that make organisations a learning environment (Ven Seng et al, 2002).

- **Primary outcomes**

The primary outcomes are increases in organisational profit through managing and promoting human capital at work (Bontis & Fitz-enz, 2002). ). It is also provides other benefits such as, customer loyalty, cost reduction and improved productivity (De Publos, 2002). Because of the importance of human capital in the behavioural school, many authors declare the significance of disclosing the intellectual capital in the financial reports (Ibid).

Knowledge management strategies and facilities vary and depend on the perceived type of knowledge, mainly if it is more technology-oriented such as in the technocratic

school; or if it is more human- oriented such as in the behavioural school or mixed; such as in the commercial school. The goals of knowledge management vary as a result of different perceived attributes of knowledge. In the technocratic school, technological innovation is required. In the commercial school, market share, growth rate, and profitability are required, while in the behavioural school, human innovation is essential. The attributes within each school refer to knowledge codification, diffusion, and application. Technologies and knowledge exchange are connected to knowledge codification and diffusion respectively, while knowledge ownership, leverage and primary outcomes relate to knowledge application; since all these attributes are based on how knowledge is understood, adopted and acted upon in an organisation.

The different emphases in each of these schools of knowledge management influence the development of this thesis in conjunction with the concept of knowledge management styles discussed in Section Twelve.

## **2.7 The Five Knowledge Enabler Cycles**

Knowledge enablers work in cycles to create knowledge. Knowledge enabling should be thought of in an evolutionary manner: always aimed at simultaneously creating and improving knowledge, as well as realising the potential of the company (Von Krogh et al, 2000). The five knowledge-enabling cycles of Von Krogh et al (Ibid) are:

- Instill Knowledge Vision Cycle (IKVC)
- Manage Conversations Cycle (MCC)
- Mobilise Knowledge Activists Cycle (MKAC)
- Create the Right Context Cycle (CRCC)
- Globalise Local Knowledge Cycle (GLKC)

### **2.7.1 Instil Knowledge Vision Cycle (IKVC)**

Knowledge vision is an organisational managers' insight into present and future situations (Von Krogh et al, 2000; Kenny, 1994). This cycle relates to strategies, and should be used in the knowledge era of organisations. The need for managers to develop a vision for their organisation is considered to be a vital part of their role.

Vision provides direction for employees and helps them make sense of their position (Kenny, 1994). A vision for the future is important for managers to know what the firm can achieve not only in the local market, but also in international markets. Since organisational strategies and goals are connected to the vision of an organisation, it helps to establish differences among the global results (De Pablos, 2002).

The variables, considered as candidates to measure organisational performance, are leadership, future perspective, profit, the increase of profit, return on assets (ROA), and financial return. According to De Pablos's (2002) study, future vision is considered the best indicator of performance.

An organisation's vision is conceptualised in order to derive sense from the information that informs the decision-making process (Hodgkinson, 2002). The elaboration of behavioural rules is essential for reciprocated communication between group members (Vallaster, 2001). A vision stimulates people to think about what workers want and how they can do the task, so that they are prepared for potentially urgent situation.

Individuals are provided with the opportunity to understand what needs to be done by vision conceptualisation (Hodgkinson, 2002). In addition, they can recognise and share the possibilities with others in the organisation. An organisation's good vision is upheld by exciting prospects and possibilities. In articulating that vision, they can keep its competitive edge. The individual plays the main role in problem-solving. Organisational vision should not ignore harnessing an individual's knowledge (Bhatt, 2002). If individual knowledge does not grow, it is unlikely their interactions will create valuable organisational knowledge (Ibid).

Sharing visions with others is fundamental for an organisation's success (Hodgkinson, 2002). The values that can be gained by sharing a vision are as follows:

- The fear of facing problems is reduced, through improved frankness and self-confidence behaviour (Tichy & Sherman, 1993).
- The employees do not need much supervision, and their performance is improved (Ibid).
- An employee's positive feeling toward organisation is reinforced, thus helping him or her to work correctly without instruction and limitation (Ibid).
- The individual's roles and tasks are more specific and easier to control (Ibid).

A vision must be created, conceptualised, shared and visualised. Vision visualisation is a powerful tool in achieving organisational goals as demonstrated in models used by the world's top business people and athletes (Bowen Jr, 2002). When a vision is visualised, it is easily accessible, and motivates people to focus on what is important to their organisation. It is beneficial if the visualisation is based on past business successes. The

resulting model is intended to help others apply their thoughts through simulating the model. For example, if the organisation has a vision to invest in the real estate industry, they should model factors that affect that industry, such as opportunities, risks, strengths and weaknesses of that market.

The following are some strategies or activities that can be used by managers to create vision-oriented knowledge.

- Dedication to direction: Managers should carefully construct a road map to achieving their vision.
- Commitment to creativity: The vision should be shared among the employees in an organisation to help it become successful (Hodgkinson, 2002). It should urge the new thinking of ideas and actions from employees (Von Krogh & Roos, 1995).
- Visualise the organisation vision in a suitable style: When it is visualised in a model, the employees understand more about their organisation's future goals.
- Build vision by using past experiences of success.
- Reform existing task systems: A managers' vision should always enable employees to learn from each other. They should also learn from the varying outcomes.
- Keep contact with the external community: The vision of a company should be known to stakeholders and customers.
- Be dedicated to decisive competitiveness: Nonaka noted: "if the phrasing of knowledge vision is open-ended enough, it will be better able to shift with and adapt to competitive dynamic" (Von Krogh et al, 2000 p108). He added: "if competitors make too much progress in one discipline or technology, the

company may need to do more intensive knowledge creation in similar areas, with more effective knowledge transfer“ (Ibid).

### **2.7.2 Manage Conversation Cycle (MCC)**

This cycle concerns the enabling of individuals, groups and communities to interchange ideas, experiences and knowledge through conversation.

Community members may develop the idea for the solution to a specific problem and formulate it as a prototype that can be justified or modified to meet the solution of any similar problem (Wiig, 1993). If knowledge is defined as a justified true belief then, theoretically, formulating knowledge in context then justifying it as a new belief could generate knowledge indefinitely. Implementation of this technique is impeded through the political and economy situation.

Overcoming fear is one of the most important tasks of managers these days. According to Bennet (2002), fear of the future is overcome if the organisation engages in conversation. Some activities that manager can deploy are: connect with customers and find what their critical strategies are; listen to customers, friends, family, encouraging employees to make conversation about creative work.

Some technologies help organisations to support electronic conversations among an organisation's employees, customers, dealers, and stakeholders. Names for those technologies vary from *virtual company* (Zhuge, 2002; Kock, 2001; Bierbaum, 1999), *e-conversation/discussion* (Coffman, 2001; Williams, 2001), *e-conference* (Gillette, 2001; Judith, 1999) to *web-based conversation/web collaboration* (Williams, 2001;

Hamblen, 2001). All of these have a common feature related to how an organisation maintains its environment electronically.

### **2.7.3 Mobilise Knowledge Activist Cycle (MKAC)**

A knowledge Activist is someone, a group or a department that takes a particular responsibility for supporting and coordinating knowledge-creation efforts throughout an organisation (Von Krogh et al, 1997). Their capability resides in a department or in a person.

A knowledge activist is rarely directly involved in sharing tacit knowledge; rather a knowledge activist helps establish the right enabling context (Von Krogh et al, 2000).

A Chief Knowledge Officer (CKO) may be one of many knowledge activists in a firm. The primary role for a CKO is to convert knowledge into profit by enforcing benefits from the organisation's intellectual capital (Guns, 1998). Another of his/her main roles is to manage and recover isolated tacit or explicit knowledge (Caddy, 2001). These staff are distributed throughout the organisation and involved in key business processes (Bontis, 2002).

In general, the roles of knowledge activists are as follows: Catalysts of Knowledge Creation, Coordinator of Knowledge Creation, Merchants of Foresight (Von Krogh et al, 2000).

- **Catalysts of knowledge creation**

There is a commonly held view that new knowledge always begins with an individual. For example, a smart investigator has an insight that leads to a new patent, or a middle manager's making sense of market trends becomes the catalyst for an important new



product concept (Tyndale, 2002). The catalyst for innovation can be found at different levels of an organisation. Top management officials play this role or assign an employee to do it (Despres & Chauvel, 1999). The individual or group that acts as a catalyst adds the necessary value in the organisation, in order to support a commitment to innovation (Fiol & Lyles, 1985; Crossan et al, 1999).

The necessary values that lead commitment to innovation and creation can be presented as two functions. Firstly, the human catalyst should travel freely around the company, talking, asking and triggering new questions and enquiries. This person might ask, where is the problem? When did you have this problem? Moreover, the catalyst should seek out employees who have distinctive minds, then encourage and help these people to transfer their ideas into something tangible.

Secondly, the catalyst helps to establish an enabling context for knowledge creation. Knowledge cannot be separate from its context. It is part of the physical, mental or virtual place where it was created. Where there are individuals in an organisation who do not have the ability to articulate their knowledge in a formal way, the catalyst should have the ability to convert the tacit knowledge into the right context. This should connect with tacit knowledge in relating to an organisation's culture.

According to Von Krogh et al, (2000), the ideal knowledge catalyst has a skill profile related to his or her ability to motivate skills, respect others, improve group dynamics and relationships; help the group to develop a charter of their tasks and responsibilities;

develop a social network inside and outside the company; and understand the operations of a business and its key products and markets.

- **Coordinator of knowledge creation**

Knowledge-based companies regularly include different people with the same interests or tasks that take complementary roles or tasks within the same competence area. It is beneficial for people in this situation to be networked or mapped by a coordinator; the employees with similar interests can get to know each other. This is particularly important in firms whose employees are spread globally.

A good coordinator of knowledge should do the following:

- Bring together the right people, stimulating creative communication and helping them to share their tacit knowledge.
- Share inspiring stories from different conversations describing who is involved, how long they have been working together, their ideals and their problems.
- Trace organisational knowledge by using the “yellow pages” technique (Wexler, 2001).
- Trace an organisation’s knowledge by using cleverly constructed databases that “point to knowledge but do not contain it” (Davenport & Prusk, 1998).

A CKO is more likely to view technology as an enabler that helps him or her to manage knowledge effectively (Bonner, 2000). The organisation’s purpose can be fulfilled by adopting a wide variety of delivery methods, such as virtual learning, the corporate university and self-directed learning (Ibid).

- **Merchants of foresight**

A knowledge activist can be viewed as a merchant or businessman dealing in insightful thoughts, ideas and innovations. A knowledge activist who plays the role of “merchants of foresight” is a knowledge broker in terms of supplier-customer relationships. A Knowledge broker represents the company where he works and, uses its knowledge resources. Knowledge brokers should be linked electronically to all global sources of highly-specialised knowledge commodities, constituents and services (Lapp, 1999).

Old ideas should also be recognised by knowledge brokers as a knowledge source (Hargadon & Sutton, 2000). Ideally, he is inspired from watching and tracing the company users, whether they are employees, customers, suppliers or any users who reveal good ideas. These good ideas are converted into inventions and products.

#### **2.7.4 Create the Right Context Cycle (CRCC)**

The previously mentioned cycles have many activities that help the organisation to create, share and manage knowledge. CRCC is a knowledge enabler that is the first seed for knowledge creation. Knowledge can be created everywhere, but the problem is whether or not the knowledge is applied. Most companies have access to many documents, whether they are on computers or in books. The main dilemma is how to create the right context to utilise that content. The right context for useful knowledge creation involves an organisational structure that encourages solid relationships for effective collaboration (Von Krogh et al, 2000). Since knowledge creation begins with individual tacit knowledge, effective collaboration means there is a willingness to share and learn from others (Ibid). The ultimate value of any project to the organisation is decided by the context within which the project is placed (Hackney & McBride, 1995). The acceptance and willingness of employees to share is an important factor to create the right context.

- **The willingness**

Although there are knowledge enablers that support knowledge management, in any knowledge management project the employees attitudes toward that support needs to be recognised as affecting their productivity. The employees' attitude can be represented by their willingness, or acceptance, to participate in that project. The willingness to do a task becomes a part of an organisational culture. There are incentives that encourage an employee willingness to work together, such as employee share options, or welfare schemes.

Training is one activity used by managers to give their employees the opportunity to acquire knowledge. An important question is how to deliver this training to maximize worker's willingness to learn and implement new skills (Hyland et al, 1998). There are difficulties in ensuring that all employees train, especially if the majority are coming from a wide range of ethnic backgrounds (Ibid). This often exists in multicultural countries (eg, Australia, USA, and Canada). Addressing the issues of people's willingness to work together is more important than just bringing them together in training programs.

- **The place**

According to Nonaka and Konno (1998), “place” is the space recognised as a foundation for knowledge creation. While space could be virtual and real employee interactions in order to create knowledge. The interactions are between legislative, commercial and social forces on one side and the organisation on the other, between the infrastructure and IT, organisation’s employees with each other’s.

The importance of having a place within the right context overtime resulted from changes in organisational structure and environmental influences. This is particularly true in today’s organisations, where disruptive and complex interactions are common. There are different structures, such as cross-functional, process-based, virtual corporation, and hypertext organisation (Von Krogh et al, 2000). Disruption exists in the organisation’s structure and its environment. Knowledge management projects are part of the solution for disruptive situations, and should be driven by its own context.

According to Hackney and McBride (1995), the context within which work is applied can be considered at multiple levels across time. The levels are:

- The external context where the legislative, commercial and social forces act upon the organisation.
- The organisational context where the infrastructure of the organisation and IT act upon the organisation.
- The individual context where the interactions between individuals act upon the organisation.

### **2.7.5 Globalise Local Knowledge Cycle (GLKC)**

Knowledge globalisation is not only restrict to large multinational companies, but is also relevant to small and medium enterprises (SME). An organisation globalises its operations because of considerations of cost, as a company can get cheaper labour cutting the cost of production. Also, companies obtain new information, which can be developed into knowledge and tangible benefit (Von Krogh et al, 2000).

According to (Von Krogh et al, 2000), knowledge can be globalised through three phases: triggering, packaging and recreating.

- Triggering is selecting a group or unit with the abilities to continuously look globally for opportunities.
- Packaging and dispatching is the process by which knowledge is moved across organisational boundaries.
- Re-creating knowledge is the last phase involved re-creating knowledge from feedback of dispatched knowledge. The feedback is more effective when the dispatched knowledge receiving apparatus is switched on and understood; this motivates the receivers towards new action (Cohen & Levinthal, 1990).

## **2.8 Knowledge Creation**

The concept of knowledge creation is introduced in Section Three of Chapter One. Organisational knowledge is formed through the interaction between technologies, techniques and people (Bhatt, 2001). Knowledge creation is the ability of an organisation to develop novel and useful ideas and solutions (Marakas, 1999). This is done by reconfiguring and recombining foreground and background knowledge (tacit

and explicit knowledge) through different sets of interactions (Bhatt, 2001). The best known recent work on knowledge creation is that of Nonaka and other colleagues and has strongly influenced the approach of this thesis. The Nonaka model for creation knowledge is based on the idea that interaction between tacit and explicit knowledge produces knowledge.

**Figure (2.1): Nonaka Four Modes of Knowledge Conversion: source (Nonaka & Takeuchi, 1995)**

The four modes of knowledge conversion will now be described.

### **2.8.1 Socialisation**

The first mode of knowledge conversion is socialisation; where tacit knowledge is converted to tacit knowledge. This occurs when the converter releases personal knowledge, making it available for diffusion to others.

The socialisation process is appropriate for broad task domains, where knowledge is available to individuals, groups and the whole organisation (Becerra-Fernandez & Sabherwal, 2001). The socialisation process consists of formal and informal procedures

that disseminate knowledge. The dissemination of knowledge can be broad or narrow. Dissemination is broad when knowledge is available to the whole organisation, and narrow when it is available only on a “need-to-know” basis (Jordan & Jones, 1997).

Knowledge management includes a set of strategies and facilities that enable knowledge dissemination. Since socialisation strategies contribute to knowledge dissemination, the strategies classified as socialisation depend on the way people interact with each other.

### **2.8.2 Externalisation**

The second mode of knowledge conversion is externalisation; where tacit knowledge is converted to explicit knowledge. The conversion is intended to release personal knowledge and make it more able to be captured in explicit routines and procedures.

The externalisation process is appropriate for a focused task domain (Becerra-Fernandez & Sabherwal, 2001). Knowledge of elemental technologies, information processing devices and databases are needed, because tasks require it (Kusonaki et al ,1998).

Knowledge acquisition in externalisation has an internal focus where an organisation seeks employees; and case-based knowledge where a problem-solving scope focuses on finding a radical and highly innovative solution to a problem.

Knowledge management includes a set of strategies and facilities that enable knowledge codification. Since externalisation strategies contribute to knowledge codification, the strategies are classified as externalisation strategies. The strategies should make organisational knowledge easy to document in files or diagrammed in some forms. Knowledge is best extracted from different resources such as competitors, or a social



environment, then upgraded in databases and documents as internal knowledge. These strategies package available knowledge in different contexts, or formal representations, i.e. metaphors, analogies, concepts, hypotheses, models and if-then-else rules.

### **2.8.3 Combination**

The third mode of knowledge conversion is combination where explicit knowledge is converted to explicit knowledge. The converter's intention is to make processed knowledge easier to distribute to other systems through specific technology. It can also capture and process the knowledge if required.

The combination process is appropriate for a broad task domain, where knowledge is available to individuals, groups and whole organisation (Becerra-Fernandez & Sabherwal, 2001).

The combination process always has formal procedures to disseminate knowledge via advanced technology, making it widely available. Knowledge management includes a set of strategies and facilities that enable knowledge dissemination. Since combination strategies contribute to knowledge dissemination, these strategies are classified as combination strategies.

### **2.8.4 Internalisation**

The fourth mode of knowledge conversion is internalisation where explicit knowledge is converted to tacit knowledge. The intention of the converter is to make processed knowledge easier to articulate and justify it in order to be internalised by individuals. The articulation of knowledge constitutes a context for justification (Tell, 1997, 2000; Grand & Von Krogh, 2000), and enables the creation of common representations that

allow for better task co-ordination (Prencipe & Tell, 2001). Codification is an extension of articulation brought forward in linguistic and symbolic representation (Ibid). Knowledge that has the explicit attribute is more likely to be articulated and more often to be represented in forms of texts, tables and diagrams (Dayasindh, 2002).

The internalisation process is appropriate for a focused task domain (Becerra-Fernandez & Sabherwal, 2001). Knowledge acquisition in the internalisation process can have an external focus where the organisation deliberately scans the external environment for ideas and practises. The problem-solving scope is focused on the search for incremental improvement to existing products.

Codified knowledge is transferred to employees by oral or electronic means, thereby giving them the benefit of this knowledge as soon as possible. If knowledge does not transfer quickly, other competitors will exploit this knowledge for their own utilities. However, it must be internalised by the employees so it must be in an understandable form.

These strategies and facilities include more specific types of knowledge, i.e. tacit “mostly human-oriented” and explicit, “mostly technology-oriented”. These facilities and strategies should be classified into four categories based on whether the strategies convert tacit to tacit, tacit to explicit, explicit to explicit or explicit to explicit.

Saviotti (1998) and Roberts (2000) insist that complete tacit and complete explicit are not always available. There is often a piece of knowledge in existence somewhere between complete tacit and complete explicit. Roberts (2000) explains that knowledge

transferring makes a distinction between tacit and explicit and knowledge transferring is related to knowledge diffusion (Ibid).

The five knowledge enabler cycles involve different activities that the managers can employ to create knowledge. There are four knowledge management processes. The Socialisation process makes knowledge available through the diffusion of formal and informal knowledge to individuals, groups and the whole organisation. The Combination process diffuses and makes knowledge available to individuals, groups and the whole organisation through advanced technology. The Externalisation process helps to codify explicit. It is used for internal tasks where capturing expert and case-based knowledge is required. The Internalisation process articulates knowledge in order to justify it within an organisational context. This process is proper for external tasks, where knowledge is articulated from the external environment to fit the organisational context. The organisation is more likely to acquire information than knowledge from an external environment (Soo et al, 1999).

There are two areas that need to be examined: In knowledge transferring, the identification of the type between the tacit and explicit; there is little mention in the literature about knowledge application as a key component to studying the effect of knowledge diffusion and codification on organisation's performance.

Information in extensive adaptation to the context in which it is applied differentiates knowledge from information (Brakensiek, 2002, Leonard & Sensiper 1998), in the way that information becomes understood and applicable (McLernon, 2002). Knowledge without context to application will not add any value to an organisation (Merlyn &

Välikangas, 1998). The increment of adaptation to the context in which knowledge is applied is related to knowledge abstraction (Boisot, 1998).

The codification, diffusion and application are explained and defined in the I-Space model (Boisot 1998) in the following Section of this thesis. The theories of both Nonaka and Boisot classify the ways knowledge can be created through proposed cycles. These cycles are shown in the spiral of the Nonaka model (Nonaka & Takeuchi, 1995). They are social learning cycles in I-Space, within the three dimensions of the Boisot model (Boisot, 1998). The I-Space model has a clear starting point for empirical research that supplies some explicit expectations (Rosendaal & Van Doesburg, 2002).

## **2.9 I-Space, i.e. Information Space**

I-Space, shown in Figure 2.2, is a model used to study complex systems such as organisations in the information era. Because organisations are loosely coupled systems with many situation possibilities, their members should work to reduce the complexity. I-Space is a visualised model whose dimensions, abstraction, codification and diffusion, are employed by organisational members to process the complex input into simplified output (Anderson et al, 1999).

I-Space is a model that analyses information flows to demonstrate their relationship in a social learning process (Boisot & Benita, 1999). The more structured the information the easier to share (Ibid). Structuring in this model is represented by abstraction and codification dimensions of I-Space, while sharing is represented by the diffusion dimension.

The codification dimension demonstrates how a phenomenon can be clearly represented in concepts or categories. The higher the degree of codification the faster a phenomenon

is represented (Boisot & Benita, 1999). The abstraction dimension measures how much a phenomenon changes from just a concrete category perception to an abstract category concept. When a phenomenon is confined to an abstract category, there is a stronger degree of understanding and application (Ibid). Diffusion measures how much the percentage of the population will access the given information. The higher the degree of diffusion the higher percentage of people who have access to the given information (Ibid).

**Figure (2.2): Dimensions of I-Space: source (Ashford, 1997)**

## **2.10 Economic Value and I-Space**

In the context of I-Space, the economic value is a result of a combination of utility and scarcity of knowledge assets, where utility is a function of the degree of codification and abstraction and scarcity of the knowledge asset is a function of how close to the origin the knowledge is along the diffusion dimension. Thus, the lower the percentage of the population that possesses some useful information, the scarcer is it (Boisot & Benita, 1999). In other words, the economic value varies depending on how much knowledge is codified, abstracted and diffused. Valuable knowledge can be located all over I-Space.

## **2.11 The Implementation of I-Space**

Stenmark (2002) uses I-Space to analyse and define the role of Intranets in knowledge management. His initial point is that knowledge can exist on different levels in individuals, groups and whole organisation, while his primary interest is on the individual and organisational level.

The Intranet helps individuals and whole organisation acquire information from different resources whether it is internal or external. This is represented along the diffusion dimension of I-Space. There should also be awareness about the amount of information available, so the individual or organisation is not overloaded. The abstraction dimension is about making employees aware of who is practicing and applying information at the individual and organisational levels. An Intranet, as a tool for a communication, should provide employees at both levels with more formal collaboration tools, such as whiteboards and project areas. Along the codification dimension, the employees are better able to collaborate with each other (Stenmark, 2002).

Rosendaal and Van Doesburg (2002) state that the dimensions of I-Space can be used in a social cycle as an instrument to explain the variances in an organisation's learning. Their result are not completely conclusive, but do indicate that the dimensions may be used to explain this variation (Rosendaal and & Doesburg, 2002).

Boisot and MacMillian (2001) model the relationship between the three dimensions of I-Space and an organisation's profit. They hypothesise that diffusion in I-Space is a positive function of the degree of codification and abstraction (Boisot .& MacMillion,

2001). When the degree of abstraction or codification is increased, profit was positively affected by the research and development undertaken (Ibid).

Research and development is associated with absorptive capacity (Cohen & Levinthal 1990). There are two types of absorptive capacity: potential absorptive capacity and realised absorptive capacity. When knowledge is applied and processed to commercial ends, such as profit, the potential absorptive capacity becomes necessary (Carlsson, 2004). According to Cohen and Levinthal, the performance of an organisation is positively affected by the ability of an organisation to assimilate and apply knowledge. Both knowledge assimilation and application refer to the absorption capacity (Cohen & Levinthal, 1990).

I-Space is a source of empirically testable research hypotheses concerning the way that knowledge flows are managed across different industries where one of the important questions to ask for future development is: how does the changing value modify strategies chosen by an organisation? The value is often extended to be more than profit; it can be any measure of organisational performance; the organisations can be from different industries and may affect the approach to KM (Boisot & MacMillan, 2001).

The question is answered by investigating the strategies and how they affect the value plotted along the three dimensions of I-Space. Organisational performance is the value in I-Space that can vary based on how much knowledge is codified, abstracted and diffused (Boisot & Benita, 1999). A set of styles can be defined from which an organisation can choose where these style relate to how the firm's particular managers deal with their knowledge (Birkinshaw, 2002), as well as their approach to KM (Jordan

& Jones, 1997). Some literature on knowledge management styles will now be presented.

## **2.12 Knowledge Management Styles**

Jordan and Jones (1997) suggest five dominant knowledge management styles, arguing that with only one style is not possible to conduct efficient and effective knowledge management:

- The knowledge acquisition style with two dimensions: focus and search.
- The problem solving style with a four dimensions: ‘location’, ‘procedure’, ‘activity’ and ‘scope’.
- The dissemination style with two dimensions (‘processes’ and ‘breadth’). Process describes whether knowledge is shared formally or informally. Breadth describes knowledge sharing as wide or narrow.
- The ownership style with two dimensions identity and resources. Identity refers to the extent to which the individual regards his knowledge base as being part of his own personal identity. On the other hand, resource ownership relates to the way in which knowledge is dispersed.
- The memory style refers to the orientation adopted within the company for storing knowledge, and consists of one dimension, which is the representation.

Kusunoki et al (1998) studied organisational performance through organisational capabilities. Organisational capabilities consist of multilayered knowledge. Based on these layers, they are classified into two types: local and process capabilities along two dimensions: modularity and designability. Using a large-scale data-set on product development organisations of Japanese manufacturing firms, it is found that the dynamic interaction of many knowledge practices plays a crucial role as core



capabilities for product development. It is significant that these organisations are relatively competitive and that the dynamic interaction of knowledge requires individual knowledge to be transferred across the organisation. Typical examples included communication as a technology-oriented practice and coordination as a human-oriented practice across different functional groups.

Choi and Lee (2003) pointed to four knowledge management styles based on tacit and explicit dimensions. These styles vary from industry to industry. Organisations that adopt more dynamic styles have a higher performance than others. In the dynamic style, organisations tend to have a mixed approach between human and technology activities.

In a study of nine Korean companies, Lee and Suh (2003) found that seven out of nine companies place greatest importance on combination, in terms of the SECI knowledge conversion types. The next important process was externalisation. The third one was socialisation and the last one is internalisation. They argue that some companies place equal amounts of importance on the four types of knowledge conversion. However, most companies place different stresses on different types, because of different corporate sizes and situations. They also find that use of the four knowledge-conversion types is different from industry to industry. This, however, was not confirmed by empirical testing.

As described in Section 2.6, Nonaka classified KM strategies based on the model of knowledge conversion. From a manager's perspective these strategies are investigated through five knowledge enabler cycles (Von Krogh et al, 2000). They are discussed in

Section 2.7, which are aimed at improving manager's organisational knowledge management capacity.

## **2.13 Chapter Summary**

This Chapter reviews the background literature on which the work presented in the following chapters is based. The K-Space or “knowledge space” model developed in Chapter Three comes out of the both the Nonaka and Boisot models described above. These models relate knowledge creation, through making knowledge available, codifiable and applicable, with organisational performance as the measure of economic value. The model also helps to justify knowledge conversion modes as knowledge management styles, in order to improve the organisation's knowledge management capacity. The knowledge enabler cycles will be used to develop a survey instrument to validate these styles.

## **CHAPTER 3. DEVELOPMENT OF THE K-SPACE MODEL AND RESEARCH HYPOTHESES**

### **3.1 Introduction**

Following the review of the literature presented in Chapter 2, the K-Space “knowledge space” model was developed to give the research a firm and original theoretical basis. This model combines the concepts of both Nonaka and Boisot models in order to facilitate the study of the effect of KM strategies on organisational performance by translating the I-Space dimensions from information to knowledge. The process of development and explanation of the K-Space model has been published elsewhere (Al-hawari & Hasan, 2002). The dimensions of K-Space affect knowledge creation through making knowledge available and codifiable, thereby transforming economic value and influencing organisational performance. The model also helps to justify the treatment of the four knowledge conversion modes as the four knowledge management styles, which can be used to improve an organisation’s knowledge management capacity.

This chapter describes the K-Space and explains its implications, leading to an enunciation of the research questions and hypotheses.

### **3.2 K-Space (Knowledge Space)**

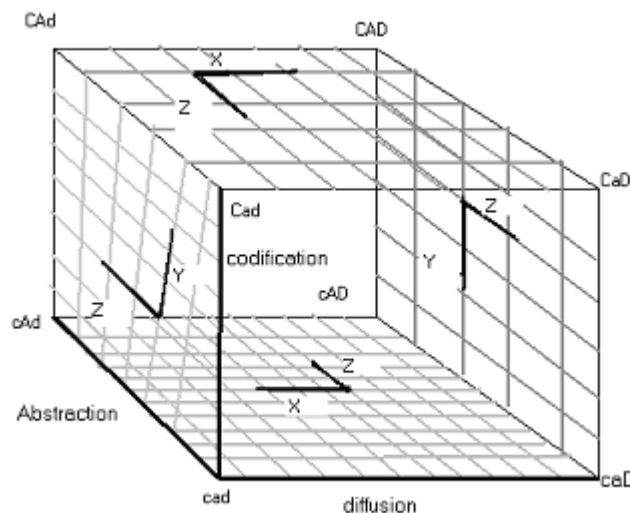
K-Space is a proposed extension of I-Space from Information to Knowledge. It is a cube that brings together the three essential dimensions of knowledge, namely, codification, diffusion and abstraction, with associated scales that range from codified to uncoded, from diffused to undiffused and from concrete to abstract. The dimensions of K-Space, diffusion, abstraction and codification are initially taken directly from those of I-Space (Boisot ,1998). The four knowledge conversions processes of Nonaka, socialisation, externalisation, combination, internalisation (SECI) occupy planes in K-Space (Nonaka & Takeuchi, 1995).

*The codification dimension* covers a range of knowledge from that which is hard to articulate (denoted by a small c), and easier to show than to tell, to that which is easily captured in figures and formula and is more standardised and automated (capital C).

*The diffusion dimension* covers a range of knowledge from that which is available to only one or two agents within a single sector (small d) to that which is readily available to all agents who wish to make use of it (capital D).

*The abstraction dimension* covers a range of knowledge, from that which can be used by only one or two agents within a single sector (small a) to that which is generally applicable to whole agents (capital A). When knowledge is applicable to whole agents, knowledge can be categorised as abstract where is a stronger degree of shared understanding and application (Boisot & Benita, 1999).

**Figure (3.1): K-Space**



In summary, codification, abstraction and diffusion are considered knowledge variables in an organisation and take the dimensions of K-Space directly from those of I-Space. From the discussion and analysis above. It seems more appropriate to use the concepts of availability, rather than diffusion, and applicability rather than abstraction, when dealing with knowledge rather than information. From this point on these alternative terms will be used.

### **3.3 Knowledge Classification for K-Space**

Because of the variability of knowledge availability, K-Space broadens the classical definitions of tacit and explicit from Nonaka's work to include semi-tacit and semi explicit using knowledge diffusion/availability dimension (Roberts, 2000; Saviotti, 1998). The prefix "semi" extends the classical definitions of tacit and explicit from Nonaka's work (Nonaka & Takeuchi, 1995), where tacit knowledge is highly personal and difficult but not impossible to share, and explicit knowledge is easily processed and transmitted.

Knowledge has been popularly classified into two types; tacit and explicit (Nonaka & Takeuchi, 1995; Choi & Lee, 2003a, 2003b ) to which can be added semi-tacit (Maiden & Rugg, 1996), and semi-explicit based on the K-Space perspective (Al-hawari & Hasan, 2002). These will now be defined and located in K-Space.

#### **3.3.1 Tacit Knowledge**

Knowledge, when it is tacit, has the lowest rating on the scales of diffusion/availability and codification. In addition, a low level of abstraction/applicability (cad) represents the case of a single person who has his/her own knowledge, which is difficult for others to adopt and apply. For example, when someone knows how to fix a unique and complex technical problem requiring specialist knowledge or experience. High levels of

abstraction/applicability (cAd), represent the case of someone who has a more general knowledge that can be shown to others in order for them to adopt and apply it; for example, how to ride a bicycle.

### **3.3.2 Explicit Knowledge**

Knowledge, when it is explicit, has the highest rating on the scale of diffusion/availability and codification. In addition, a low level of abstraction/applicability (CaD) represents the case of knowledge that is embedded in a system such as computer software or an artificial intelligence application and accessible to many in the organisation. However, it could be adopted and applied by only a single person or a very small group of people for example; the system consist of specific knowledge about some unique technical problems and how to fix them. High levels of abstraction/applicability (CAD) represent the case of knowledge that is embedded in systems accessible to many and that can be easily adopted and applied by many people in the organisation or even outside it. For example; when an employee makes a request from a knowledge base system so that additional information is available when sending it to someone else in the organisation. In this example three technologies are integrated to achieve the goal: the knowledge based system, the network system and the intelligence system.

### **3.3.3 Semi-Tacit Knowledge**

Knowledge, when it is semi-tacit, has the highest rating on the scale of diffusion/availability and the lowest rating on the scale of codification. In addition, a low level of abstraction/applicability (caD), represents the case of knowledge that is recognised and available to many people because it has been acquired from highly available resources such as the internet or a knowledge base system, but is too specific to be applied and adopted by all people in organisation; for example, a mathematical

equation about promoting products. High levels of abstraction/applicability (cAD), represent the case of knowledge that is recognised and available to many people, because it has been acquired from highly available resources such as the Internet or knowledge base system but, it is possible to be applied and adopted by all people in the organisation; for example: knowledge that should be disclosed to stakeholders.

### **3.3.4 Semi-Explicit Knowledge**

Knowledge, when it is semi-explicit, has the lowest rating on the scale of diffusion/availability and the highest rating on the scale of codification. In addition, a low level of abstraction/applicability (Cad) represents the case of knowledge that is just available to very few people in the organisation and embedded in computer systems that are just accessed by very few of people. This knowledge can be adopted and applied by very few people in the organisation because of its complexity or privacy; for example: an engineer designs a machine on his own computer. High levels of abstraction/applicability (CAAd) represent the case of knowledge that is available to very few people in an organisation and is embedded in computer systems that are just accessed by very few people. In addition, many people in the organisation can eventually adopt this knowledge because it can be easily interpreted and explained; for example: technical documentation.

It should be noted that the most variable dimension among all types of knowledge is the abstraction/applicability dimension, which relates to how much potential knowledge can be adopted and applied in the organisation.

### **3.4 The SECI Modes Location in K-Space**

Using Stenmark's (2002) method to analyse and define the role of each mode in I-Space, it is possible to locate the four modes of Nonaka's SECI model in K-Space as shown in Figure 3.2.

#### **3.4.1 Socialisation**

The socialisation process affects the availability of knowledge along the diffusion/availability dimension. The diffusion/availability of knowledge is always done via non-technology means. Therefore, knowledge codification is always low and constant. Thus, there should be awareness about the amount of knowledge available. The abstraction/applicability dimension makes employees aware of who is practicing and applying knowledge. Accordingly, the socialisation process is most likely to occupy the bottom side of K-Space.

#### **3.4.2 Externalisation**

The externalisation process affects the codifiability of knowledge along the codification dimension. Knowledge acquisition along the diffusion/availability dimension has an internal focus as an organisation seeks employees and case-based knowledge. Therefore, the diffusion/availability dimension is always low and constant. Thus, there should be awareness about the amount of knowledge that is codified. The abstraction/applicability dimension is making employees aware of who is practicing and applying knowledge. Accordingly, the internalisation process is most likely to occupy the left side of K-Space.



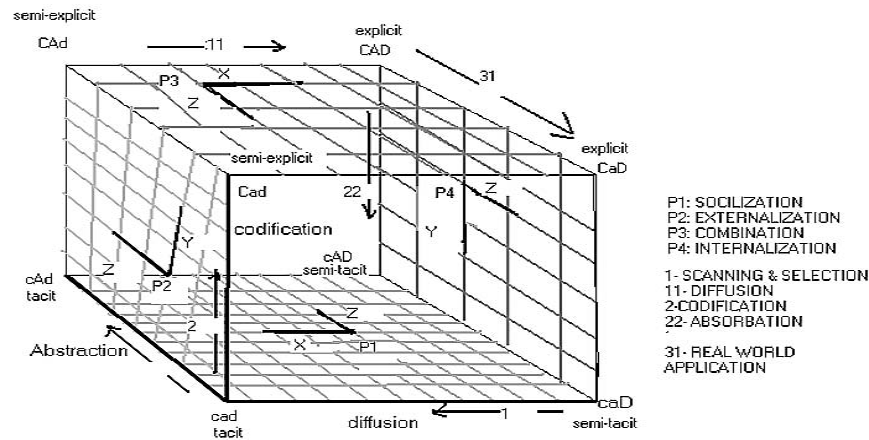
### **3.4.3 Combination**

The combination process affects the availability of knowledge along the diffusion/availability dimension. The diffusion of knowledge is always done via advanced technological means. Therefore, knowledge codification is always high and constant. Thus, there should be awareness about the amount of knowledge available. The abstraction/applicability dimension makes employees aware of who is practicing and applying knowledge. Accordingly, the combination process is most likely to occupy the top side of the K-Space.

### **3.4.4 Internalisation**

The internalisation process affects the codifiability of knowledge along the codification dimension. Knowledge acquisition along the diffusion/availability dimension has an external focus as an organisation deliberately scans the external environment for ideas and practises. Therefore, the diffusion/availability dimension is always high and constant. Thus, there should be awareness about the amount of knowledge that is codified. The abstraction/applicability dimension makes employees aware of who is practicing and applying knowledge. Accordingly, the internalisation process is most likely to occupy the right side of K-Space.

**Figure (3.2): K-Space Showing the Four Planes on Cube**



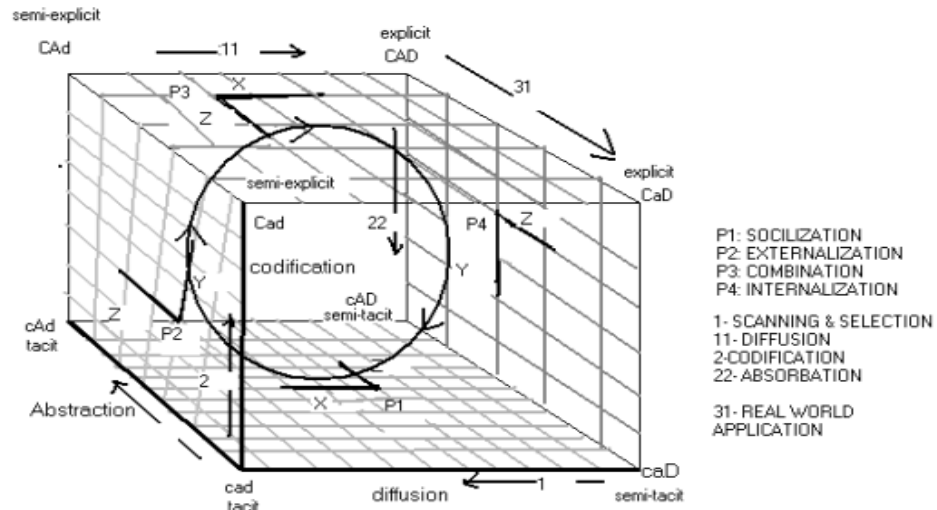
### 3.5 Knowledge as an Object in K-Space

Knowledge is recognised in K-Space as an object that can move in space. An object moves through space driven by the effect of force, which can be viewed as a set of knowledge elements. In this research, these elements will be extracted from the five knowledge enabler cycles discussed in Chapter 2 and shown in K-Space in Figure 3.2.

Any object in space is identified by its position; hence, the properties of knowledge are the values on the dimensions of that space. Knowledge elements are the strategies and facilitations that move knowledge and affect the values of its dimensions in K-Space. Since the four classes of strategies help convert knowledge from one type to another. This perspective of the conversion process enables knowledge to be viewed as dynamic and flexible in its movement, rather than static. In contrast to the 2-dimensional SECI model, knowledge elements now be seen to act in 3-diminsional space with the tacit/explicit classification of knowledge expanded to semi-tacit and semi-explicit. In

the following section the notation of the SECI conversion processes is expanded to involve semi-tacit and semi-explicit knowledge.

**Figure (3.3): Knowledge Enabling Cycles in K-Space**

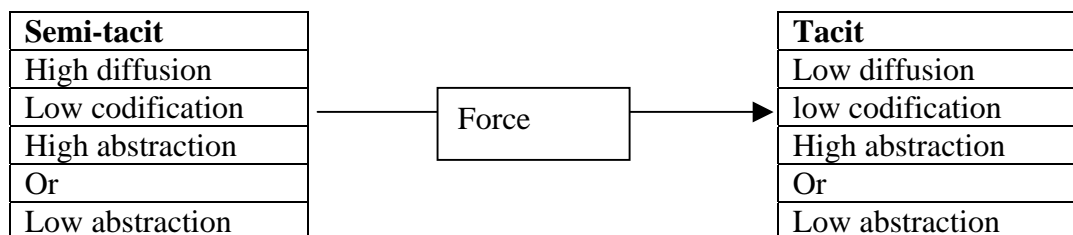


### 3.6 Knowledge Conversion within the K-Space

In this section, K-Space is used to identify four new knowledge conversion modes, involving not only tacit and explicit, but also semi-tacit and semi-explicit forms of knowledge using K-Space. It is assumed that knowledge is converted from type into other and is driven by a force through the effects of the knowledge elements.

#### 3.6.1 Adoption: Converting Knowledge from Semi-Tacit to Tacit

**Figure (3.4): The Adoption Force**



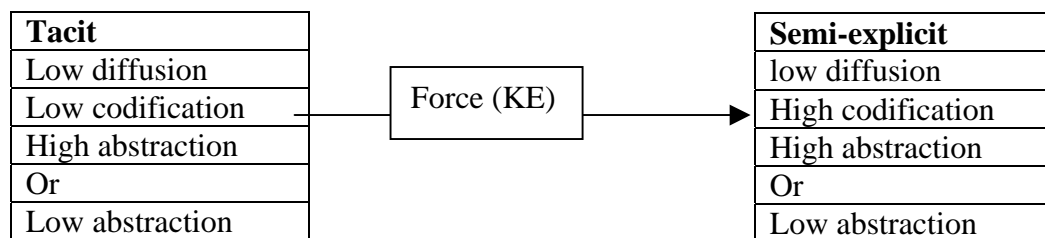
The forces that contribute to tacit knowledge adoption in individuals from more widely held semi-tacit knowledge is called adoption forces. In the adoption forces, the

abstraction/applicability dimension of knowledge can vary between high and low values. The knowledge availability/diffusion goes from high to low under the action of the force. The codification is low and constant, since tacit knowledge is diffused via non-electronic means.

An example of this process involves knowledge forced to move from where it is highly available at the whole organisational level to be available to individuals under the influence of managers, who want the individuals to adopt new knowledge; this is related to the perceived benefits that might flow from adoption (Boisot, 1998).

### 3.6.2 Standardisation: Converting Knowledge From Tacit to Semi-Explicit Forms

**Figure (3.5): The Standardisation Force**

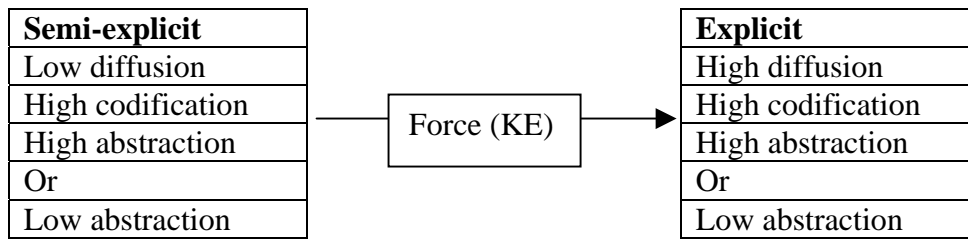


The forces that work to standardise practical tacit knowledge into a semi-explicit form are called standardisation forces. In standardisation forces, the knowledge diffusion/availability dimension is constant and low, since knowledge acquisition along this dimension has an internal focus as an organisation seeks knowledge from employees and specific cases. The abstraction/applicability dimension of knowledge can vary from low to high, while codification varies from low to high under the influence of the standardisation force. This is because knowledge that is standardised in metaphors, rules, concepts and so on, is most likely to be converted into highly structured semi-explicit knowledge.

Knowledge that is practiced efficiently by individuals affecting organisational performance should be kept in a reliable resource in order to facilitate access and benefit to others. When tacit knowledge is ready to be formalised to semi-explicit knowledge, a team of experts can be used to convert the practical knowledge to an agreed or standardised practice. Different professionals such as CKOs, Knowledge stewards and knowledge brokers can do this task.

### 3.6.3 Systemisation: Converting Knowledge From Semi-Explicit to Explicit Forms

**Figure (3.6): The Systemisation Force**



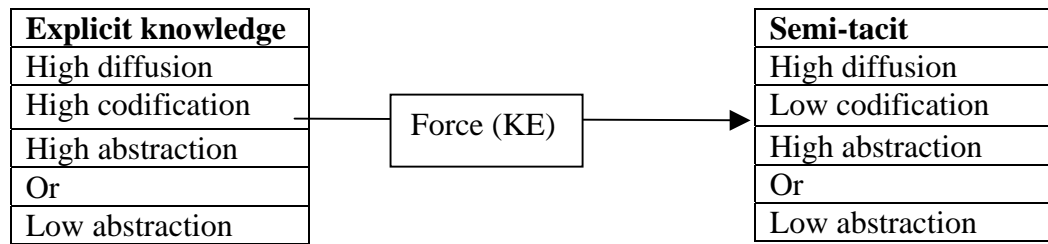
The forces that contribute to making knowledge explicitly available from semi-explicit forms, usually via highly integrated technology systems, are called systemisation forces. In systemisation forces, knowledge abstraction/applicability can vary between low and high. The diffusion/availability of knowledge varies from low to high under the influence of the force. The codification dimension remains high and constant, since knowledge is diffused via electronic means and thus always requires highly structured knowledge.

Once knowledge is semi-explicit it is more easily converted into completely explicit knowledge. The most powerful changes that make semi-explicit knowledge explicit are those, which improve the telecommunication system in the organisation, in order to give employees better access to that system. Communications technology play a main role in

improving the system, but must be integrated into other technology applications in the organisation, such as Database Management Systems, Yellow Pages, Knowledge Base Systems and so on.

### 3.6.4 Articulation: Converting Knowledge From Explicit to Semi-Tacit Forms

**Figure( 3.7): The Articulation Force**



The forces that contribute to the articulation of knowledge from explicit forms into semi-tacit ones are called articulation forces. In articulation forces, knowledge diffusion/availability is constant and high, since knowledge acquisition along this dimension has an external focus as an organisation deliberately scans the external environment for ideas and practises. The abstraction/applicability dimension of knowledge can vary from low to high values. The codification dimension goes from high to low under the influence of the force. When knowledge is explicit it is relatively easy to convert to semi-tacit knowledge. Semi-tacit knowledge is more easily articulated, rather than purely tacit knowledge in an organisational setting.

Knowledge that has the explicit attribute is more likely to be articulated and more often to be represented in the form of texts, tables and diagrams (Dayasindh, 2002). Codification as a human activity is an extension of articulation brought forward in linguistic and symbolic representation (Prencipe & Tell, 2001).

### 3.7 The Four Forces and Knowledge Management Styles

As outlined in Chapter 1, this research concerns the way knowledge creation processes mediates the relationship between knowledge management styles and organisational performance, as shown in Figure 1.3. In order to do this, it is necessary to identify a set of suitable knowledge management styles. For this reason, the four forces described above are used in this research to define four corresponding knowledge management styles, namely Adoption, Standardisation, Systemisation and Articulation. The effect of these styles on diffusion/availability, codifiability and abstraction/applicability dimensions of K-Space is summarised in table 3.1.

The forces have elements extract from the five knowledge enabler cycles. These are related to the way that managers improve their knowledge management capacity through Knowledge Creation. Knowledge Creation uses to identify intermediate and moderating variables on the relationship between the KM styles and organisational performance. Now that the KM styles have been identified and located in K-Space, the hypotheses of the research begin to emerge.

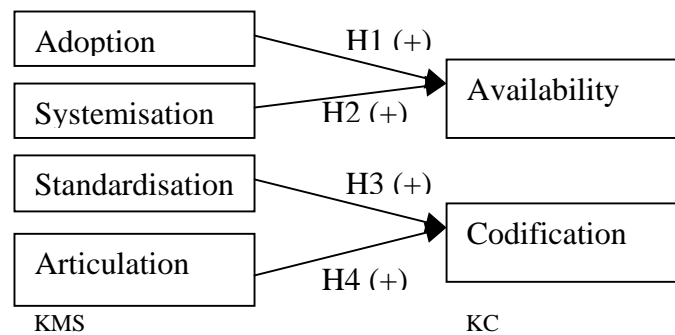
**Table (3.1): An Effect of the four KM Styles on K-Space Dimensions**

KM Styles → Dimensions↓	Adoption	Standardisation	Systemisation	Articulation
Availability (Diffusion)	Variable	Constant (L)	Variable	Constant (H)
Codification	Constant (L)	Variable	Constant (H)	Variable
Applicability (Abstraction)	Variable	Variable	Variable	Variable

### 3.8 KM Styles and Knowledge Creation

The cognitive approach to knowledge creation, described in chapter 1, reveals the ability of an organisation to make knowledge available and codifiable. The ability of an organisation to make its knowledge available and codifiable is presented through the deployment of the four knowledge management styles. Therefore, an initial framework depicting the relationship between the four knowledge management styles and knowledge creation in term of knowledge availability and codifiability is shown in figure 3.8.

**Figure (3.8): Framework Depicting the Relationship between the KMSs and Knowledge Creation**



Abstraction is suggested as the fundamental dimension when analysing the degree of knowledge application in an organisation (Arora & Gambardella, 1994). Organisational performance in K-Space has a similar view to that of economic value in I-Space. Economic value results from combining utility and scarcity of organisational assets, which include both information and knowledge. With reference to K-Space, utility is a function of the degree of codification and abstraction (applicability). The scarcity of the knowledge asset is a function of how close it is to the origin along the diffusion (availability) dimension. The lower the percentage of the population that possesses useful knowledge the scarcer it is (Boisot, 1998). In particular, the more a knowledge availability is decreased but knowledge codifiability, and applicability are increased, the



maximum economic value is obtained. The increment and decrement are along the abstraction level. In both knowledge availability and applicability; the domain of knowledge determines the abstractness level (Boisot, 1998). Knowledge available or applicable to the whole organisation is the most abstract knowledge. Knowledge available or applicable to a department or group is less abstract. Finally, knowledge available or applicable to an individual is the least abstract. Furthermore, the abstractness level for knowledge codification is determined by codification form (Schulz & Jobe, 2001; Boisot, 1998). Knowledge encoded in codes and figures are the most abstract form. Knowledge encoded in words and texts are less abstract form. Knowledge encoded in pictures and images are the least abstract form. Generally, the maximum economic values in I-Space, with value approaching highly application level, where knowledge is strongly applicable to the whole organisation (Boisot, 1998). Since organisational performance more than just achieving one maximum value, there are a set of values: business size, innovation, profit, revenue growth and market share. The main dimension that determines the best performance is the applicability of knowledge to the whole organisation. Therefore, organisational performance is based on how much knowledge is strongly codified, available and applicable to the whole organisation.

### **3.9 Knowledge Availability and Organisational Performance**

The organisation that has the ability to make knowledge available most effectively is more likely to survive than the organisation that has less experience in making knowledge available (Argot et al, 2000). When knowledge is available there is better cooperation and communication throughout the organisation, and the resulting financial performance and functioning of the organisation improves (X Si & D Bruton, 1999). Argot et al (2000) warn that success in achieving knowledge availability is very difficult since most individuals are reluctant to share knowledge. However, Zollo and Winter

(2002) state that once knowledge is embedded into the work process the success of knowledge diffusion increases, as it will become a natural behaviour characteristic of the people.

There is an overall agreement that the primary role of an organisation is not just acquiring and diffusing knowledge; it should be applied toward the production of goods and services (Kogut & Zander, 1992; Cohen & Levinthal, 1990). When knowledge is available to the whole organisation, the focus is on the outcomes, such as productivity and profitability (Argot et al, 2000). As the researcher utilises knowledge availability as it can be aligned along a continuum of abstractness; the hypothesis here is based on Schulz and Jobe's (2001) view regarding knowledge codification effectiveness on organisational performance. They hypothesise that knowledge codification's effect on organisational performance is not a direct relationship; it is moderated by some variables. Therefore, the researcher utilises this view to assume a relationship between knowledge availability and organisational performance. This relationship is most likely moderated by knowledge applicability.

*H5: Available knowledge will have a positive effect on organisational performance only when knowledge is strongly applied to whole organisation.*

### **3.10 Knowledge Codification and Organisational Performance**

The role of knowledge codification is particularly significant on an organisation's innovation (Sorensen & Snis, 2001) and performance (Zollo & Winter, 2002). Codification is not deemed successful until codified knowledge is applied. A common obstacle that gets in the way of successfully using codified knowledge is in assuming that it is both adequate and actually applied (Zollo & Winter, 2002). There is an indirect

cost of an inappropriate application of knowledge, such as security issues. This often adds to the general increase in difficulties due to the formalisation and structuring of knowledge (Ibid). According to Schulz and Jobe (2001), the relationship between knowledge codification and performance has to be moderated by different variables. In this research, knowledge applicability most likely moderates this relationship.

*H6: Codified knowledge will have a positive effect on organisational performance only when knowledge is strongly applied to whole organisation.*

### **3.11 Knowledge Application and Organisational Performance**

Undertaking research and development positively affects profit when the degree of application is increased (Boisot & MacMillian, 2001). According to Cohen and Levinthal (1990), the performance of an organisation is positively affected by the ability of organisation to assimilate and apply knowledge. Knowledge assimilation can also refer to an absorption capacity (Ibid). In the theories of Jean Piaget, assimilation is defined as the application of a general schema to a particular instance (Piaget, 1997). When the schema is knowledge, a particular instance is organisational performance. Knowledge affects organisational performance when it is applied.

Expenditure on R&D as a fraction of annual sales is a common measure used for estimating an organisation's absorptive capacity (Decarolis & Deeds, 1999; Cohen & Levinthal, 1990,1994). According to Decarolis and Deeds (1999), the direct relationship between R&D and organisational performance is not always valid. Furthermore, according to them, the R&D is a measure of knowledge application. From the point view of the previous argument about the relationship between absorptive capacity and organisational performance and the R&D is a measure of knowledge application.

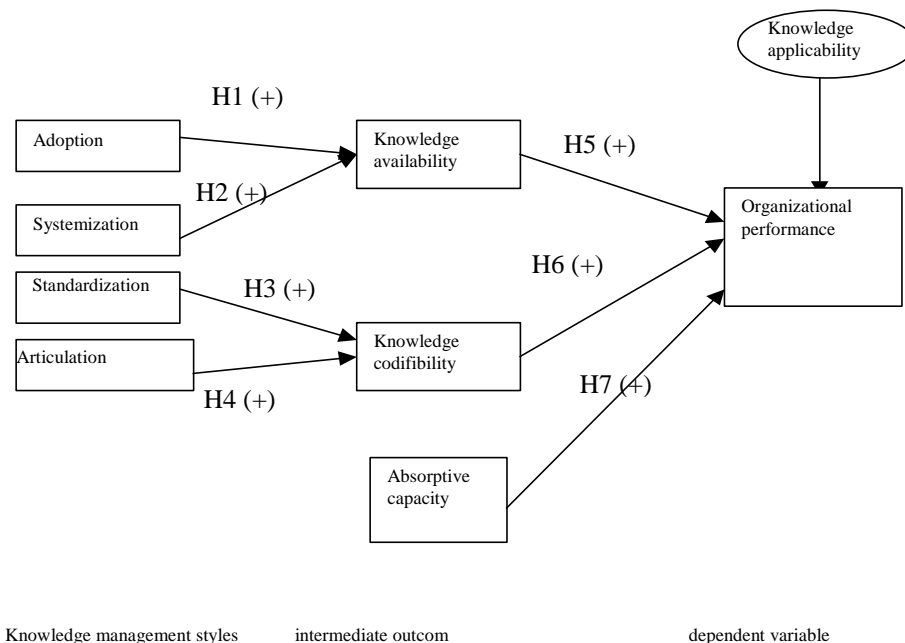
Therefore, knowledge application is most likely to moderate the relationship between organisational performance and absorptive capacity

*H7: Absorptive capacity will positively affect organisational performance when the knowledge is strongly applied to whole organisation.*

### 3.12 The Research Integrative Framework

The previous argument defines the integrative framework that connects the four knowledge management styles with K-Space dimensions and organisational performance. In this framework, knowledge creation in terms of knowledge availability and codifiability mediate the relationship between the four knowledge management styles and organisational performance. Knowledge application moderates the relationship between knowledge creation processes, absorptive capacity and organisational performance. The organisational performance is the dependent variable in this framework.

**Figure (3.9):The Integrative Research Framework**



### **3.13 Knowledge Management Styles vs. Organisational Performance: A direct Relationship**

#### **3.13.1 Unbalanced Knowledge Management Styles vs. Organisational Performance**

As knowledge management is not an end in itself, but rather a means to improve organisational performance, the latter is the main dependent variable in this study. Knowledge management styles involve a variety of knowledge conversion processes, and, according to Nonaka et al (1994), knowledge conversion processes support knowledge creation. These authors argue that organisational performance in terms of innovation, product development and competitive advantage is highly determined by the creation of knowledge. Therefore, knowledge management styles are highly likely to have a profound effect on organisational performance.

*H8: The adoption KM style positively affects organisational performance.*

*H9: The systemisation KM style positively affects organisational performance.*

*H10: The standardisation KM style positively affects organisational performance.*

*H11: The articulation KM style positively affects organisational performance.*

#### **3.13.2 The Balance of Knowledge Management Styles Vs. Organisational Performance**

In the literature reviewed, it is noted that a mixture between human-oriented and technology-oriented approaches to KM lead to best performance. In addition, Nonaka defines balance as the ability to equally use sets of different activities in relation to the different SECI modes of knowledge conversion (Nonaka & Takeuchi, 1995). Nonaka proposes that using all four different knowledge creation modes in a more balanced way is the best innovation enabler. As innovation is a part of organisational performance

(Choi & Lee, 2003), the balance of using these different activities affects organisational performance. Graham and Pizzo (1996) define balance as the ability to make knowledge management activities central to an organisation's strategies. It is appropriate to expect that the balance between the four knowledge management styles affect organisational performance.

*H12: Organisations with the most balance between knowledge management styles have significantly better performance than organisations with less.*

### **3.14 Research Questions and hypotheses**

One reason for focusing on organisational performance as proposed is that it is a field with high uncertainty and complexity, typically requiring firm specific capabilities (Kusunoki et al, 1998). The other is to provide a context for better understanding of knowledge management activities, and how knowledge application is necessary to organisational performance.

To examine these points and address the issues raised, the primary research questions are:

- How do knowledge management styles contribute to knowledge creation and organisational performance?
- Is knowledge application the fundamental dimension when analysing organisational performance?
- Does industry type make a significant difference among these knowledge management styles?

Based on the early theoretical analysis of this problem, an empirical study is conducted, followed by a confirmatory analysis. There are two phases in this approach, using a survey-based methodology. The first phase develops the instruments and pre tests all

constructs to check their reliability and validity. This phase includes a pilot test of the instrument. The second phase includes the administration of a survey to a large group of managers in various industries. Based on the hypotheses and research questions, the survey data is then analysed and the results are discussed.

### 3.15 The hypotheses of the Study

The hypotheses to be tested are related to the four research questions via the framework in Figure (3.9). Firstly, based on the discussion of KMSs in Section 7, and the possible relationships between them, the following set of hypotheses are proposed:

<p><u>Research Question 1:</u> How do knowledge management styles contribute to knowledge creation and organisational performance?</p>
<p>The hypotheses</p> <p>H1: The adoption KM style positively affects knowledge availability.  H2: The systemisation KM positively affects knowledge availability.  H3: The standardisation KM style positively affects knowledge codifiability.  H4: The articulation KM style positively affects knowledge codifiability.  H8: The adoption KM style positively affects organisational performance.  H9: The systemisation KM style positively affects organisational performance.  H10: The standardisation KM style positively affects organisational performance.  H11: The articulation KM style positively affects organisational performance.  H12: The organisations with the most balance between knowledge management styles have significantly better performance than the organisations with less.</p>

As discussed in Section 9, 10 and 11, the availability of knowledge, nor codification of knowledge, it's not enough to influence organisational performance. Rather, it is the application of knowledge that is the best predicator of organisational performance. The hypotheses that address these issues are as follows:

**Research Question 2:**

Is knowledge application the fundamental dimension when analysing the organisational performance?

The hypotheses

H5: Available knowledge will have a positive effect on organisational performance only when it is strongly applied to whole organisation.

H6: Codified knowledge will have a positive effect on organisational performance when it is strongly applied to whole organisation.

H7: Absorptive capacity will positively affect organisational performance when the knowledge is strongly applied to whole organisation.

**Research Question 3**

Does the industry type make a significant difference among these knowledge management styles?

H13: Industry type makes a significant difference to the use of the four styles in an organisation.

### **3.16 Chapter Summary**

This chapter begins with the development of a new K-Space model, where knowledge is an object that is mobilised in space rather than treating knowledge as a 2-dimensional or static.

In relation to K-Space, the new terms semi-tacit and semi-explicit are introduced. These are related to the amount of knowledge that is transferred in an organisation. Semi-tacit knowledge is tacit knowledge that is transferred, and becomes available to groups and the whole organisation rather than staying at the individual level. Semi-explicit knowledge is structured knowledge that is available only to individuals.



This chapter then discusses four knowledge conversion processes as styles for managers in order to improve their organisational knowledge management capabilities. Adoption, Standardisation, Systemisation and Articulation are the new conversion processes that are used to define the four KMSs. The KMSs have an effect on knowledge availability and codifiability; their effect is proposed in a set of hypotheses. Knowledge availability and codifiability have an effect on organisational performance when knowledge is strongly applied to whole organisation. Knowledge application to whole organisation is used, because the focus is on outcomes such as productivity and profitability.

Organisational performance is a very important indication of an organisation's knowledge management competence. Organisational performance is connected to the ability of an organisation to create knowledge and apply that knowledge, as well as how much it spends on research and development, and training programs.

At this stage all research questions and hypotheses for the research have been identified. In the next chapter, the methodology and the survey development are discussed as the initial step for the empirical study.

## **CHAPTER 4. The Methodology used for the Empirical Research**

### **4.1 Introduction**

The purpose of this chapter is to explain the methodology adopted for empirically assessing the hypotheses presented in the previous chapter. This includes a discussion of the empirical methodology, methods of data collection, sampling strategy and an outline of the analytical procedures.

This chapter is divided into Ten Sections. The Second Section explains the paradigm of the research. The quantitative methodology is explained in Section Three. Section Four shows what the differences are among the concepts, operations and measures, and gives an example to confirm the idea.

Data collection and the reduction of error in the research are discussed in Section Five. The sampling strategy is presented in Section Six. The discussion of the mail survey and other methods for collecting data is presented in Section Seven.

Section Eight explains the importance of taking ethical issues into consideration in social research. The administration of the mail survey is discussed in Section Nine, and finally, in Section Ten, the conclusion is presented.

### **4.2 The Theoretical Paradigm**

A paradigm is a framework or a set of “basic beliefs” (Guba & Lincoln, 1994) that researchers need to get ideas about the nature of reality, to identify the relationship between variables and to specify appropriate methods for conducting particular research

(Ibid). There are many paradigms for social science such as Positivism, Realism, Post-positivism, Critical theory and Constructivism.

Buttery and Buttery (1991) argue that positivism forms the basis of natural science and that this has influenced scholars of management as a rational system. The positivism paradigm assumes that one reality is driven by universal laws and truths. Researchers adopting this paradigm are assumed to be objective and independent. Problem solving under this paradigm starts with formulating hypotheses that are subjected to empirical testing through quantitative methods (Buttery & Buttery, 1991). Quantitative methods provide an objective, value free and unambiguous interpretation of reality (Guba & Lincoln, 1994). However, because positivists consider reality to be apprehendable and measurable with zero error (Sweeny, 2000) and use exact and rigorous measures (Neuman, 2003), this paradigm is not suitable for this research as it deals with variables in a complex, social, real life experience (Perry et al, 1997).

Post-positivism is another paradigm often adopted in the social sciences. It was developed to overcome the major disadvantages of positivism (Guba & Lincoln, 1994), by arguing that in spite of the existence of the real world that needs to be discovered, it is independent of researchers and open to different perceptions (Easton, 1998). These perceptions are not reality, but merely windows to obtain a better picture of that particular reality. In other words, post-positivism emphasises the importance of multiple measures and observations, each of which may possess different types of errors. Triangulation needs to be applied across these multiple erroneous sources to get a better picture of what is happening in reality (Godfrey & Hill, 1995; Sweeney, 2000; Trochim, 2003).

Under the post-positivism paradigm, researchers tend to emphasise deductive logic in which research is influenced by theory/hypothesis reflected in a predominantly formal writing style (Onwuegbuzie, 2002), as is utilised in this research. This paradigm also emphasises the objectivity of the researcher by triangulating across multiple fallible perspectives while at the same time acknowledging the probability of bias (Guba & Lincoln, 1994; Trochim, 2003). Based on this discussion, it is claimed that this research is best described as following a post-positivist paradigm.

### **4.3 Quantitative Methodology**

Neuman (2003) argues that variables and relationships are the central idea in quantitative research. This is the key objective in this research. Moreover, quantitative methods are very useful in providing detailed planning prior to data collection and analysis, because they provide tools for measuring concepts, planning design stages, and for dealing with sampling issues (Neuman, 2003). Therefore, this quantitative approach also utilise a deductive mode in testing the relationship between variables.

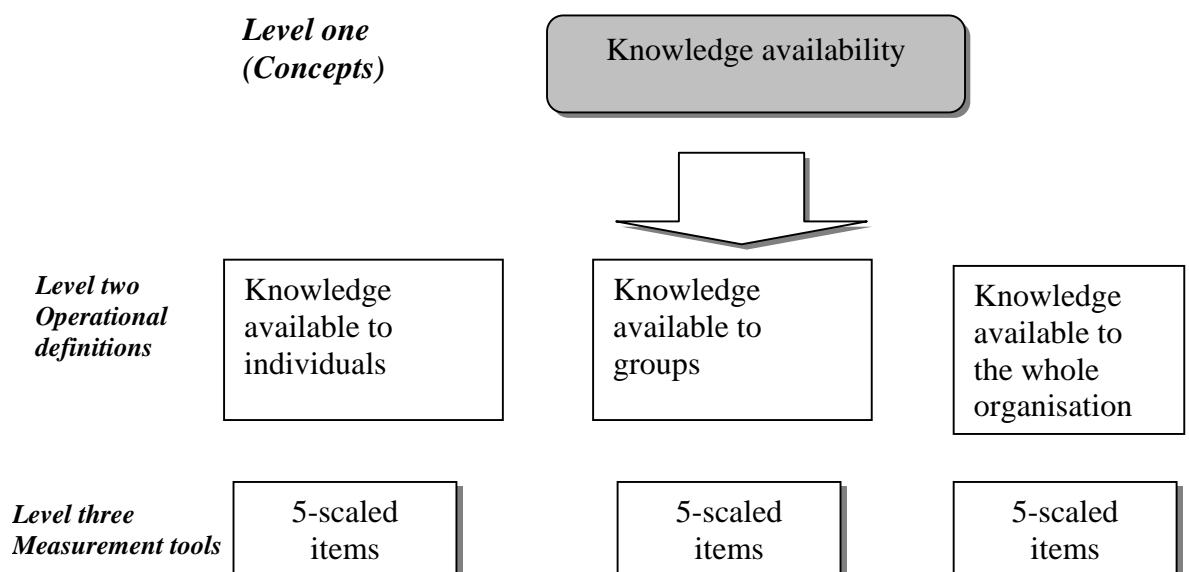
### **4.4 Conceptualisation, Operationalisation and Measures**

Before the measurement and data collection can be initiated, the business researcher must identify the concepts relevant to the problem (Davis & Cosenza, 1993; Zikmund, 2003; Neuman, 2003). This section distinguishes between concepts, operations, and measures.

Concepts (*or constructs*) are “a generalised idea about a class of objects, attributes, occurrences, or processes”(Zikmund, 2003). Neuman (2003) defines conceptualisation as a process of, “taking a construct and refining it by giving it a conceptual or theoretical definition”. An operational definition gives meaning to a concept by

identifying the activities or operations that are important to measure it (Zikmund, 2003; Neuman, 2003). Operationalisation links conceptual definitions to a specific set of measurement techniques or procedures (Neuman, 2003). Measures are used to determine what variable amount an object possesses (Emory & Cooper, 1991). The measurement process of some constructs start with conceptualisation, followed by operationalisation and then application of measurement tools. The relationship between concepts, operations definitions, and measurement tools in this research is illustrated in figure 4.1, as one example knowledge availability measures. In this example, the major concept (knowledge availability) is personalised into three constructs, and then each construct is measured using different numbers of scaled items.

**Figure (4.1): The Concept of Knowledge Availability**



## **4.5 Data Collection**

The use of key informants in organisations has been a popular method for data collection in many research contexts (Huber & Power, 1985). Usually, these respondents are in the senior ranks of the organisation, residing at middle managers, top managers and executive managers. With these positions come knowledge of the organisation and its relative strategies. The use of key informants for knowledge management purposes comes from those in the organisation that has access to, and use of, organisational knowledge. This can be virtually any one in the organisation.

In this study, those people must be able to explain the structural elements of the organisation in addition to the knowledge-oriented processes. The respondent profile considered ideal for this study includes executives as well as top and middle managers. These organisational respondents use knowledge for the realisation of their duties, in supporting their organisation's knowledge activities

Huber and Power (1985) propose several plans for improving the precision of reports gathered from key respondents. These principles adhere to the development of this research design. Table 4.1 relates these strategies with potential sources of error and outlines procedures to improve the precision.

**Table (4.1): Condenses Procedures for Precision Improvement of Collected Data:  
adopted from (Huber & Power, 1985)**

## 4.6 Sampling Strategy

A common goal of survey research is to collect data that represents the population. The researcher is always looking for ways to generalise his/her findings based on the sample drawn from the population. The researcher must take care in the selection of a sample, to minimise the chance that the estimates obtained from a sample may differ from those that would be obtained if all units in the population had been included.

One of the approaches used to make inferences from the sample to the population is to use a confidence interval approach. In this approach, the sampling error in business is criticised as a weakness (Wunsch, 1986). The recognition of the sampling error is done through determining the error estimation for the sample.

The confidence interval focuses on the reliability of the sample mean in estimating the population mean. Because of the error and sampling variability, the mean value of the sample is not exactly the same as the mean value of the entire population. Statisticians compute an interval around the sample mean with a high confidence factor for tackling the unknown population mean. This interval is the confidence interval. It reflects two important things related to the estimation of the mean: the size of the sample and the level of confidence required (Fowler, 1988; Shadish et al, 2002; Trochim, 2003).

Cochran (1977) uses two factors to express the error estimation in the research:

- The margin error, or the risk the researcher is willing to accept.
- The alpha level, which represents the willingness of the researcher to report a mistake made accidentally to accept that the true margin of error exceeds the acceptable margin of error (Bartlett et al, 2001).



### **4.6.1 Cochran's Formula**

There are many formulas within this approach, while Cochran's formula (Cochran, 1977) is used more often than others (Bartlett et al 2001). This formula is used to compute the sample.

### **4.6.2 Sample Size Determination**

Based on the work of Cochran (1977), the determination of sample size took into account the following:

- o Whether categorical or continuous variables would play a primary role in data analysis.
- o What alpha level could be used in the formula.
- o What is the acceptable margin of error in the formula.

Firstly, the continuous variables play a main role in this research. The majority of the research hypotheses are built on continuous variables. Knowledge management styles, knowledge availability, knowledge codifiability, knowledge applicability, organisational performance and absorptive capacity are all based on the five point Likert scale.

Secondly, the alpha level used in determining a sample size in most research studies is either 0.05 or 0.01 (Ary et al, 1996). In particular, although there is a lack of empirical studies in knowledge management, the majority of the studies use alpha level 0.05 (Choi & Lee, 2003; Saarenket et al, 2003). In Cochran's formula, the alpha level is incorporated by utilising the t-value for the alpha level selected (Bartlett et al 2001).

Finally, the acceptable margin of error for a continuous data is 3% (Krejcie & Morgan, 1970).

Based on these details, the formula to be used is as follows:

$$n_o = \frac{t^2 * s^2}{d^2} \text{-----4.6.2.1}^\tau$$

Where  $n_o$  is the sample size, ignoring the finite nature of the population involved,

t is the value for selected alpha level 0.05 is 1.96,

d is the acceptable margin of error for the mean being estimated =  $5 * 0.03 = 15\%$ ,  
where 5 is the value of the continuous five point Likert scale (.Bartlett et al 2001),  
and

s is the estimation of standard deviation in the population. To estimate the standard deviation, Cochran (1977) and Choi & Lee (2003) use the result of the pilot study.

The maximum standard deviation for continuous variables in the pilot study is 1.58.

Therefore, referring back to equation (4.6.2.1):

$$n_o = \frac{1.96^2 * 1.58^2}{0.15^2} \cong 426$$

### 4.6.3 Population Size

There is no official or universally accepted definition for an SME “Small and Medium Enterprise” (Kuwayama, 2001). However, for the OECD (Organisation for Economic Co-operation and Development) countries, of which Australia is one. The broad definition for an SME is an enterprise that has less than 500 employees (Ayyagari et al, 2003). In Australia, the official definition of SME is an enterprise that has at least 100 employees (Ibid). Because of the different definitions of SMEs in regard to the number of employees, the researcher utilises the definition of SME as an organisation that has between 100-500 employees.

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<sup>τ</sup> source (Bartlett et al 2001)

In particular, this range is recognised as a medium enterprise (Iles, 2002, Harvie & Lee, 2001). SMEs have proved to be important agents in innovation and technology advancement (ENSR, 1995). Furthermore, in Australia alone, 45% of the national employment rate is in SMEs (Kuwayama, 2001). In addition to the restrictions imposed by these factors, this research is also limited by the cost and the accessibility of a database that lists these enterprises. For these reasons, the size of the population used for the survey is limited to profitable medium enterprises that are listed in an electronic commercial database in Feb 2003 ( Business who's who of Australia <sup>TM</sup>).

The population surveyed thus contain 1,638 organisations. Since the sample size obtained from equation (4.6.2.1) exceeds 5% of the population ( $\cong 82$ ), the Cochran (1977) correction formula should be used to calculate the size of the final sample needed to ensure the generalisability of the research findings (Bartlett et al, 2001).

$$n = \frac{n_o}{(1 + \frac{n_o}{population})} \text{-----4.6.3.1}^\tau$$

$$n = \frac{426}{(1 + \frac{426}{1638})}$$

$$n \cong 338$$

The sample size required, therefore, is 338 organisations from different industries. Following the recommendation of (De Vaus, 2002) for selecting random samples from the population, 338 organisations were selected randomly from the database as the research sample.

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<sup>τ</sup> source (Bartlett et al 2001)

## 4.7 Mail Survey

The mail survey is the most common survey method deployed by the researchers.

The mail survey was selected as the quantitative research method for this study. The objective of the mail survey was to collect and then analyse data in order to test the hypotheses.

According to Galpin et al (1984), the advantages of mail questionnaires are that they are easy to distribute and tabulate. Also, they can reach a large sample at lower cost than interviews or other methods. They are likely to have less researcher bias than interviews, higher perceived anonymity of respondent and less vulnerability to social desirability issues (Zikmund, 2003; William et al, 1995; Biner & Barton, 1990).

The researcher, however, is not able to interact with the respondent. The researcher is also not assured that the intended respondent is the actual respondent (Galpin et al 1984, Malhotra, 1996), and the respondent may find the whole survey process too impersonal. Also, the researcher may have a low response rate (Galpin et al, 1984; Kumar et al, 1999; Zikmund, 2003). Table 4.3 presents comparative information of three methods for collecting data.

**Table (4.2): Comparative Information about three Methods for Collecting Data.**  
**Source: (Summerhill & Taylor, 2003)**

## **4.8 Ethical Considerations in the Study**

Ethical considerations are a significant issue in social research. Fontana and Frey (1998) emphasise that as the object of inquiry in social research is human beings, extreme care has to be taken to avoid any harm to them. Psychological harms such as stress, emotional distress, self doubt and so on can trigger sensitive issues and emotional experiences (VanManen, 1990).

To address the ethical issues arising from the questionnaire, the Human Ethics application form, the cover letter Appendix I and questionnaire Appendix II were submitted and approved by the university's Human Research Ethics Committee prior to commencing the research Appendix III. Information about ethical considerations was explained to potential participants in the research in the human Ethics Application form and the cover letter. Such information included the nature and aims of the research, the entirely voluntary participation, the protection of confidentiality and privacy of participants, the use and distribution of research finding, and the storage of data.

## **4.9 Administration of the Mail Survey**

Following the suggestions in the research methods literature (Leedy & Ormrod, 2001, De Vaus 2002), careful consideration was given to the design of envelop, cover letter, and questionnaire, in order to minimise non-sampling errors. Stamped, self-addressed, university envelopes were used to minimise the effort involved in returning the questionnaire.

The cover letter Appendix I, which used the university official letterhead, was developed to describe the background of the study and to request participation. The

cover letter also contained information about the incentive for responding, privacy and confidentiality issues and the sample selection method, the voluntary nature of the study, and the proposed use of the survey results. The identity number was later used for two reasons:

- To ensure that unnecessary reminders were not sent to those who already responded.
- To follow the respondents who are interested in the short result report.

The protection of the respondent's privacy and confidentiality was emphasised in the cover sheet. The incentive for participation was to promise to send a summary of the results of the study in return for the completion of the questionnaire. Follow-up reminder letters were sent Appendix IV in order to get higher response rates from the mail surveys (James & Bolstein, 1990; Kanuk & Berenson, 1975); it was similar in content to the cover letter but placed more emphasises on the importance of completing the survey.

## **4.10 Chapter Summary**

This chapter includes the justification of the methodology that is used to test the research questions and hypotheses. It demonstrates how the post-positivist paradigm fits this research and why a quantitative method should be used. This research data was collected by mail from the key informants in the organisations, such as executive, top and middle managers. It was found that the 338-sample size is enough to generalise the results. The importance of citing the ethical considerations in any social research is discussed. In the quantitative method, a distinction should be made between the concepts and operations. The next chapter discusses the concepts, operations and measures of this research and describes the questionnaire development.

# **CHAPTER 5. IDENTIFICATION OF CONCEPTS AND MEASURES LEADING TO THE DEVELOPMENT OF THE QUESTIONNAIRE**

## **5.1 Introduction**

This chapter concerns the manner in which the constructs in the research framework, represented in Figure 3.9 are operationalised. It describes how items for each construct are chosen to build a homogenous scale with high internal consistency and validity. The existing measures are used where possible and in some instances a subset of items from the original scales are used.

This chapter defines all the concepts, operations and measures in this study. The concepts and their measures are based on the literature review. The chapter has Thirteen Sections. The Second Section deals with the process of the development of the questionnaire, where the concepts are defined, specified and refined. The Third Section addresses the importance of including some negative wording in the questionnaire. Section Four shows how the five knowledge enablers are used to extract the items for the four knowledge management styles.

The next four sections deal with constructs that are suggested as mediating or moderating factors in the relationship between knowledge management styles and organisational performance as indicated in Figures 1.3 and 3.9. In the Fifth Section, knowledge availability items are added to the questionnaire. Knowledge codification items are defined in Section Six. The knowledge applicability concept and its measures are introduced in Section Seven. Section Eight discusses the concept of absorptive capacity.



In Section Nine the concept and measures of organisational performance are defined. Style dispersion, together with its relationship to the balance of the four knowledge management styles, is introduced in Section Ten. A summary of all the items for all the concepts is presented in tables in Section Eleven. The introduction of a scale development is introduced in Section Twelve. An overall summary of this chapter is presented in Section Thirteen.

## **5.2 Questionnaire Development**

Questionnaire items were developed in an iterative manner based on recommendations from Churchill (1979). The author developed a list of 65 candidate items to measure the different concepts in this study: adoption knowledge management style, systemisation knowledge management style, standardisation knowledge management style, articulation knowledge management style, knowledge availability, knowledge applicability, knowledge codifiability, organisational performance and absorptive capacity. This was done by conducting a literature review that dealt with the concepts in the integrative framework depicted in Figure 3.9, and the set of the hypotheses articulated in Chapter 3.

The aim of the empirical research is to test whether the dimensions proposed in K-Space support a significant distinction between different kinds of knowledge management styles. This represents the first step in testing the full framework, where managers would be asked to rank a variety of knowledge elements according to the framework.

First, generic descriptions of knowledge elements were produced. Next, a set of items was developed to measure the constructs proposed in the framework. The sources of the questionnaire items for each construct are as follows:

- Knowledge availability is measured through a set of items based on knowledge functions applied in each of the three domains (individual, group and the whole organisation). The items of this construct are basically adopted from Achterbergh and Vrien (2002).
- Following the work of Schulz and Jobe (2001), knowledge codification is measured through a set of items in three forms,
- Knowledge applicability is measured through items adopted from research conducted by Gold et al (2001).
- The absorptive capability construct is determined through a measure prepared and used by Cohen and Levinthal (1990).
- Organisational performance is measured from a non-financial perspective adopting the method developed and validated by Choi and Lee (2003).

Three employees working in a knowledge management project in a reputable local company reviewed these items. Two of them only work as a team members and the third manages knowledge management project. As the result of this revision some questions were reworded.

An initial version of the questionnaire was constructed by placing each knowledge management practice description at the top of a page, followed by the set of items. Items featured a five-point Likert scale, with response options ranging from "strongly disagree" to "strongly agree". The questionnaire design was also discussed by four PhD

students; one of them was from the Marketing Department at Wollongong University, who has already done his survey; and the rest were in the Department Of Information Systems and have has experience with questionnaires. An employee, who works in a Research Company, also reviewed the questionnaire.

At this point, the questionnaire was divided into ten sections. Nine sections represented the nine constructs in the framework in figure 3.9. The tenth section represented demographic information: the employee's age, sex, number of years working in the organisation, job status, annual income and the highest level of education completed.

### **5.3 Positive and Negative Wording**

In order to avoid responses biased and acquiescence bias among the subjects, the instrument included both positive and negative items in the scales (e.g., Anastasi, 1988; Dillon et al, 1993; Guy et al, 1987; Kerlinger, 1964; Zikmund, 1991). The inclusion of positively and negatively worded items in the response elicitation has long been promoted as a means of providing some control of acquiescence bias (Engelland et al, 2001).

The positive and negative items should be mixed up to help to avoid an acquiescent response set (De Vaus, 1991). The negative worded statements were written in bold print to avoid confusion (CTE, 2002)

## **5.4 The Four Knowledge Management Styles and Knowledge Elements**

The framework of the study is based on four knowledge management styles. The adoption style includes socialisation knowledge elements; the articulation style includes internalisation knowledge elements where knowledge acquisition is externally focus, where the organisation is deliberately scanning the external environment for ideas and practices. The standardisation style includes externalisation knowledge elements where knowledge acquisition is internally focussed and the organisation seeks knowledge from employees, which is case-based. Finally, the systemisation style includes combination knowledge elements ( see also Hasan & Al-hawari, 2003; Al-hawari & Hasan, 2002, 2004).

### **5.4.1 Descriptions of Knowledge Elements**

In this study, four knowledge management styles are identified for use through a review of recent literature describing knowledge management. Knowledge elements were selected for the four kind of knowledge management styles and extracted from the set of five knowledge enabler cycles: Instil knowledge vision cycle (IKVC), Manage conversation cycle (MCC), Mobilise knowledge activist cycle (MKAC), Create the right context cycle (CRCC), and Globalise local knowledge cycle (GLKC). The use of generic descriptions for these enablers are drawn from Von Krogh et al (2000) and other literature as indicated. The descriptions of knowledge elements are modified for improved readability and cover all knowledge management styles. This is summarised in Table 5.1.

**Table (5.1): Five Knowledge Enablers and the Knowledge Elements**

<b>Knowledge management styles</b> →	<b>Adoption</b>	<b>Standardisation</b>	<b>Systemisation</b>	<b>Articulation</b>
Knowledge enabler cycle ↓				
Instill knowledge vision cycle (IKVC)	Commitment to the generativity in organisation (Hodgkinson, 2002) (Von Krogh et al, (2000)	Focus on reformation of the existing knowledge systems (Von Krogh et al, (2000)	Dedication to direction (Von Krogh et al ,2000)	
	Focus on reformation of existing task systems (Von Krogh et al, 2000) (Abusabha et al, 1999)			Keep a contact with external community. (Von Krogh et al, (2000)
				Dedication to decisive competitiveness (Von Krogh et al, 2000)
Manage conversations cycle (MCC)	Establish conversational etiquette (Von Krogh et al, 2000) (Abusabha et al, 1999)	Editing the conversation appropriately (Von Krogh et al, 2000)		

	Create an atmosphere of acceptance (Von Krogh et al, 2000) (Abusabha et al, 1999)			
	The patient and enjoyment are required (Isen et al , 1987) (Abusabha et al, 1999)			
Mobilise knowledge activists cycle (MKAC)	Knowledge activist should encourage employee rotation across areas (Von Krogh et al, 2000)	Capture and transfer of experts knowledge (Von Krogh et al, 2000)		Knowledge activist should support online - job training (Von Krogh et al, 2000)
	Knowledge activist encourages employee to involve in brainstorming retreats or camps (Von Krogh et al, 2000)	Manage the electronic chat groups /web-based discussion groups to acquire what is important and store it on special electronic systems (Von Krogh et al, 2000) (Bonner, 2000)		

	Knowledge activist should let the novices and mentors transfer knowledge (Von Krogh et al, 2000)			
	Sharing inspiring stories with the employees from different conversations (Von Krogh et al, 2000)			
Create the right context cycle (CRCC)	The willingness of people to share the knowledge with each other (Hyland et al, 1998) (Glanville, 2001)	The attitude of the employees toward technology as the tool that tackles their knowledge (Anandarajan et al, 2000) (Martiny, 1998) (Morris ,2001)		The willingness of managers to access and know the legislatives and asocial forces of any aimed market (Hackney & McBride, 1995)
				The attitude of the employees toward technology as the tool to acquire knowledge (Anandarajan et al, 2000) (Martiny, 1998) (Morris, 2001)

Globalise local knowledge cycle (GLKC)	The organisation knowledge is presented through experts (Shariq, 1999) (Kidger, 2002) (Bender & Fish, 2000)		Organisation knowledge is presented through yellow pages tools (Malik, 2002)	The ability of an organisation to analyse and understand the feedback that impact organisation knowledge (Macintosh & MacLean, 2001) (Tiwana & Bush, 2001)
			The organisation knowledge is presented through documents, manuals or reports (Robertson, 2002) (Rowley, 1999)	
			The organisation knowledge is presented through knowledge-base systems. (Ohsuga, 1995)	



## **5.5 Knowledge Availability**

The availability of knowledge is treated as a multidimensional construct, where the focus is on the three domains of knowledge availability. The abstraction dimension of K-Space is probably the most important dimension in studying the effectiveness of knowledge on organisational performance. This research, therefore, utilises the work of Schulz and Jobe (2001) to build a construct with different levels that align knowledge availability along a continuum of abstraction. Because the domain of knowledge availability determines the abstraction level of knowledge (Boisot, 1998), it is used to build the knowledge availability construct with the focus on three different domains of availability. Knowledge available to the whole organisation is the most abstract knowledge; where it guides proposals for new goals, assesses new development as opportunities and threats, etc. Knowledge available to a department or group is less abstract as, it helps for example, in coordination among the departments to establish norms for their own activities in terms of maximised performance, etc. Finally, knowledge available to an individual is the least abstract when it helps the employees to know their duties and tasks, know how to act in uncertain situations, etc..

The availability of knowledge can be broadly characterised along a continuum ranging from what can be termed ‘cognitive’ to ‘community’ models of knowledge management (Swan et al, 1999). The cognition model is primarily concerned with how knowledge is preserved and circulated within the organisation, often regarding the application of information and communication technologies (Cole-Gomolski, 1997). Knowledge can be embedded within an organisation’s systems, or in individuals or groups (Blacker, 1995).

An organisation is where knowledge is integrated with individuals, groups and the whole organisation in the process of producing goods and services (Grant, 1996; Holtshouse, 1998; Kogut & Zander, 1992; Nonaka & Takeuchi, 1995 ). In their design model for knowledge-based decisions, Foot et al (2002) agree that while knowledge should be available for a primary user, a group and whole organisation, the sources and functions of knowledge in these domains are different. Group knowledge is a construct of all the individual's knowledge that contributes to problem solving (Salisbury, 2001).

Knowledge assets exploited at the whole organisation domain helps it to be more competent and capable (Sanchez, 1997; Teece, 1998), while knowledge at the individual domain helps to build a competitive advantage (Wright et al, 2001). More recently, Willem and Buelen (2002) explain that knowledge of the group helps to build a competitive advantage.

This research acknowledges three levels of functions (Table 5.2) that relate to the viable knowledge that can be used by a unit. The unit could be an individual, department, or whole organisation (Achterbergh & Vrien, 2002). The domain of knowledge availability varies between individual, group and the whole organisation. The function of knowledge in each domain is varied as well. In order to determine which different kinds of knowledge functions are useful in various knowledge availability domains, a multi-items construct is used to capture all the combinations of knowledge availability domains and knowledge functions. The respondents are asked to rate how knowledge helps in achieving these functions in each of the three knowledge availability domains: knowledge available to individual, knowledge available to department, and knowledge available to the whole organisation.

**Table (5.2): Knowledge Functions for Individual, Group and Whole organisation:  
Source Achterbergh & Vrien, (2002)**

## **5.6 Knowledge Codifiability**

The codification of knowledge is treated as a multidimensional construct; the focus is on the three forms of codification. As with knowledge availability, discussed in Section 5.5, this research utilises the work of Schulz and Jobe (2001) to build a construct with different dimensions in regard to its alignment along a continuum of abstraction. Schulz and Jobe (2001) treat codification as a three forms construct and that has been adopted in this study. In the first, knowledge is represented in numbers and codes, such as mathematical formulas, computer programs, bar codes and the like. In another form, knowledge is presented in words and texts, such as knowledge in natural language

(policy statements, metaphors, reports, etc). In the third form, knowledge is presented in humanised objects such as a pictures and sounds (Ibid).

Because the form of knowledge codification determines the abstraction level of knowledge (Boisot, 1998), it is used to build the knowledge codification construct as three different forms of codification. Knowledge encoded in numbers and codes is the most abstract form. Knowledge encoded in words and texts is a less abstract form. Finally, knowledge encoded in pictures and images is the least abstract.

Codification creates perceptual and conceptual categories that assist the classification of the phenomena. The assigning of phenomena to categories is known as coding (Boisot, 1998). The less the phenomena is categorised, the lower the level of codification (Ibid). The level of codification of organisational knowledge is not exogenous to an organisation. Rather, it is increasingly a decision variable for an organisation

## **5.7 Knowledge Applicability**

Knowledge application is related to how much knowledge is processed and used in an organisation (Gold, 2001). When knowledge is applied well, it offers a comprehensive solution that helps organisations to achieve their goals effectively (Lanser, 2002). As well as reducing training time, the accuracy and consistency of information is improved through the application of knowledge (Robertson, 2002). Efficiency gains are made through higher-quality decisions (Hansen & Thompson, 2002), better operations (Kaplan, 2002), and the productivity of the organisation (Hollander & Mihaliak, 2002). Efficiency is not the only thing that can be achieved when knowledge is process well, however. The ability of an organisation to face challenges is also increased. CEOs often

realise the organisational attitude toward business challenges are underpinned by processing knowledge (Lindholm, 2002).

Robertson (2002) reveals the importance of applying knowledge in the strategic direction of the organisation. Different issues, such as knowledge, energising the strategic direction and control of an organisation (Walters et al, 2002). Knowledge plays a positive role in strategic direction through assisting the management to recognise the appropriate link between the board and staff role in management implementation (Tecker et al, 1999). The effect of knowledge on the strategic direction impacts both current and future planning, extending over several years (Fusaro, 1998; Leonord, 1995).

In addition these are some extra applications of knowledge at the organisational level:

- Knowledge is used and processed to solve problems. Knowledge of mathematics, artificial intelligence, etc provide a good assistance in finding solutions in organisations (Bulkeley, 2002). The required knowledge for solving problems should be continually upgraded by escalating the expenses of information, communication technology, education and training (Sangran, 2001).
- Product development is not far from knowledge application in an organisation. Knowledge and its management is seen as the best way to facilitate new product developments (Glasgow, 2002), since the failure to harvest its full value is to misunderstand the subtle ways that different features of knowledge influence new product success (Yang et al, 2002).
- Learning from both successes and mistakes are likely to benefit the organisation

It is suggested that organisational learning and knowledge management are not synonyms for the same activity but are complementary, overlapping processes that offer maximum benefit when used together (Farr, 2000).

The organisation's learning most likely comes from current and past experiences. The reliance on past experience reduces the amount of human capital an organisation imports in the future (Madsen et al, 2002). In addition, the greatest long-term predictor of organisational success is hooked to the way that organisation learns from its mistakes (Eisinger, 2001).

In summary, organisations process their knowledge to adjust their strategic direction, to improve efficiency, to influence changing competitive conditions, to solve new problems, to develop new products and/or services, and to learn from experience. These areas have been used to measure how much knowledge is able to be applied in an organisation (Gold, 2001).

## **5.8 Absorptive Capacity**

An analysis of the literature suggests that another mediating factor in the application of knowledge may depend on the absorptive capacity. This construct refers to knowledge assimilation within an organisational context and, according to some authors (Lemon & Sahota, 2003 ; Cohen & Levinthal, 1990,1994 ;Petroni & Panciroli, 2001; Decarolis & Deeds, 1999), it is a mandatory requirement for problem-solving and decision-making. It is included in this study as independent variable. Expenditure on R&D as a fraction of annual sales is a common measure used for estimating an organisation's absorptive capacity. Another measure that can be used for the same purpose is an investment in personal training (Liu &White, 1997; Petroni & Panciroli, 2001).

## **5.9 Organisational Performance**

Organisational performance is the main dependent variable in the study. Organisations who have effective ways to manage their knowledge are much prepared to face changes in a new economy, thereby being innovative (Clarke & Rollo, 2001; Nonaka & Takeuchi, 1995; Beijerse, 2000) to invest and compete (Carneiro, 2000).

Companies that achieve the biggest growth revenue often rely on knowledge packaging (Misek, 2002). In addition to the obvious financial measures of performance, such as profit or return on investment, other measures are considered. Economists report a connection between knowledge management in the organisation and the market share (Strassmann, 1999; Coffman, 2000). Organisations with increased market share are more likely to have higher performance than those do not have increment (O'Regan, 2002).

Knowledge management is practiced in small, medium and large enterprises. SME “small and medium sized enterprises” often contain a fertile environment for knowledge creation, transfer and innovation (eg, Hoolandt, 2004; Bryant & Colwell, 2002; Braun, 2002). In the literature cited here, there is a relationship between knowledge management and a set of organisational factors, such as business size, innovation, profit, revenue growth and market share.

In the empirical study, one of the few approaches to measure the outcomes of knowledge management is related to business vision, where the balance scorecard is used to measure the result of knowledge drivers or activities (Gautreau & H.Kleiner, 2001). The effectiveness of this measure is recognised, because it is based on the

concept of benchmarking. Indeed, The usefulness of benchmarking as an instrument of managerial practice is widespread because of increased global competition, development of information technology, database and network (Drew, 1997). Benchmarking is now one of the most popular tools for strategic management (Rigby, 1994). Organisational performance is measured by a benchmarking approach with items from a scale developed by Lee and Choi (2003a, 2003b), which is included in the questionnaire.

## 5.10 Style Dispersion

To operationalise balance and balance approaches, the measure of style dispersion for each organisation is computed. The style dispersion is essentially the variance of styles across the four management styles. It represents the degree to which a manager takes a balanced approach to knowledge management.

Assuming that a manager have a choice between (L) styles. The measure of style-dispersion for each manager (k), where  $Style_{i,k}$  gives the extent to which style in organisation is implemented by a manager (k), and  $Avg_k$  is the average level of all styles in the organisation that deployed by the manager (k).

$$Style.Disp_k = \frac{1}{L-1} \sum_{i=1}^L (Style_{i,k} - Avg_k)^2 \text{-----5.10.1}$$

$$Avg_k = \frac{1}{L} \sum_{i=1}^L Style_{i,k} \text{-----5.10.2}$$



The main empirical predication of Hypothesis 12 is that a low value of style-dispersion in the organisation is positively associated with organisational performance. Since performance is implication of balanced approaches might vary across the four-management style. It is important to note that hypothesis 12 implies that all knowledge management styles are of equal importance for an organisation.

## 5.11. Constructs and the Items

The items that measure the different constructs in the study are summarised in Tables 5.3 to 5.10.

**Table (5.3): Items Measuring the Adoption Knowledge Management Style**

Variable name	Item
	My organisation
Adopt1	.... Employees are allowed to rotate their job with others in the organisation.
Adpot2	.... Vision is made clear, and well known, to employees.
Adopt3	.... Holds group discussions with formal protocols such as; avoiding questions with the answers YES or NO, echoing ideas and solutions, etc
Adopt4	.... Holds group sessions that have a variety of participants with their own knowledge.
Adopt5	.... Holds group sessions where the participants' feelings are respected even when there is disagreement with their viewpoint.
Adopt6	...Holds group sessions where smiles and fun are encouraged
Adopt7	.... Invites employees to brainstorming sessions in order to solve problems.
Adopt8	.... Tells success stories about other companies.
Adopt9	... Employees have a willingness to share their knowledge with each other.
Adopt10	.... Knowledge is spread outside the organisation by the experts/spokespersons
Adopt11	... Encourages the transfer of knowledge from mentors to novice employees.

**Table (5.4): Items Measuring the Systemisation Knowledge Management Style**

Variable name	Item My organisation
Sys1	...Has knowledge technology integrated with an advanced communication system
Sys2	...Has systematic approach to problem solving.
Sys3	...Stores knowledge in electronic documents
Sys4	...Stores knowledge in data base system
Sys5	... Stores knowledge in Hyper text / WebPages
Sys6	... Stores knowledge in a yellow pages system
Sys7	.... Stores knowledge in a knowledge base system

**Table (5.5): Items Measuring the Standardisation Knowledge Management Style**

Variable name	Item My organisation
Stand1	.... Ensures expert knowledge is captured and/or documented
Stand2	.... Holds electronic discussions capturing the knowledge obtained from them.
Stand3	.... Has Employees that are willing to document their knowledge
Stand4	.... Strives for all employees to have access to captured knowledge.

**Table (5.6): Items Measuring the Articulation Knowledge Management Style**

Variable name	Item In My organisation
Art1	...Past knowledge is captured and/or documented.
Art2	... Knowledge that is obtained from competitors is captured and/or documented.
Art3	... Knowledge that is obtained from customers is captured and/or documented
Art4	...Knowledge that is obtained from external partners is captured and/or documented.
Art5	...Employees are encouraged to get on line training on how to capture/document what they are learning.
Art6	...There is an incentive to document relevant legislation and social issues that affect your market.
Art7	...Employees are able to acquire knowledge using the latest technological.
Art8	... Customer feedback and comments about your products and services are captured, documented, processed and analysed.

**Table (5.7): Items Measuring the Knowledge Availability**

Variable name	Item In My organisation
Avail1	... Knowledge helps the employees to know their duties and tasks
Avail2	...Knowledge helps the employees to know how to act in uncertain situations
Avail3	...Knowledge helps the employees to recognise the gap between their expected and actual performance
Avail 4	... Knowledge helps the employees to close the gap and learn from mistakes
Avail 5	.... Knowledge helps departments to recognise the gap between their expected and actual performance
Avail 6	... Knowledge helps departments to coordinate their activities in order to maximise performance.
Avail 7	... Knowledge helps departments to realise the effects of uncertainty and its impact on their performance
Avail 8	.... Knowledge helps to set new goals in a changing environment.
Avail 9	.... Knowledge helps to assess and review proposed new goals.
Avail 10	.... Knowledge helps with the assessment of new development as opportunities and threats.
Avail 11	.... Knowledge helps to have regular measures to counter the imbalance between desired and current goals.

**Table (5.8): Items Measuring Knowledge Applicability**

Variable name	Item In My organisation
Appl1	... Has a process for applying knowledge learned from mistakes
Appl2	... Has a process for applying knowledge learned from experiences.
Appl3	... Has a process for using knowledge for the development of new products and/or services.
Appl4	... Has a process for using knowledge to solve new problems
Appl5	... Matches sources of knowledge to problems and challenges.
Appl6	... Uses knowledge to adjust strategic direction as needed.
Appl7	... Uses knowledge to improve efficiency
Appl8	...Is able to locate and apply knowledge to the changing competitive condition.
Appl9	... Makes knowledge accessible to those who need it.
Appl10	... Takes advantage of new knowledge
Appl11	... Quickly applies knowledge to critical competitive needs.
Appl12	... Quickly identifies sources of knowledge in solving problems

**Table (5.9): Items Measuring Knowledge Codification**

Variable name	Item
	My organisation
Cod3	...Represents knowledge in numbers and codes
Cod2	... Represents knowledge in words and text
Cod1	... Represents knowledge in pictures and images

**Table (5.10): Items Measuring Organisational Performance**

Variable name	Item
	Compared to key competitors, My organisation:
Per1	...Is more successful
Per2	...Has greater market share
Per3	...Has a faster growth rate
Per4	... Is more profitable
Per5	...Is more innovative
Per6	... Is of larger size (number of employees)

**Table (5.11): Items Measuring the Absorptive Capacity**

Variable name	Item
	Compared to the annual revenue, Your organisation
Ac1	... Research & Development expenses are high.
Ac2	... Training expenses are high

## 5.12 The Scale Development

The scale was developed based upon a two stage approach (Stratman & Roth, 2002) and the recommendation of Churchill, (1979). In the first stage, precise definition and requirement items for each construct are developed with the tentative indications of reliability and validity. In the second stage, these items are refined and validated using survey data collected on the scale developed in the first stage of the pilot study.

The steps used to develop the scale are adopted from (Stratman & Roth, 2002; Churchill 1979 ). In the next chapter, the pilot study is presented and its importance is discussed.

**Figure (5.1): Steps Used to Develop the Scales: adopted from (Churchill, 1997 ; Stratman & Roth, 2002)**

## 5.13 Chapter Summary

This chapter provides an overview and explanation of the concepts and their measures represented in Figure 3.9. There are nine concepts with sixty-two items. These are:

The four knowledge management styles:

- o The adoption style with eleven items.
- o The systemisation style with seven items.
- o The standardisation style with four items.
- o The articulation style with eight items.

The three mediating variables:

- o Knowledge availability with three different domains of availability; individual, group, whole organisation with eleven items.
- o Knowledge codification with three different forms of codification and three items.
- o Absorptive capacity with two items.

The moderating variable:

- o Knowledge applicability with twelve items.

The dependent variable:

- o Organisational performance with six items.

The next chapter presents the results of the pilot study.

## **CHAPTER 6. THE PILOT STUDY**

### **6.1 Introduction**

The purpose of this chapter is to describe the pilot study designed in order to pre-test the internal consistency and validity of the new and modified scales developed in the previous chapter.

The use of a pilot study is recognised as a critical part of a rigorous scale development methodology. A pilot study consists of data collection from a small set of subjects, and which serves as a guide for the main study (Zikmund, 2003). A pilot study is an experimental study used to prove whether or not a particular instrument of the investigation works, it is also called “pre-testing”, or “trying-out” (Baker, 1994). A particular advantage of a pilot study is that it gives preliminary warning about where the main research could potentially fail and where the possibility of research protocol may not be followed correctly, or whether suggested methods or instruments are inappropriate or complicated (Teijlingen & Hundley, 2001). The main reasons for conducting a pilot study are summarised in Table 6.1



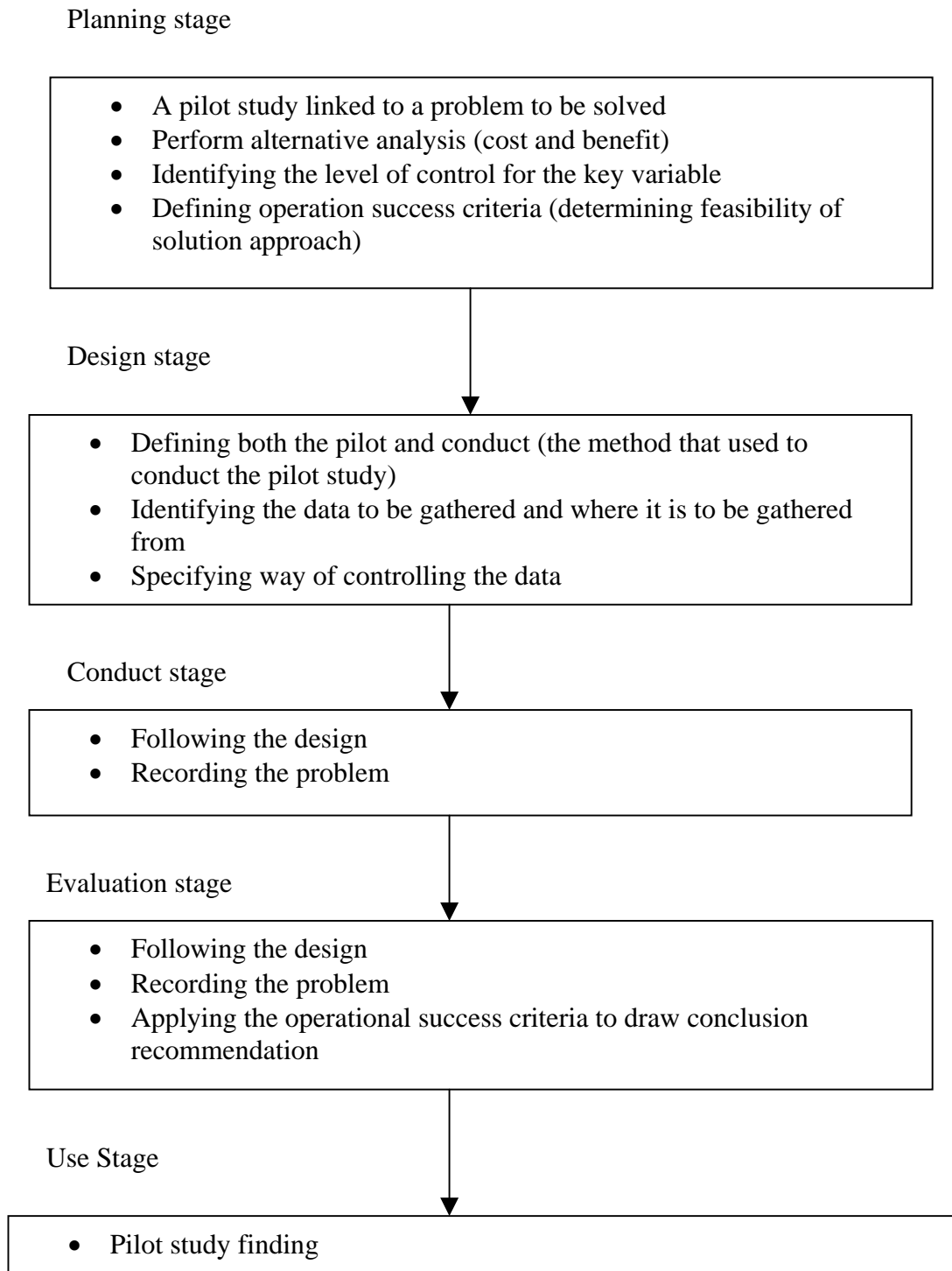
**Table (6.1): Reasons for Conducting a Pilot Study: adopted from (Teijlingen & Hundley, 2001)**

One problem with a pilot study is that its participants are not included in the main study. Social scientists make an argument in which they state that the essential feature of a pilot study is that its data should not be used to test the hypothesis (Peat et al, 2002).

There are different categories of pilot studies in relation to their implementation. (Glass, 1997) classifies pilot studies into three categories, based on their implementation. The first category is ‘rigorous’, because the implementation is very important. The second category is ‘moderate’, because the implementation is of an average importance. The third category is the ‘informal’ approach, because implementation is of low importance. In each category, some key steps are more applicable in one approach than the other

(Ibid). In this research, the rigorous category for the pilot study is most likely suitable, since the implementation is very important to enhance the efficiency of conducting a pilot study. Glass's key steps for this approach are listed in Figure 6.1.

**Figure (6.1): Pilot Steps: adopted from (Glass, 1997)**



## 6.2 The Planning Stage

The pilot study was planned to confirm the reliability and the validity of the new scales, which in this case are the four knowledge management styles and the three domains of knowledge availability, which are particularly complex.

*The complexity inherited in many business processes cannot be adequately measured with a single item. Multi-item scales can reduce measurement error and provide more robust measure of complex variables by combining several individual items (Stratman & Roth, 2002).*

The measurement of complex organisational phenomena is best done through multi-items, since the multi-items are generally used to improve the confidential level of the measure (Gold, 2001). Further, the multi-items measure also has a greater exploratory power than a single-item measure (Patel et al, 2002). The single-item measures are mostly criticised by authors, as being weak to measure the constructs (Sevensson, 2001).

Another complex issue that need to be clarified in a pilot study is the influence of control variables. For instance, it is anticipated that industry types may act as a control variable that may affect the relationship between the four KMSs and the organisational capability to make knowledge available and codifiable (Cardinal et al, 2001; Kusunoki et al, 1998; Park & Kim, 1999; Appleyard & Kalsow, 1999, Kankanhalli et al, 2003).

A reliability test can be used to examine the consistency with which individuals respond to the test in diverse settings. If such individuals respond to the item in the same way in diverse occasions, such instruments will be considered a stable and exact measurement of the information of interest. To test the reliability, Cronbach alpha is calculated for each scale. Based on the recommendation of (Nunnally, 1978), in order to confirm its value, it must be greater than 0.7. The Cronbach's Alpha can be increased in either the

average correlation or the number of items (Zander & Kogout, 1995). Henryson (1971) notes that an "item-to-total-test correlation should fall between .3 to .7 for inclusion" in a survey test.

It is imperative to validate the construct to establish that items that are distinctive and that the instrument is able to communicate the desired message for respondents to understand. This test, called construct validity, determines the extent to which an instrument measures a theoretical construct. The content validity is one indication of the scale validity. The item-to-total-test correlation is used to check the content validity for all multi-items constructs (Lee & Choi, 2003). Discriminate validity is used to indicate whether or not the four knowledge management styles are *not* related in reality. It is also used to find how much the two constructs knowledge applicability and absorptive capacity measure different concepts, especially some authors used absorptive capacity to measure knowledge applicability (Decarolis & Deeds, 1999).

### **6.3 Design Stage**

Calder et al (1981) suggest convenience sampling for theory testing in a pilot study. Because a pilot study tests an initial theoretical model, the focus is not on generalising. The important issue is that the sample should be representative for testing the model (Morgan & hunt, 1994). Hunt et al (1982) recommend a sample size between 12 and 30 for the pilot study. However, the larger the sample, the more accurate the results are (Emory & Cooper, 1991).

## **6.4 Conduct Stage**

The pilot survey was conducted on 45 managers in different organisational units within a local organisation. These units have their own budget, profit centre and employees. For the purpose of validating the survey instruments in different industries, the author utilise the work of Bontis et al (2003). They find that in one organisation, different departments have different strategies to manage their knowledge flow. In order to cover widely the possibility of deploying the four knowledge management styles, different departments in the organisation were taken. Respondents were asked to read each item in the survey and indicate their level of agreement with each item before progressing to the next one.

Copies of the survey were sent and received by mail and Dillman (1978) procedures were followed to control the data. Several attempts were made to contact each potential respondent by phone and follow up via e-mail a few days after the initial survey was sent. A total of 30 surveys were returned for a response rate of 66%.

Some managers were not happy with some of the in the questionnaire, so they rewrote some items in their own words. To some managers some questions were not clear enough and they contacted the researchers for clarification.

## 6.5 Evaluation Stage

As was mentioned in the previous section, the number of returned respondents was 30, of which four are discarded from the analysis, because many questions were not answered. Therefore, 26 questionnaires were used in the pilot analysis.

The respondents were 42.3% female and 57.7% male. Some respondents had vast experience in their organisation; for example, 46.2% had more than 10 years experience. The respondents were from both top and middle management levels, 34.6% and 57.7% respectively. Executive managers made up 7.7%. The majority of respondents (12 people) had Bachelors Degrees, 11 Master degrees, 2 Secondary school and 1 Doctoral Degree. Demographic data is shown in Table 6.3.

**Table (6.2): Demographic Data for the Pilot Study**

<b>Demographic object</b>	<b>The valid items</b>	<b>Frequency</b>	<b>Percent %</b>
Sex	Female	11	42.3
	Male	15	57.7
Employee years	<1	3	11.5
	1-2	2	7.7
	3-5	6	23.1
	6-10	3	11.5
	>10	12	46.2
Salary	36,001-50,000	1	3.8
	50,001-70,000	13	50.0
	70,001-90,000	6	23.1
	>90,000	6	23.1
Job Status	Executive management	2	7.7
	Top management	9	34.6
	Middle management	15	57.7

Education	Secondary school	2	7.7
	Bachelor	12	46.2
	Master	11	42.3
	Doctoral	1	3.8

**Table (6.3): Survey Items and their Relationship to the Measure of Interest**

Item #	Name	Measure	Variable description
1-11	Adopt 1-11	Adoption style	Organisational strategies that make individuals practise and share their knowledge with others
12-18	Sys 1-7	Systemisation style	The technology within an organisation
19-22	Stand 1-4	Standardisation style	Knowledge formalisation within the organisation
23-30	Artic 1- 8	Articulation style	Knowledge interpretation within the organisation
31-34	Avail 11-14	Knowledge available to individuals	Knowledge helps the individuals
35-37	Avail 21-23	Knowledge available to departments	Knowledge helps departments
38-41	Avail 31-34	Knowledge available to whole organisation	Knowledge helps the whole organisation
42-53	Appl 1-12	Knowledge applicability	How much knowledge is able to be applied in an organisation
54	Cod3	Knowledge codifiability	Encode knowledge in numbers and codes
55	Cod2	Knowledge codifiability	Encode knowledge in words and texts
56	Cod1	Knowledge codifiability	Encode knowledge in pictures and images
57-62	Per 1-6	Organisation performance	Organisational innovativeness and successfulness
63-64	Ac 1-2	Absorptive capacity	Organisational expenses on research & development and training
65	Age	Personal background	Age
66	Sex	Personal background	Sex
67	Emyears	Personal background	Years in current position

68	Jobs	Personal background	Job title
69	Salary	Personal background	The annual salary
70	Educ	Personal background	Highest completed level of education

## 6.6 Descriptive Statistics

**Table (6.4): Descriptive Analysis for the Pilot Study**

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
ADOPT1	26	2.00	5.00	3.6154	.85215	-.811	.029
ADOPT2	26	2.00	5.00	4.0385	.99923	-.864	-.139
ADOPT3	26	1.00	5.00	3.3846	1.20256	-.528	-.674
ADOPT4	26	1.00	5.00	4.2308	.86291	-2.105	7.134
ADOPT5	26	1.00	5.00	3.9615	1.03849	-1.311	1.744
ADOPT6	26	1.00	5.00	3.7692	1.58028	-1.015	.145
ADOPT7	26	1.00	5.00	3.9615	1.14824	-1.465	1.895
ADOPT8	26	1.00	5.00	3.3077	1.19228	-.654	-.350
ADOPT9	26	2.00	5.00	3.8846	.90893	-.797	.253
ADOPT10	26	2.00	5.00	3.7692	.76460	-.733	.812
ADOPT11	26	2.00	5.00	3.9615	.95836	-.805	-.003
SYS1	26	2.00	5.00	3.1923	1.02056	.073	-1.342
SYS2	26	2.00	5.00	3.5000	.94868	-.305	-.783
SYS3	26	3.00	5.00	4.1154	.58835	-.008	.136
SYS4	26	1.00	5.00	3.7692	1.06987	-1.411	2.038
SYS5	26	2.00	5.00	3.8077	.63367	-.856	1.927
SYS6	26	1.00	4.00	2.4231	.94543	-.068	-.823
SYS7	26	1.00	4.00	2.7692	.86291	-.323	-.318
STAND1	26	1.00	5.00	3.5385	.98917	-.787	.488
STAND2	26	1.00	4.00	2.4231	.94543	.239	-.706
STAND3	26	2.00	5.00	3.7308	.82741	-.816	.503
STAND4	26	2.00	5.00	3.7692	.81524	-.974	.908
ARTIC1	26	2.00	4.00	3.5769	.75753	-1.478	.570
ARTIC2	26	1.00	4.00	3.3462	.93562	-1.101	-.098
ARTIC3	26	2.00	5.00	3.9231	.84489	-.709	.429
ARTIC4	26	1.00	5.00	3.3462	.93562	-.783	.148
ARTIC5	26	1.00	5.00	2.9231	1.16355	.160	-1.105
ARTIC6	26	1.00	5.00	3.3462	1.09334	-.567	-.875
ARTIC7	26	2.00	5.00	3.8846	.90893	-.797	.253
ARTIC8	26	2.00	5.00	3.8077	1.02056	-.562	-.650
AVAIL1	26	4.00	5.00	4.3846	.49614	.504	-1.899
AVAIL2	26	3.00	5.00	4.2308	.65163	-.261	-.554
AVAIL3	26	2.00	5.00	4.0385	.82369	-.540	-.090
AVAIL4	26	3.00	5.00	4.1538	.73170	-.251	-1.004
AVAIL5	26	2.00	5.00	4.0385	.87090	-.865	.570
AVAIL6	26	2.00	5.00	4.0385	.95836	-.967	.331
AVAIL7	26	2.00	5.00	3.7692	.76460	-.733	.812
AVAIL8	26	3.00	5.00	4.3077	.61769	-.287	-.506
AVAIL9	26	3.00	5.00	4.1923	.63367	-.166	-.403



AVAIL10	26	3.00	5.00	4.2692	.53349	.213	-.278
AVAIL11	26	2.00	5.00	3.8462	.78446	-.252	-.163
APPL1	26	2.00	5.00	3.3077	.97033	-.118	-1.133
APPL2	26	2.00	5.00	3.5000	.98995	-.402	-.927
APPL3	26	2.00	5.00	3.5385	1.06699	-.001	-1.184
APPL4	26	2.00	5.00	3.3846	.89786	-.523	-.972
APPL5	26	2.00	5.00	3.5385	.94787	-.425	-.705
APPL6	26	2.00	5.00	3.9615	.91568	-.936	.530
APPL7	26	2.00	5.00	3.9231	.97665	-.953	.229
APPL8	26	2.00	5.00	3.8462	.73170	-.412	.470
APPL9	26	2.00	5.00	3.8077	.89529	.045	-1.093
APPL10	26	2.00	5.00	3.8077	.80096	-.638	.508
APPL11	26	2.00	5.00	3.4231	1.02657	-.016	-1.081
APPL12	26	2.00	5.00	3.6923	.97033	-.451	-.603
COD3	26	1.00	5.00	2.8077	1.16685	.404	-.356
COD2	26	2.00	5.00	4.1154	.65280	-1.048	3.676
COD1	26	2.00	5.00	3.1538	.88056	.442	-.270
PER1	26	2.00	5.00	3.7692	.76460	-1.315	1.774
PER2	26	2.00	5.00	3.3846	.75243	-.184	-.278
PER3	26	2.00	5.00	3.3846	.75243	-.184	-.278
PER4	26	2.00	5.00	3.1154	.86380	.168	-.806
PER5	26	2.00	5.00	3.4615	.81146	-.109	-.314
PER6	26	2.00	4.00	2.6923	.73589	.571	-.874
AC1	26	1.00	5.00	2.7692	.95111	.200	.107
AC2	26	2.00	4.00	3.0000	.80000	.000	-1.410
AGE	26	2.00	4.00	2.8846	.71144	.171	-.887
SEX	26	1.00	2.00	1.5769	.50383	-.331	-2.055
EMYEARS	26	1.00	5.00	3.7308	1.42990	-.729	-.748
JOBS	26	1.00	3.00	2.5000	.64807	-.955	-.044
SALARY	26	2.00	5.00	3.6538	.89184	.411	-1.013
EDUC	26	1.00	5.00	3.3462	.89184	-1.144	2.253
Valid N (listwise)	26						

## 6.7 Scale Reliabilities

Following the recommendation in the planning stage, the reliability test was done using Cronbach's alpha, which for reliability should be greater than 0.7; an "item-to-total-test" correlation should fall between 0.3 to 0.7. Internal reliabilities for each scale were assessed, and the results are presented in the Table 6.5:

**Table (6.5): Internal Reliabilities for the Scales in the Pilot Study**

Scales	Number of items		Cronbach's alpha	
	First stage	Second stage	First stage	Second stage
Adopt	11 items	10 items	0.9030	0.9155
Sys	7 items	5 items	0.6524	0.7272
Stand	4 items	4 items	0.8372	0.8372
Artic	8 items	7 items	0.8188	0.8281
Av1 (Individual)	4 items	4 items	0.8647	0.8647
Av2 (Department)	3 items	2 items	0.6291	0.7573
Av3 (Whole organisation)	4 items	4 items	0.7947	0.7947
Appl	12 items	12 items	0.9663	0.9663
Per	6 items	5 items	0.7181	0.8234
Ac	2 items	2 items	0.7259	0.7259

The adoption style (Adopt) scale has 10 items; adopt 1 has been removed because total test correlation score is (.0725). The systemisation style (Sys) scale has 5 items, and both sys 2 and sys 6 have been removed to increase alpha. In the standardisation style (Stand) scale, all the four items fall in the standard score to total test correlation, and their alpha is greater than (.7). The articulation style (Artic) scale appears to be a good construct, however, Artic 7 has been removed because its score does not fall in the standard score of total test correlation (.2899). Considering the availability variable, Av1 and Av3 are also good constructs; there is no need to drop any of their items. Av 6 has been dropped to increase alpha for Av2. Considering the codification variable, Cod3, Cod2 and Cod1 have only one item each. Considering the performance (Per) variable, Per6 has been dropped because its score does not fall in the standard score of total test correlation (.1124). Considering the absorptive capacity variable, (Ac) alpha is greater than (.7) and so acceptable. The applicability variable (Appl) scale is excellent; its value is (.9663). The following tables 6.6-6.15 present inter-item correlation for all the scales noted above.

**Table (6.6): Correlation Matrix for Adoption Scale**

ADOPT2	ADOPT3	ADOPT4	ADOPT5	ADOPT6	
ADOPT2	1.0000				
ADOPT3	.4532	1.0000			
ADOPT4	.4996	.2965	1.0000		
ADOPT5	.5411	.3326	.7245	1.0000	
ADOPT6	.7160	.5435	.4992	.8606	1.0000
ADOPT7	.7683	.4457	.5341	.5354	.6943
ADOPT8	.6612	.3605	.6669	.7853	.7517
ADOPT9	.4895	.1154	.2393	.4613	.6129
ADOPT10	.6927	.3179	.2658	.2906	.4047
ADOPT11	.7117	.4298	.6400	.4807	.5296
ADOPT7	ADOPT8	ADOPT9	ADOPT10	ADOPT11	
ADOPT7	1.0000				
ADOPT8	.6810	1.0000			
ADOPT9	.4938	.5139	1.0000		
ADOPT10	.4907	.3004	.3630	1.0000	
ADOPT11	.7256	.6759	.4080	.3695	1.0000

**Table (6.7): Correlation Matrix for Systemisation Scale**

	SYS1	SYS3	SYS4	SYS5	SYS7
SYS1	1.0000				
SYS3	.4279	1.0000			
SYS4	.3353	.4888	1.0000		
SYS5	.1832	.1692	.4039	1.0000	
SYS7	.3249	.3697	.6332	.2082	1.0000

**Table (6.8): Correlation Matrix for Standardisation Scale**

	STAND1	STAND2	STAND3	STAND4
STAND1	1.0000			
STAND2	.5593	1.0000		
STAND3	.7707	.3560	1.0000	
STAND4	.7059	.2874	.7344	1.0000

**Table (6.9): Correlation Matrix for Articulation Scale**

	ARTIC1	ARTIC2	ARTIC3	ARTIC4	ARTIC5
ARTIC1	1.0000				
ARTIC2	.6100	1.0000			
ARTIC3	.5721	.4904	1.0000		
ARTIC4	.5535	.4974	.5410	1.0000	
ARTIC5	.3247	.3561	.4413	.2459	1.0000
ARTIC6	.1839	.3474	.1166	.2692	.3991
ARTIC8	.5632	.5752	.4924	.4076	.4586
	ARTIC6	ARTIC8			
ARTIC6	1.0000				
ARTIC8	.4922	1.0000			

**Table (6.10): Correlation Matrix for Knowledge Availability to Individuals**

	AVAIL11	AVAIL12	AVAIL13	AVAIL14
AVAIL11	1.0000			
AVAIL12	.7043	1.0000		
AVAIL13	.4518	.7280	1.0000	
AVAIL14	.4916	.6776	.7198	1.0000

**Table (6.11): Correlation Matrix for Knowledge Availability to Departments**

	AVAIL21	AVAIL23
AVAIL21	1.0000	
AVAIL23	.6146	1.0000

**Table (6.12): Correlation Matrix for Knowledge Availability to the Whole Organisation**

	AVAIL31	AVAIL32	AVAIL33	AVAIL34
AVAIL31	1.0000			
AVAIL32	.5581	1.0000		
AVAIL33	.7096	.7873	1.0000	
AVAIL34	.3493	.3838	.3897	1.0000

**Table (6.13): Correlation Matrix for Knowledge Application Scale**

	APPL1	APPL2	APPL3	APPL4	APPL5
APPL1	1.0000				
APPL2	.8328	1.0000			
APPL3	.7994	.7953	1.0000		
APPL4	.7770	.7650	.7773	1.0000	
APPL5	.6825	.7247	.7697	.8279	1.0000
APPL6	.5991	.6398	.6771	.5539	.7161
APPL7	.7435	.8274	.7323	.6737	.6947
APPL8	.5764	.7179	.6739	.6416	.6433
APPL9	.6694	.7898	.7408	.6928	.6454
APPL10	.6968	.7315	.7345	.6076	.6160
APPL11	.6271	.7675	.6601	.6843	.7431
APPL12	.7418	.8328	.7846	.7381	.7527
	APPL6	APPL7	APPL8	APPL9	APPL10
APPL6	1.0000				
APPL7	.8464	1.0000			
APPL8	.6475	.7104	1.0000		
APPL9	.4298	.6229	.6858	1.0000	
APPL10	.6985	.7473	.6300	.7831	1.0000
APPL11	.5712	.6721	.6759	.7884	.6867
APPL12	.7065	.7760	.7757	.7119	.6414
	APPL11	APPL12			
APPL11	1.0000				
APPL12	.8186	1.0000			

**Table (6.14): Correlation Matrix for Performance Scale**

	PER1	PER2	PER3	PER4	PER5
PER1	1.0000				
PER2	.7167	1.0000			
PER3	.4386	.5761	1.0000		
PER4	.5264	.7290	.4829	1.0000	
PER5	.3719	.2872	.3528	.3775	1.0000

**Table (6.15): Correlation Matrix for Absorptive Capacity Scale**

	AC1	AC2
AC1	1.0000	
AC2	.5783	1.0000

## 6.8 Scale Validity

The content validity of all multi-items constructs is done using the score to total test correlation (Lee & Choi, 2003). All the checked scales are in the acceptable range.

With a small sample such as this, it is not suggested to check discriminate validity by the confirmatory factor methods (Zander & Kogut, 1995; Gold, 2001). Zander and Kogut (1995) suggest that when the number of items (64) are greater than the number of respondents (26), and if the average correlation between items within a scale is greater than the average correlation between items in two different scales there is a reasonable indication of the discriminant validity of these scales (Zander & Kogut, 1995; Soo et al, 1999).

The validity was done this way for the following

- The four knowledge management styles
- Knowledge application and absorptive capacity

The following tables show the ,“within=the values on the diagonal “ average correlation and the, “between=the values under the diagonal “ average correlation.

**Table (6.16): Knowledge Management Styles Average Correlation within the Scale Vs. Average Correlation Between the Scales**

	Adopt	Sys	Artic	Stand
Adopt	.607			
Sys	.372	.570		
Artic	.493	.411	.570	
Stand	.583	.437	.549	.741

**Table (6.17): Applicability and Absorption Capacity Average Correlation within the Scale Vs. Average Correlation Between the Scales Correlation**

	Appl	Ac
Appl	0.753	
Ac	0.602	.860

In all of the above tables the “within” correlation is greater than the “between” correlation. This gives an indication that the constructs are reasonably valid.

## 6.9 Cluster Analysis

Since the sample was small enough to test discriminate validity by confirmatory factor methods, Cluster analysis was run as a confirmatory analysis (Scott et al, 1992) to provide evidence that all the items of the four knowledge management styles are distinctly classified into four groups.

The Hierarchical cluster analysis gives indication that the four management styles are valid. The most important thing with the Hierarchical cluster analysis is that no essential assumption be made prior to the undertaking of the analysis (Coakes & Steel, 1999).

To select a cluster solution, the agglomeration schedule is interpreted (Coakes & Steel, 1999; Choi & Lee 2003). The preliminary purpose of this schedule is to provide assistance in making the best choice in the cluster (Coakes & Steel, 1999). The best

choice is selected at the point where the distance shows a sudden remarkable large increase (Diekhoff, 1992). This distance is represented in the coefficient column in the agglomeration schedule.

The items in all four styles were added to the cluster analysis. Table (6.18) shows that there is an exceptionally large increase in the coefficient values between 4 and 3 clusters.

**Table (6.18): Agglomeration Schedule for the Four Knowledge Management Styles Items**

Cluster numbers	Coefficients
25	8.00
24	13.00
23	13.00
22	14.50
21	15.00
20	15.00
19	16.00
18	16.50
17	18.33
16	19.67
15	21.90
14	23.00
13	24.25
12	26.43
11	28.38
10	29.00
9	29.00
8	31.06
7	34.16
6	34.50
5	36.61
4	39.00
3	46.33
2	48.90
1	88.95

Based on Diekhoff's (1992) suggestion, the number of clusters should be 4. The result of the cluster analysis therefore indicates that the four styles are valid.



## **6.10 Limitations**

There are some limitations connected with the preliminary investigation method techniques in the pilot study. First, the sample size is relatively small, with only 26 respondents. This substantially limits the type of analysis and presents some potential for unrepresentative results. Although there is diversity presented in the managers and in their units; the pilot study was done in different units of one organisation.

## **6.11 Use Stage**

The correlation enables the researcher to review and modify some potential problems with the items, which leads to scaling down the survey instruments in a more appropriate number of questions. Additionally, the correlations indicate that the items of multi-items constructs appear to be high in the majority of these items. The scales administrated also shows high internal reliability and a reasonable indication of validity.

## **6.12 Chapter Summary**

The pilot study was conducted to help the researcher to assess the reliability and validity of the survey instrument and the process of its administration and data analysis. Although the sample was small, it indicates that the scale can be used to test the study's hypotheses. The reliability of the scales is within an acceptable range for social science research. The discriminate validity is done by the simple method and indicates that the scales are discriminated by their items. Further, the pilot study uncovered some limitations that were avoided in the main study. The next chapter discusses the confirmatory analysis for the scales based on the main survey respondents.

## **CHAPTER 7. SURVEY DATA ANALYSIS**

### **7.1 Preparation of the Survey Data for Statistical Analysis**

The purpose of this chapter is to report on the data collection used to test the research hypotheses presented in Chapter three. It discusses the response rates and descriptive statistics of the sample. Due to an insufficient sample in the pilot study to make a factor analysis, it replicates the measurement model validation undertaken in the pilot study. Also, it provides the results of the confirmatory analysis, and the discriminant validity and reliability statistics of the new sample.

A codebook Appendix V is developed not only to make data input and transformation easier to understand, but also to prevent mistakes in the statistical analysis. Survey data is prepared for analysis in four stages.

In the first stage, the codes of some items are reversed “recoding” before summing the score of question item. Some scales have negative responses to avoid the influence of acquiescence and extremity bias. For example, the positive statement “strongly agree”, initially had a score of five, while “strongly disagree” had a score one. In the negative statement “strongly disagree” gets five “i.e. a score of 1”, and “strongly agree” gets one “i.e. a score of 5”. The frequency statistic is analysed on the demographic information of the population being studied. The total number of participants and the percentage of each category for demographic representation is calculated.

In the second stage, confirmatory factor analysis is conducted to assess the overall measurement models and examine the discriminant validity of the four knowledge

management styles, using four alternative models. For each alternative model, chi-square differences and the Goodness of Fit Index of model is examined to evaluate discriminant validities.

Factor analysis is conducted as a structure detection method for justified scales of organisational performance and knowledge applicability. In addition, factor analysis is conducted to explain how the three domains of knowledge availability relate to the construct measuring it and to establish consistency of the items.

The interrater reliability is conducted because of different raters “executive managers, top managers and middle managers ” are used to rate the companies. The Cronbach's alpha is conducted to check the internal consistency of measures.

The non-response bias is checked using the extrapolation estimation method. Finally, the scores of all interval levels of measurement are summed up and used in the analysis.

## **7.2 Descriptive Statistic**

The SPSS™ (version 11) is used for the statistical analysis of the survey data.

The questionnaire is sent to 338 profitable small and medium enterprises. The respondents are executive managers, top managers and middle managers. 25 are returned as undelivered, because of faulty addresses; addition 15 cases are undelivered because managers are no longer at their positions. 8 cases have many missing response items. The total 152 questionnaires are returned in a form eligible for the analysis.

The overall response rate for this study is 45%. This is regarded as relatively high, since the respondents are managers supposed to be too busy to answer questionnaires. Because the achieved responding sample was 152, the standard error in the analysis will be  $\sqrt{\frac{338}{152}} \cong 1.50$  larger than all the sample calculations in chapter four imply. However, it is found that sample is sufficient to represent the regression analysis conducted.

## 7.2.1 Respondent Characteristics in Terms of Main Industry, Revenue and Employees' Numbers

Table 7.1 summarises the respondent's characteristics in terms of main industry type, number of employees and total sale revenue.

**Table (7.1): Respondent Characteristics**

Industry type

Main Industry	Sub Industry	Percent %
System-Based (12.5%)	IT Suppliers	3.3
	Transport & Storage	2.0
	Communication	2.0
	Finance & Business	5.2
Material-Based (67.1%)	Agriculture & Mining	13.1
	Manufacturing	21.1
	Utilities & Construction	13.2
	Wholesales & Retail	19.7
Service-Based (20.4%)	Community & service	14.5
	Personal & Other Services	5.9

Number of Employees

Range of employees number	Percent
100-200	44.1%
201-300	11.2%
301-400	8.6%
401-500	36.1%
Total	100%

Total Sale Revenue (Australian Dollar)

Range of revenue	Percent
<=100000000	56.6%
100000001-200000000	23%
200000001-300000000	6.6%
>=300000001	13.8%
Total	100%

The majority of the firms, 67.1%, are in material-based industries. The majority of firms, 67%, have 100-200 employees. More than half of the firms have total revenue less than or equal to 100,000,000 AUD.

### 7.2.2 Demographic of Study Sample

The following tables give a general overview of the sample surveyed in term of the demographic information.

**Table (7.2): Demographic Data for the Main Survey**

<b>Demographic object</b>	<b>The valid items</b>	<b>Percent %</b>
Sex	Female	18.4
	Male	80.9
Employee years	<1	8.6
	1-2	14.5
	3-5	19.7
	6-10	19.7
	>10	36.8
Salary	<70,000	11.8
	70,001-100,000	25.7
	100,001-130,000	22.4
	130,001-160,000	13.2
	>160,000	22.4
Job Status	Executive management	38.2
	Top management	32.2
	Middle management	28.3
Education	High School	16.4
	College	7.9
	Bachelor	33.6
	Graduate Diploma	15.1
	Master	23.0
	Doctoral	3.3
Age	20-35	17.1
	36-50	53.3
	51-65	28.9



The majority of respondents sex are male 81%. The majority of respondents age are 36-50 and their percentage is 53.3%. The respondents have long experience in their organisations and more than 10 years. Executive managers are the most respondents with 38.7%. 25.7% of the managers are earning 70000 to 100000 Australian dollar. The majority of respondents, 33.6% have a Bachelor Degree. Appendix VI shows the Frequency report for the set of variables in the study. In addition, it shows the skewness and kurtosis of the respondents for each scale in the survey instrument.

The appendix also indicates that the scales used and the research sample surveyed display normal distribution, since normality no longer has a severe effect on results (De Vaus, 2002), and the sample size is large enough (i.e., 100 or more) to assume reasonable normality in the scales (StatSoft, Inc 2003).

## **7.3 Validity of the Scales**

### **7.3.1 Knowledge Applicability**

First, the correlation coefficients are computed and the significance values scanned Table VII.1. The results reveal that correlation coefficients between items are generally greater than 0.3, which indicates they are suitable for factor analysis (Coakes & Steed, 1999).

For a more accurate judgment, further analyses are conducted. To examine whether the data set is appropriate for a factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Barlett's Test of Sphericity are utilised. As shown in Table VII.2, the KMO statistic shows 0.893 at a significant level of 0.001. Although a more rigorous cut-off point is 0.6 (Garson, 2001), the KMO generally measure should be

greater than 0.5 (De Vaus, 1991; Field, 2000). In comparison with these cut-off levels, the KMO result is very high. Barlett's Test of Sphericity is also highly significant (chi-square = 927.521 with 66 degree of freedom, at  $p < 0.001$ ). The Inspection of the Anti-Image correlation matrix Table VII.3 reveals that all measuring of sampling adequacies MSAs are well above the acceptable level of 0.5 (Coakes & Steed, 1999). It is concluded that a factor analysis of the scale items is appropriate.

Next, the eigenvalue and the screen plot are investigated to determine the number of factors. An initial Analysis for a scale generated one component with an eigenvalue of 5.993. As shown in Figure VII.1, the scree plot also identifies one component resulting in a distinct break between the first component and other components (Gebotys, 2001). Finally, factor loadings is investigated. Generally, factor loadings below 0.4 are considered low, and low-loading items should be suppressed (e.g., De Vaus, 1991; Field, 2000; Garson, 2001; Hair et al., 1995; Stevens, 1992; Eley & Stevenson 1999, Chidambaram 2003). The result shows the loading values of most of the items exceed the cut-off level.

**Table (7.3): Results of Factor Analysis for the Knowledge Applicability Scale**

<b>Items</b>	<b>Factor Loadings</b>
APP1	.652
APP2	.669
APP3	.526
APP4	.712
APP5	.628
APP6	.647
APP7	.607
APP8	.679
APP9	.748
APP10	.678
APP11	.750
APP12	.756

### 7.3.2 Organisational Performance

The correlation matrix for the 5 scale items shows that the correlation coefficients are generally greater than 0.3 Table VIII.1. Both the KMO analysis (0.798, a highly significant result) and the Bartlett's test (chi-square = 268.104 with 10 degrees of freedom, highly significant), Table VIII.2. The Inspection of the Anti-Image correlation matrix Table VIII.3 reveals that all measuring of sampling adequacies (MSAs) are well above the acceptable level of 0.5 and this indicates that a factor analysis is appropriate. The eigenvalue and the screen plot are investigated with an eigenvalue of 2.946, and the screen plot confirmed this Figure VIII.1. As shown in Table 7.4, the factor loadings of the items are 0.60 or higher. It is concluded that the 5-item scale measures the organisational performance is unidimensional.

**Table (7.4): Results of Factor Analysis for the Organisational Performance Scale**

<b>Items</b>	<b>Factor Loadings</b>
PER1	.903
PER2	.674
PER3	.647
PER4	.650
PER5	.608

### 7.3.3 Knowledge Availability

As defined previously, knowledge availability is a multidimensional construct with three different domains of availability: individual, group and the whole organisation. Factor analysis is used to see whether or not the three domains are valid, and how much the items have loading on each domain Table 7.5 shows that three domains of availability are valid and their loading factor on their items are greater than 0.40.

**Table (7.5): Loading Factor of Knowledge Availability**

Factors			
Items	1	2	3
AVAIL1	<b>.656</b>	.271	.297
AVAIL2	<b>.895</b>	.277	.220
AVAIL3	<b>.647</b>	.245	.359
AVAIL5	.464	.229	<b>.818</b>
AVAIL6	.476	.349	<b>.465</b>
AVAIL7	.307	<b>.744</b>	.217
AVAIL8	.245	<b>.831</b>	.175
AVAIL9	.189	<b>.793</b>	.136

Because the multi-item construct measures each variable, factor analysis with rotated factor matrix checks unidimensionality among the items; and those with factor loading values lower than 0.40, are eliminated (Eley & Stevenson, 1999; Chidambaram, 2003; De Vaus, 1991; Field, 2000; Garson, 2001; Hair *et al.*, 1995; Stevens, 1992). Therefore, AVAIL4 and AVAIL10 are eliminated from the analysis.

#### **7.3.4 Knowledge Management Styles**

Factor analysis is conducted to assess the overall measurement models, with rotated factor matrix checking unidimensionality among the items.

**Table (7.6): Loading Factor of the Items of the four Knowledge Management Styles**

Items	Factors			
	1	2	3	4
ADOPT1	.220	<b>.547</b>	.104	.179
ADOPT2	.124	<b>.501</b>	.005	.003
ADOPT3	.162	<b>.639</b>	-.0005	-.001
ADOPT4	.146	<b>.616</b>	.001	.133
ADOPT5	.003	<b>.635</b>	.003	.158
ADOPT6	.008	<b>.682</b>	.211	.222
ADOPT7	-.163	<b>.426</b>	.176	.320
SYS1	.390	.284	<b>.510</b>	.244
SYS2	.269	.187	<b>.655</b>	.01
SYS3	.114	.135	<b>.788</b>	.206
SYS4	-.003	-.005	<b>.447</b>	.007
STAND1	.264	.242	.175	<b>.705</b>
STAND2	.007	.225	.296	<b>.475</b>
STAND3	.332	.007	.009	<b>.457</b>
STAND4	.347	.281	.254	<b>.528</b>
ARTIC1	<b>.762</b>	.195	.008	.280
ARTIC3	<b>.746</b>	.265	.125	.004
ARTIC4	<b>.770</b>	.009	.003	.142
ARTIC6	<b>.522</b>	-.002	.128	-.010
ARTIC7	<b>.800</b>	.005	.111	.279
ARTIC8	<b>.690</b>	.286	-.001	.155

Table 7.6 provides the results of the rotated factor matrix of the four styles and then the items which have a loading factor less than 0.40 are eliminated .Therefore Adopt 8, 9, and 10 are removed from the Adoption style, Sys5 from the systemisation style is removed, Artic 2, and Artic 5 are removed from the articulation style.

In order to establish discriminant validity among the four styles, the styles are needed to be shown as a non-related in reality (Trochim, 2002). It then uses the Chi-square test and the analysis of model fits. That is, the null hypothesis of chi square test is that the factor analysis fits the data. The non-significant model is desirable, whereas a statistically significant Chi-square test means that the more factors are needed to account for the structure of data (University of Texas, 2002). Therefore, all the items of

the four styles are entered into factor analysis test. The Goodness of-fit test through the Chi-square value is recorded for four alternative models. The first alternative is when all the items enforce to generate one factor. The second is when all the items enforce to generate two factors. The third is when all the items enforce to generate three factors. Finally, The fourth is when all the items enforce to generate four factors

**Table (7.7): Goodness of Fit Index and the significance of Chi-square for the Knowledge Management Styles**

Alternatives	Chi-square (Goodness of fit index)	d.f
1	585.801(p<0.01)	189
2	345.942(p<0.01)	169
3	218.775 (p<.01)	150
4	163.10 (p>.01)	132

Table 7.7 shows that the first three alternatives are significant. Therefore, the null hypothesis of the model fitness should be rejected. Accordingly, the first, second and third alternatives are not significant to fit the data. Whereas, the fourth alternative, Chi-square is not significant. Therefore, the null hypothesis of the model fitness should be accepted. Accordingly, four models are significant to fit the data. Further, the Chi square value is decreased from 585.801 in the first alternative to 163.10 in the fourth alternative. Therefore, the proportion of variance among the four styles is increased when they are studied in four models instead of one, two or even three. Accordingly, the four styles are shown as non-related in reality and thus indicate that the four styles should be considered distinct.

## 7.4 Inter-rater Reliability

Inter-rater reliability is the extent to which two or more individuals (coders or raters) agree. Inter-rater reliability addresses the consistency of the implementation of a rating system, and the relationship between the judgments that at least two raters make independently about a phenomenon (Cranny & Doherty, 1988; Harvey & Lozada-Larsen, 1988; Muller et al, 1999). Because there are replies from multiple respondents, executive managers, top managers and middle managers in one organisation, it is necessary to assess inter-rater reliability of the scales.

The inter-rater reliability is determined by the interclass correlation coefficient (ICC). Because different raters are used to rate the organisations, their ratings are averaged, and ICC (1,K) can be computed via one-way ANOVA (Choi & Lee, 2003a, 2003b)

**Table (7.8): Inter-rater Reliability for all the Scales**

<b>Scale</b>	<b>ICC(1,K)</b>
Adoption	.7394
Systemisation	.6618
Standardisation	.6595
Articulation	.8616
Knowledge availability	
Individual	.8535
Department	.7570
Whole Organisation	.8788
Knowledge applicability	.9006
Organisation performance	.8159
Absorptive capacity	.5496

A number of studies suggest that ICC is acceptable when the ranges from 0.512 to 0.991 (Choi & Lee 2003a, 2003b). All the results are in the acceptable range. This gives an

indication of the consistency of the implementation of a rating system among the raters who make judgment about an organisation.

## 7.5 Internal Reliability

The internal consistency measures (Cronbach's alpha) are obtained in order to assess the reliability of the measurement instruments. The following table shows the Cronbach's alpha value for each scale.

**Table (7.9): Internal Reliability for all the Scales in the Main Study**

<b>Scale</b>	<b>Cronbach's alpha(<math>\alpha</math>)</b>
Adoption	.7893
Systemisation	.6997
Standardisation	.7383
Articulation	.8767
Availability	
Individual	.8652
Department	.8060
Whole Organisation	.8789
Knowledge applicability	.9073
Organisation performance	.8199
Absorptive capacity	.5491



## **7.6 Non-Response Error Test**

The mail survey has been criticised for non-response bias due to its low response rates (De Vaus, 2002). Malhotra et al (1996) state that higher response rates, in general, imply lower rates of non response biases. Yet, response rates may not be an adequate indicator of non-response bias, since they do not indicate whether or not the respondents are representative of the original sample. In addition, non-respondents can differ from respondents in terms of demographic, psychographic, personality, attitudinal, and motivational and behavioural variables. If persons who respond differ substantially from those who do not, the results do not directly allow one to say how the entire sample would have responded, thus generalise from the sample to the population (Armstrong & Overton, 1977). While the most commonly recommended protection against non-response bias has been to reduce non-response itself, more common approach is to estimate the effects of non-response (Wayne, 1975).

To test the existence of non-response biases, this study uses the extrapolation estimation method. Because of the demographic variables in this study represent the attributes of the key informants in organisations; the non-response biases in terms of demographic variables are used. In addition, the industry type works as a control variable in the determination of the most important strategies that are deployed in the industry. It is used in the analysis of non-response biases. The extrapolation method is sometimes used as a way to estimate non-response, and is based on the assumption that subjects who respond less readily are more like those who do not respond at all (Kanuk & Berenson, 1975). 'Less readily' is defined as answering later or as requiring more prodding to answer, and readily as answering sooner, or requiring less prodding to answer (Armstrong & Overton, 1977). Employing the extrapolation estimation method,

the first 40 responses are treated as the early responses, whereas the last 40 are late responses. As the first 40 responses arrived before mailing the follow-up letter, these are regarded as non-stimulated response, and the last 40 responses as the stimulated response. Two groups are compared in terms of Mann-Whitney test to see whether or not there is a significant difference between the two groups.

In the Appendix IX, the Mann-Whitney test is not significant ( $p > .05$ ) in all the variables. Therefore, the null hypothesis should be accepted and the alternative should be rejected. The two groups must come from the same population and no difference. From the results of Mann-Whitney test between the early and the late respondents in the mail survey in terms of the demographic variables and the industry types, the non-response bias is regarded as negligible

## **7.7 Chapter Summary**

This chapter reviews the sample characteristics and descriptive analysis of the survey data. The overall response rate for the survey is 45%, and this is regarded as being relatively high.

The factor analysis provides evidence that the items of both knowledge applicability and organisational performance have loading values greater than 0.4, and graphical displays of the eigenvalues suggest that there is one predominant factor. In addition, factor analysis is used to define the three domains of knowledge availability, the loading values of the three domains are tested.

Discriminant analysis provides other evidence that the four knowledge management styles are valid and that their items are well define each style. The factor analysis defines the four styles and the loading values of each items.

The inter-rater and internal reliability values for all the scales are in the acceptable range. The Non-response error is regarded as negligible in the current mail survey, there is no significant difference between the responders before and later the follow-up letter in terms of demographic variables and industry types.

Multivariate analysis, notably multiple linear regression, is discussed in the following chapter. It describes the results from the testing of the research hypotheses derived from the proposed conceptual framework and the literature.

## **CHAPTER 8. SURVEY FINDINGS: TESTING THE THEORETICAL HYPOTHESES**

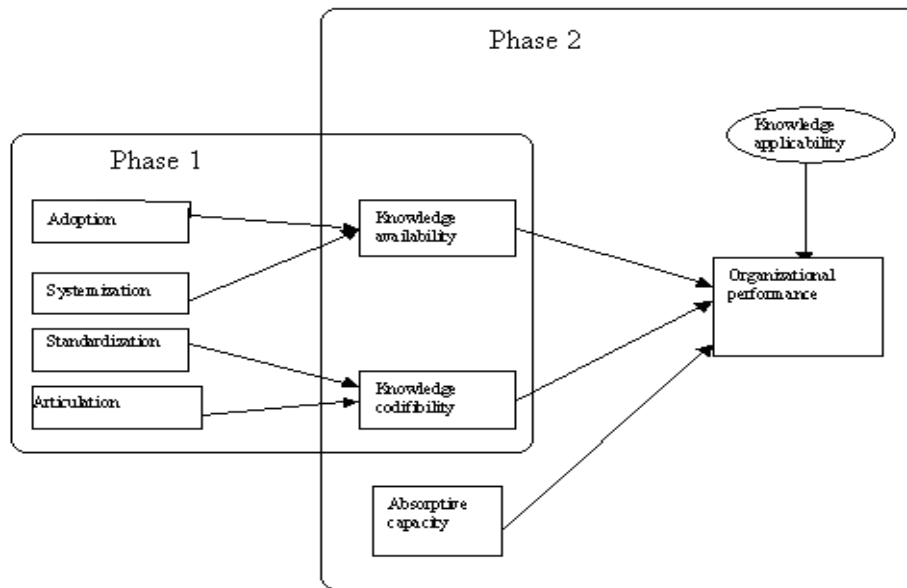
### **8.1 Introduction**

This chapter presents the results of testing the research hypotheses. This is done through a series of multiple linear regressions, simple linear regressions and MANOVA analysis of the collected data. Further, the mediation effect of knowledge availability and codifiability is tested using the procedure of Baron and Kenny (1986) as used by (Lee & Choi, 2003; De Gilder, 2003).

The previous chapter presented the descriptive analysis of the survey. The response rates and the test for non-response error were discussed. The first division of this chapter presents the results of the multivariate analyses to test the research hypotheses related to the integrative research framework in figure 3.9, as well as the literature. While a multiple linear regression analysis is used to test the research hypotheses H1-H4, H5-H6, and H8-H11, a simple liner regression is used to test hypotheses H7 and H12. Hypothesis 13 is checked by MANOVA analysis.

The second division summarises the results of the hypotheses tests from the multivariate analysis. This section concludes with a justification of the proposed hypotheses and focuses on the moderation roles of knowledge applicability to whole organisation domain.

**Figure (8.1): The two Phases of the Analysis of the Framework in Figure 3.9**



**Table (8.1): All Types of Analyses use in each Phase of the Framework**

Phase	Analysis type	Independent Variable	Dependent Variable
1	Multiple regression	Adoption, Systemisation H1 and H2	<ul style="list-style-type: none"> <li>○ Sum of Availability</li> <li>○ Knowledge availability domains                             <ul style="list-style-type: none"> <li>▪ Individual</li> <li>▪ Department</li> <li>▪ Whole organisation</li> </ul> </li> </ul>
		Standardisation, Articulation H3 and H4	<ul style="list-style-type: none"> <li>○ Sum of Codification</li> <li>○ Knowledge codification forms:                             <ul style="list-style-type: none"> <li>▪ Pictures and Images</li> <li>▪ Words and Texts</li> <li>▪ Codes and Figures</li> </ul> </li> </ul>
2	Multiple regression	Knowledge availability domains and codification forms	○ Organisational Performance
		Sum of Availability and sum of Codifiability, Moderated by Knowledge applicability H5 and H6	○ Organisational performance
	Simple Regression	Absorptive capacity, Moderated by Knowledge applicability H7	○ Organisational Performance

**Table (8.2): All separate Analyses use to Test the Rest of the Hypotheses**

<b>Analysis type</b>	<b>Independent Variable</b>	<b>Dependent Variable</b>
Multiple regression	<b>Direct relationship</b> <b>Unbalanced approach</b> Adoption, Systemisation, Standardisation and Articulation H8, H9, H10, H11	Organisational Performance
Simple Regression	<b>Direct relationship</b> <b>Balanced approach</b> Style Dispersion H12	Organisational Performance
MANOVA	<b>Fixed factor</b> Industry type <b>Covariate factors</b> Size Revenue H13	Adoption, Systemisation, Standardisation and Articulation

## **8.2 Hypotheses Testing**

### **8.2.1 Introduction**

Multiple regression analysis is a multivariate statistical technique used to examine the relationship between an outcome variable and several predictors (Hair et al, 1998). It is used to predict the relative contribution of adoption, systemisation on the outcome variable knowledge availability. The multiple regression analysis is also used to predict the relative contribution of articulation and standardisation on the outcome variable knowledge codifiability.

The multiple regression analysis is used to predict the interaction effect of knowledge applicability on the outcome variable, and organisational performance, when knowledge availability and codifiability are the predictors.

Hair et al (1998) state that multiple regression analysis provides a means of objectively assessing the magnitude and direction of each predictor's relationship to its outcome variable. The forced entry regression method is used and the Hierarchical (Blockwise

entry) regression method is used to check the moderation effect of knowledge applicability. The reason for selecting the forced entry regression method is that this method is considered most suitable for theory testing (Studenmund & Cassidy, 1987), whereas ‘stepwise’ regression is more appropriate in the exploratory phase of research, or for the purposes of prediction (Menard, 1995). The selection of the Hierarchical regression method for testing the moderation effect is that this procedure eliminates the main effect of knowledge availability and codifiability prior to examining the interaction effects (Stone & Hollenbeck, 1989). Evidence of moderation is presented when the interaction terms account for significant residual variance in the dependent variable. Therefore, the change in the  $R^2$  and the F statistic is examined in each step (Becerra-Fernandez & Sabherwal, 2001).

### **8.2.2 Testing the Underlying Assumptions for Multiple Regression**

In drawing conclusions about a population based on a regression analysis conducted on sample data, Hair et al(1998) and Berry (1993) emphasise the importance of testing to identify any violations of the underlying assumptions in multiple regression analysis.

The assumption of ‘linearity’, ‘Homoscedasticity’, ‘normality of residuals’, ‘multicollinearity’ and ‘residual independence’ in multiple regression is tested.

#### **8.2.2.1 Linearity and Homoscedasticity**

Linearity assumes that the relationship between dependent and independent variables is linear (StatSoft, 2003; Berry & Feldman, 1985; Pedhazur, 1997), whereas Homoscedasticity means that the residual at each level of the independent variables have the same variance (De Vaus, 2002). The main way of checking for the presence of Homoscedasticity is to examine residual plots for actual standardised values (ZRESID),

dependent against predicated residual values(ZPRED) and dependent variable(De Vaus, 2002).

#### **8.2.2.2 Normality**

Normality is no longer having a severe effect on results (De Vaus, 2002). The sample size is large enough (ie 100 or more) to assume reasonably normality in the scales (StatSoft, Inc 2003).

#### **8.2.2.3 Multicollinearity**

Multicollinearity is defined as a strong correlation among the predictor variables (Hair et al, 1998). The presence of multicollinearity threatens the internal validity of multiple regression analysis and increases the likelihood of typeII errors in hypothesis testing (Field, 2000). The diagnostic of multicollinearity within multiple regression procedure suggests two statistical indications: the variable inflation factor (VIF) and tolerance measures (De Vaus, 2002). The tolerance value is acceptable over 0.1 and VIF below 10 (Hair et al, 1998; Menard, 1995; Myers, 1990; Bowerman & O'Connell, 1990; Hair *et al.*, 1995; Kolacz, 2002).

#### **8.2.2.4 Independence of Residuals**

The Durbin-Watson statistic is used to test whether or not the assumption of residual independence is acceptable. The Durbin-Watson statistic, which tests whether adjacent residuals are correlated (Field, 2000), is better closer to 2 (Field, 2000).

#### **8.2.2.5 Outlier Analysis**

Cook's Distance and Centered Leverage values are used to test the influence of the outliers on the regression model. An acceptable Cook's distance value is less than 1



(Hair et al, 1998; Field, 2000), while acceptable Centered Leverage value is closer to 0 (Field, 2000).

### 8.3 Hypotheses H1-H4 Knowledge Management Styles vs. Knowledge Creation

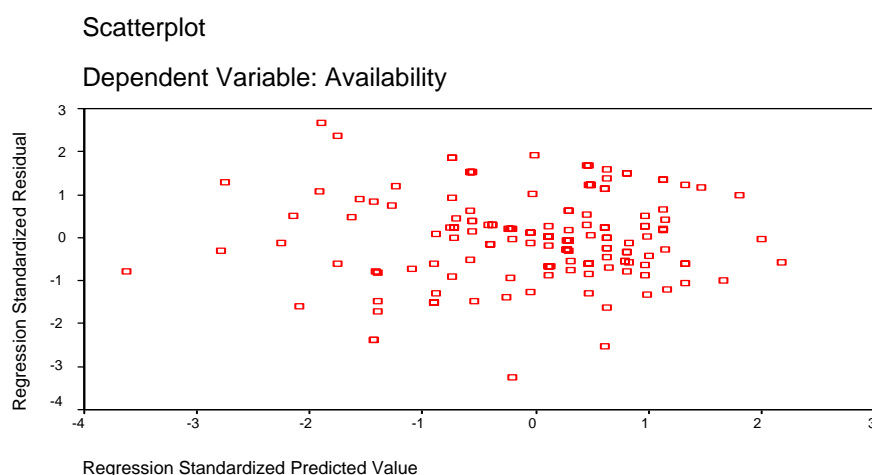
A multiple regression analysis is used to test hypotheses H1-H4. For each hypothesis, a model of regression was run separately for each of the dependent variable (knowledge availability and knowledge codifiability).

#### 8.3.1 Hypotheses H1-H2 Adoption and Systemisation vs. Knowledge Availability

##### 8.3.1.1 Linearity and Homoscedaticity

Figure 8.2 shows that the points are randomly and evenly dispersed throughout the scatterplot. This pattern is an indication of a situation in which the assumption of linearity and Homoscedaticity has been met (Hair et al, 1998).

**Figure (8.2): Scatterplot: Adoption and Systemisation vs. Knowledge Availability**



### 8.3.1.2 Multicollinearity

Table 8.3 shows the values of tolerance and VIF: both of them are in the acceptable range. All the tolerance values are greater than 0.1 and all the values of VIF are less than 10.

**Table (8.3): Collinearity Statistics: Adoption and Systemisation vs. Knowledge Availability**

Predictor variable	Collinearity Statistics	
	Tolerance	VIF
Adoption	.889	1.125
Systemisation	.889	1.125

### 8.3.1.3 Independence of Residuals and Outlier Analysis

The Durbin-Waston value is 1.437 as shown in table 8.4. Therefore, the independence of residuals assumption does not violate, because the value is very close to 2.

Appendix X and appendix XI, respectively, show that Cook's Distance and Centered Leverage values are in the acceptable range. Therefore, the outliers have no influence on the regression model.

Table 8.4 summarises the result of multiple regression for hypotheses 1-2. Industry type entered as a control variable for the relationship between Adoption, Systemisation styles and knowledge availability. In Table 8.4, where the dependent variable is knowledge availability, both styles significantly affect knowledge availability ( $p < .01$ ). Further, both styles explain 20.6% of the total variance of knowledge availability. In the same table 8.4, both adoption and systemisation positively and significantly contribute to each domains of availability. Further, adoption style contributes more to individual, group

and whole organisational knowledge (0.342, 0.269, 0.250) than the systemisation style (0.177, 0.197, 0.188).

**Table (8.4): Results of Multiple Regression Analysis for Adoption and Systemisation vs. Knowledge Availability**

Independent	Dependent Sum Availability	Availability Domains (Dependent)		
	Knowledge availability $R^2 = .206$ $F = 19.273^{**}$ Durbin-Waston=1.437	Individual $R^2 = .192$ $F = 17.723^{**}$	Group/department $R^2 = .146$ $F = 12.761^{**}$	Whole Organisation $R^2 = .129$ $F = 11.052^{**}$
KMS				
Adoption (H1)	$\beta = .335$ $t = 4.331^{**}$	$\beta = .342$ $t = 4.355^{**}$	$\beta = .269$ $t = 3.348^*$	$\beta = .250$ $t = 3.082^*$
Systemisation (H2)	$\beta = .213$ $t = 2.752^*$	$\beta = .170$ $t = 2.164^*$	$\beta = .197$ $t = 2.452^{**}$	$\beta = .188$ $t = 2.321^*$

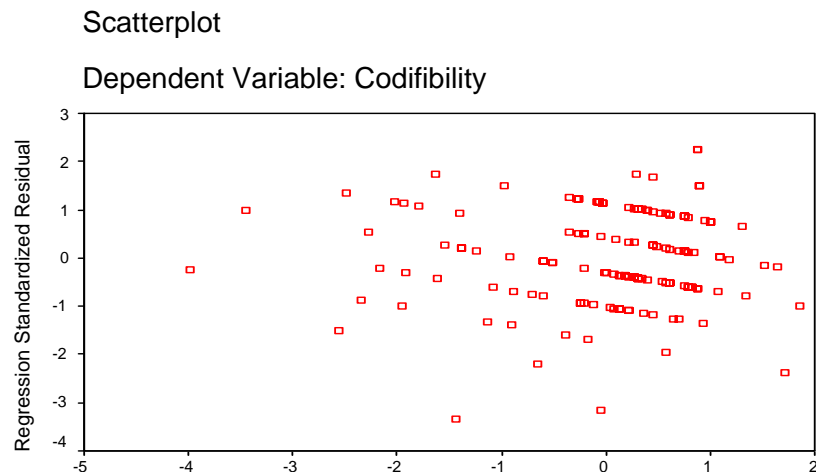
\*\* $p < .01$ , \* $p < .05$

### 8.3.2 Hypotheses H3-H4, Standardisation and Articulation vs. Knowledge Codifiability

#### 8.3.2.1 Linearity and Homoscedaticity

Figure 8.3 shows that the points are randomly and evenly dispersed throughout the scatterplot. This pattern is an indication of a situation in which the assumption of linearity and Homoscedaticity have been met (Hair et al, 1998).

**Figure (8.3): Scatterplot: Standardisation and Articulation vs. Knowledge Codifiability**



### 8.3.2.2 Multicollinearity

Table 8.5 shows the values of tolerance and VIF, both are in the acceptable range. All the tolerance values greater than 0.1, and all the VIF values are less than 10.

**Table (8.5): Collinearity Statistics: Standardisation and Articulation vs. Knowledge Codifiability**

Predictor variable	Collinearity Statistics	
	Tolerance	VIF
Standardisation	.747	1.339
Articulation	.747	1.339

### 8.3.2.3 Independence of Residuals and Outlier Analysis

The Durbin-Waston value is 1.699 as shown in table 8.6. Therefore, the independence of residuals assumption does not violate, because the value is very close to 2. Appendix XII and appendix XIII, respectively, show that Cook's Distance and Centered Leverage values are in the acceptable range. Therefore, the outliers have no influence on the regression model.

### 8.3.2.4 Result of the Multiple Regression

Table 8.6 shows the dependent variable as knowledge codifiability. Both Standardisation and Articulation significantly affect knowledge codifiability ( $p < 0.01$ ). Further, both styles explain 11.4% of the variance of knowledge codifiability.

The Standardised coefficient (beta) values for 'Standardisation' is positive, but not significant and thus violates hypothesis 3. The Standardised coefficient (beta) values for 'Articulation' is positive and significant ( $p < 0.05$ ), and does not violate hypothesis 4. Table 8.6 shows that both Standardisation and Articulation affect positively and significantly the codifiability forms. On the other hand, Standardisation contributes

significantly to knowledge as texts and figures (0.199, 0.237) respectively, but the articulation style contributes significantly to knowledge as pictures and images (0.238)

**Table (8.6): Results of Multiple Regression Analysis for Standardisation and Articulation vs. Knowledge Codifiability**

Independent	Dependent (Sum codification)	Codification Forms(Dependent)		
KMS	Knowledge codifiability $R^2 = .114$ $F=9.490^{**}$ Durbin-Watson = 1.699	Pictures/images $R^2 = .042$ $F=3.252^*$	Text/words $R^2 = .090$ $F=7.254^*$	Figures/codes $R^2 = .069$ $F=5.433^*$
Standardisation(H3)	$\beta=.138$ $t=1.537$	$\beta=-.128$ $t=-1.374$	$\beta=.199$ $t=2.187^*$	$\beta=.237$ $t=2.571^*$
Articulation (H4)	$\beta=.247$ $t=2.750^*$	$\beta=.238$ $t=2.548^*$	$\beta=.145$ $t=1.595$	$\beta=.045$ $t=.491$

\*\*p<.01, \*p<.05

## 8.4 Hypotheses H5-H6, Knowledge Availability and Knowledge Codifiability vs. Organisational Performance with the Moderation Effect of Knowledge Applicability

The reason for the selection of the Hierarchical regression method for testing the moderation effect is that this procedure eliminates the main effect of all knowledge availability and codifiability prior to examining the interaction effects (Stone & Hollenbeck, 1989). To avoid the effect of multicollinearity among the variables, the diagnostic of multicollinearity within multiple regression procedures is guided through two statistics indications: the variable inflation factor (VIF) and tolerance measure (De Vaus, 2002).

### 8.4.1 Multicollinearity

Table 8.7 shows the values of tolerance and VIF, both are in the acceptable range. All the tolerance values greater than 0.1, and all the VIF values are less than 10.

**Table (8.7): Collinearity Statistics: Knowledge Availability and Knowledge Codifiability vs. Organisational Performance**

Predictor variable	Collinearity Statistics	
	Tolerance	VIF
Knowledge availability		
Individuals	0.378	2.645
Groups	0.396	2.526
Whole organisation	0.602	1.662
Knowledge codifiability		
Pictures/images	0.933	1.071
Texts/words	0.875	1.143
Codes/figures	0.926	1.080

#### 8.4.2 Result of the Multiple Regression

Table 8.8 shows the multiple regressions results for all knowledge availability domains and codifiability forms with the organisational performance before entering the interaction effect of knowledge applicability.

**Table (8.8): Results of Multiple Regression Analysis for Knowledge Availability and Knowledge Codifiability vs. Organisational performance**

Independents	Beta	t
Knowledge availability		
Individuals	-0.116	-0.909
Departments/groups	0.162	1.301
Whole organisation	0.294	2.915*
Knowledge codifibility		
Pictures/images	-0.039	-0.485
Texts/words	0.025	0.300
Figures/codes	.074	0.915

\*\*p<.01 \*p<.05 Dependent: Organisational performance

Knowledge available at whole organisation has a positive significant relationship ( $\beta=0.294$   $p<0.05$ ) with organisational performance. The rest of knowledge availability

domains and codifiability forms have no significant effect on organisational performance.

Evidence of moderation is present when the interaction terms account for significant residual variance in the dependent variable. Therefore, the change in  $R^2$  and the F statistic are examined for each step (Becerra-Fernandez & Sabherwal, 2001). Knowledge availability and codifiability is entered first, followed by the interaction terms corresponding to hypothesis H5, and then hypothesis H6. This procedure eliminates the main effect of knowledge availability and codifiability prior to the examining the interaction effects. To measure the moderating effect for all the interaction terms, compound variables<sup>1</sup> are created by multiplying knowledge availability and codifiability scores by a knowledge applicability score. These compound variables are then entered into the regression analysis in three steps. Finally, the change in  $R^2$  and the F statistic are examined in each step.

**Table (8.9): Moderating Effect of Knowledge Applicability Part 1**

Independent	Step 1		Step 2		Step 3	
	Beta	t	Beta	t	Beta	t
Knowledge availability	0.288	3.602**	-0.247	-1.831	0.104	1.214
Knowledge codifiability	0.062	0.770	-0.040	-0.518	-0.371	-3.066*
<b>Interaction effects</b>						
Knowledge availability X Applicability (H5)			0.661	4.769**		
Knowledge codifiability X Applicability(H6)					0.601	4.555*
<b>Equation</b>						
$\Delta R^2$			0.123		0.114	
$R^2$	0.093		0.216		0.206	
$\Delta F$			22.741**		20.744**	
F	7.461*		13.295**		12.561**	

\*\*p<.01 \*p<0.05

<sup>1</sup> A moderator effect can be represented by a compound variable formed by multiplying an independent variable by a another independent variable (Hair et al 1998, Soo et al 1999)

Evidence of moderation is presented when interaction terms account for significant residual variance in the dependent variable. The change in  $R^2$  and the F-statistic are examined for each step. Throughout the analysis, attention is paid to the standardised beta coefficient to see if the statistical hierarchical step is significant. When the interaction terms are introduced in step 2 and step 3 a significant ( $p < .01$ ) increase in  $R^2$  resulted. The standardised coefficient (beta) values for all the interaction terms have positive values and thus indicate positive relationships. Therefore, hypothesis H5 and H6 are supported.

## 8.5 Hypothesis 7 Absorptive Capacity vs. Organisational Performance with the Moderating Effect of Knowledge Applicability

To measure the moderation effect of knowledge applicability on the relationship between “absorptive capacity” and organisational performance, a compound variable is created by multiplying the absorptive capacity score by the knowledge applicability score. This variable is then entered into the regression analysis. In Table 8.10, model 1 shows the results of the linear regression analysis, which includes the absorptive capacity as a predictor, whereas model 2 shows the results of the linear regression analysis and includes the compound variable along with the absorptive capacity.

**Table (8.10): Moderating Effect of Knowledge Applicability Part 2**

Independent	Model 1		Model 2	
	Beta	t	Beta	t
Absorptive capacity	0.294	1.729	-0.831	-4.764**
<b>Interaction effects</b>				
Absorptive capacity X Applicability (H7)			1.071	6.136**
<b>Equation</b>				
$\Delta R^2$			0.201	
$R^2$	0.02		0.221	
$\Delta F$			37.65**	
F	2.991		20.696**	

\*\* $p < .01$



Hair et al 1998 state that whether or not the moderator effect is significant can be determined by assessing the change in  $R^2$  before and after the addition of the compound variable into the regression model. It is assumed that if the incremental effect of  $R^2$  is statistically significant, then a significant moderator effect is presented.

For Model 2, the incremental change in  $R^2$  after the addition of the compound variable shows a marginal and statistically significant increase from .02 to .221 indicating that the addition of the compound variable improves the prediction of organisational performance. Therefore, Hypothesis 7 is supported.

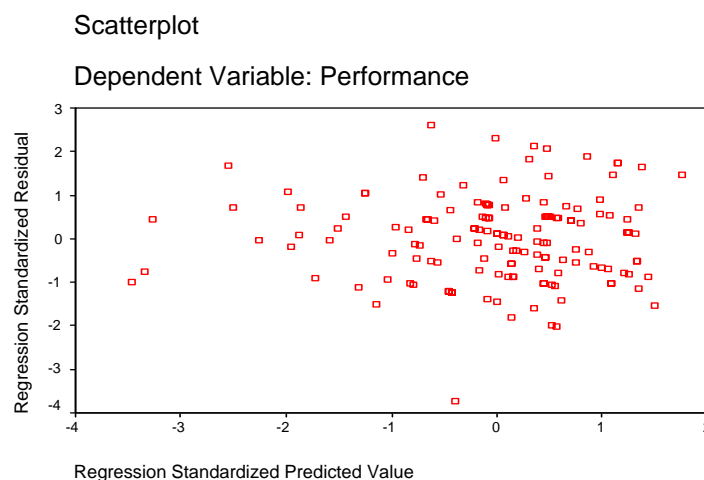
## 8.6 Hypotheses H8-H12 Knowledge Management Styles vs. Organisational Performance: A direct relationship

### 8.6.1 Hypotheses H8-H11: Unbalanced Knowledge Management Styles vs. Organisational Performance

#### 8.6.1.1 Linearity and Homoscedaticity

Figure 8.3 shows that the points are randomly and evenly dispersed throughout the scatterplot. This pattern is an indication of a situation in which the assumption of linearity and Homoscedaticity has been met (Hair et al, 1998).

**Figure (8.3): Scatterplot: Knowledge Management Styles vs. Organisational Performance**



### 8.6.1.2 Multicollinearity

Table 8.11 shows the values of tolerance and VIF, both are in the acceptable range. All the tolerance values are greater than 0.1, and all VIF values are less than 10.

**Table(8.11): Collinearity Statistics: Knowledge Management Styles vs. Organisational Performance**

Predictor variable	Collinearity Statistics	
	Tolerance	VIF*
Adoption	.755	1.324
Systemisation	.739	1.352
Standardisation	.569	1.759
Articulation	.727	1.376

\*VIF: Variance Inflation Factor

### 8.6.1.3 Independence of Residuals and Outlier Analysis

The Durbin-Waston value is 1.956 as shown in table 8.12. Therefore, the independence of residuals assumption does not violate, because the value is very close to 2. Appendix XIV and appendix XV respectively show that Cook's Distance and Centered Leverage values are in the acceptable range. Therefore, the outliers have no influence on the regression model.

Table 8.12 summarises the result of multiple regression for hypotheses 8-11. Industry type is entered as a control variable for the relationship between the four styles and organisational performance. Table 8.11 shows the standardised regression coefficient of each predictor,  $R$ ,  $R^2$ , and  $F$ , for all the predictors in multiple regression analysis.

**Table (8.12): Results of Multiple Regression Analysis for Organisational Performance vs. Knowledge Management Styles**

Model~	Standardised Coefficient	t
Adoption (H8)	.280	3.228*
Systemisation (H9)	-.039	-.445
Standardisation (H10)	.092	.917
Articulation (H11)	.204	2.305*
Equation		
R	.440	
$R^2$	.194	
F	8.525**	
Durbin-Watson	1.956	

\*\*p<.01 \*p<.05 ~ dependent variable : organisational performance

The entire model has a significant effect on organisational performance ( $p < 0.01$ ).  $R^2$  In the entire model of the four styles explain 19.4% of the variance related to organisational performance. As shown in Table 8.11, the standardised coefficient (beta) value for the Adoption style is positive and significant ( $p < .05$ ), and thus supports hypothesis H8. The standardised coefficient (beta) value for the Systemisation style is negative, but it is not significant and thus, the result does not support hypothesis H9. The standardised coefficient (beta) value for the Standardisation style is positive, but is not significant and thus, the result does not support hypothesis H10.

The Standardised coefficient (beta) values for the Articulation style is positive and significant ( $p < .05$ ), and thus supports hypothesis H11.

### **8.6.2 Hypothesis H12: The Balanced of Knowledge Management Styles vs. Organisational Performance**

As indicated previously, the measure of style-dispersion for each organisation computed represents the degree to which managers take a balanced approach to knowledge management.

Using equation 5.10.1, style-dispersion is computed for all organisations. The empirical predication of hypothesis H12 is that the smaller the style-dispersion, the more significant its association with organisational performance. The dispersion results are sorted in ascending order and the sample divided into two equal groups; in the first group, the style-dispersion is smaller while in the second group the style-dispersion is larger. A regression analysis is run on the two groups to see if there was any significant difference in their association with organisational performance and industry-type entered as the control variable for this relationship. It is important to note that hypothesis H12 implies that a balance between all knowledge management styles is of equal importance for organisations.

Table 8.13 is based on two models in the statistical analysis. The first model consists of the lower 50% of the dispersion, whereas the second model contains the higher 50% of the dispersion. Table 8.13 shows that in the first model  $R$  and  $R^2$  are greater than  $R$  and  $R^2$  in the second model. Therefore, hypothesis H12 is supported and the balance of using the four styles is significantly associated with organisational performance

**Table (8.13) Result of the Regression Models for the Balance styles**

<b>Model</b>	<b>R</b>	<b><math>R^2</math></b>	<b>F</b>
1	0.331	0.109	8.720*
2	0.152	0.023	1.756

\*P<0.05

## **8.7 Hypothesis H13, The Effect of Industry Type**

The main reason for using MANOVA analysis is to test whether or not there are significant differences between means of the four knowledge management styles according to the industry types. The industry type is an independent variable, while firm size and revenue are covariate variables to control the effect of industry type on dependent variables and all four knowledge management styles are dependent. For analysis purposes the main industries are divided into three industry groups and these industries are the most used in the literature. System-based industry or technology-based (Madsen et al, 2002; Bontis et al 2003), Material-based or Manufacturing-based Industry (Kusunoki et al, 1998; Ardichvilli et al, 2003) and service-based industry (Choi and Lee, 2003; Kankahalli et al, 2003).

In order to use the MANOVA test successfully some assumptions are tested first, Deviation from Normal Distribution, Homogeneity of Variances and Covariances, and Sphericity and Compound Symmetry (StatSoft Inc, 2003).

The first assumption is not violated because the sample size is bit large. The second assumption is tested by Box's M. The following results indicate that Box's M is not significant  $p>0.001$

**Table (8.13): Box's M Test for the four Knowledge Management Styles in Term of Industry type Effect**

<b>Box's M</b>	34.573
<b>F</b>	1.587
<b>df1</b>	20
<b>df2</b>	6581.677
<b>Sig.</b>	.046

According to this significant level, the assumption of homogeneity of variance-covariance matrices has not been violated. The Sphericity and Compound Symmetry is tested by Bartlett test of sphericity. Table 8.14 shows that the Bartlett test of sphericity is significant  $p < 0.05$ , and that the Kaiser-Meyer-Olkin measure of sampling adequacy is greater than 0.6. Therefore, this assumption is not violated

**Table (8.14): KMO and Bartlett's Test for the four Knowledge Management Styles**

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</b>	0.739
<b>Bartlett's Test of Sphericity Approx. Chi-Square</b>	130.345
<b>df</b>	6
<b>Sig.</b>	0.000

Consequently, the assumptions are tested and no real violation of these assumptions is found. Therefore, MANOVA analysis is used.

Table 8.15 shows that the three industry types make significant differences ( $p < 0.05$ ) among the four styles. Therefore, hypothesis H13 is supported.

**Table (8.15): Industry type and the four Knowledge Management Styles**

<b>Knowledge management style</b>	<b>Industry type F</b>	<b>Firm size F</b>	<b>Revenue F</b>
Adoption	3.233*	2.069	0.095
Systemisation	3.179*	1.056	1.212
Standardisation	5.272*	0.001	0.646
Articulation	25.866**	0.527	0.215

\*\*p<0.01 \* p<.05

## **8.8 Testing the Mediating Effect of Knowledge Availability and Codifiability**

In chapter 3 Figure 3.9, it is suggested that knowledge creation in terms of knowledge availability and codifiability mediate the relationship between the four knowledge management styles and organisational performance. In order to test the mediating effect of the knowledge creation process, the procedure of Baron and Kenny (1986) as used by (Lee & Choi, 2003; De Gilder, 2003) is adopted. Table 8.16 shows the results of this analysis. It can be interpreted as follows:

- Firstly, regarding how the knowledge management styles affect knowledge availability and codifiability, the adoption and systemisation styles significantly affect knowledge availability and the articulation style significantly affects knowledge codifiability. However, this is not the case of the standardisation style.
- Secondly, the adoption and articulation styles affect significantly organisational performance.
- Thirdly, knowledge availability and codifiability are entered into the regression model as a second step in the regression model between the four styles and the organisational performance. When they are entered, the effect of the four knowledge management styles on organisational performance is reduced. Comparing the results in column 3 “direct relationship” with the results in

column 4 “Mediated relationship”, all the Betas are reduced. For example, in the case of adoption, its beta value is reduced from 0.280 to 0.247, and in the Articulation case, its beta value is reduced from 0.204 to 0.189. Therefore knowledge creation in terms of knowledge availability and codifiability mediates between the four knowledge management styles and organisational performance.

**Table (8.16): Mediating Analysis Result (Beta values)**

Knowledge management styles	Knowledge creation		Organisational performance (Direct) (Beta)	Organisational performance (Mediated) (Beta)
	Knowledge availability (Beta)	Knowledge codifiability (Beta)		
Adoption	0.335**		0.280*	0.247*
Systemisation	0.213*		-0.445	-0.057
Standardisation		0.138	0.092	0.085
Articulation		0.247*	0.204*	0.189*

\*\* p<0.01 \*p<0.05

A broad summary of the results of the study is shown in appendix XVI, an expanded version of Figure 3.9. In comparison with Figure 3.9, it shows, on the left, the four KM styles, on the right, organisational performance and the relationships between them, mediated and moderated by the dimensions of K-Space.



## 8.9 Results of the Hypotheses Test

In chapter (3), a set of hypotheses are proposed. Multiple regression analyses is used to test hypotheses H1-H4, H5-H6, and H8-H11. Linear regression is used to test hypotheses H7, H12, and MANOVA analysis is used to test H13. This section discusses the results of the hypotheses test obtains from both regression analyses and MANOVA analysis

The first four research hypotheses propose the relationship between Adoption, Systemisation, Standardisation and Articulation as well as K-Space dimensions, knowledge availability and knowledge codifiability .

**H1o: Adoption does not affect knowledge availability positively.**

**H1: Adoption affects knowledge availability positively.**

**H2o: Systemisation does not affect knowledge availability positively.**

**H2: Systemisation affects knowledge availability positively .**

Table 8.4 lists the multiple regression coefficients (B), t-statistics as well as its in the regression analysis. The multiple regression coefficients and t-statistics of Adoption and Systemisation are calculated to estimate the individual contribution of these styles to the regression model for knowledge availability. Consequently, these coefficients of two styles adoption and Systemisation are significantly affect knowledge availability. Table 8.4 is also shows the result of regression between both styles Adoption and Systemisation and each of knowledge availability dimensions; knowledge available to individual, to department and to the whole organisation.

Table 8.4 shows that both adoption and systemisation contribute positively and significantly to each knowledge availability domains. Further, the Adoption style contributes more to individual, group and whole organisational knowledge (0.342, 0.269, 0.250) than the Systemisation style (0.170, 0.197, 0.188). Therefore, H1o and H2o are rejected and both H1 and H2 are accepted.

**H3o: Standardisation does not affect knowledge codifiability positively.**

**H3: Standardisation affects knowledge codifiability positively.**

**H4o: Articulation does not affect knowledge codifiability positively.**

**H4: Articulation affects knowledge codifiability positively.**

Table 8.6 lists the multiple regression coefficient (B), t-statistics and the significance of t-statistics in the regression analysis. The multiple regression coefficient and t-statistics of Standardisation and Articulation are calculated to estimate the individual contribution of these styles to the regression model for knowledge codifiability. Table 8.6 shows that the coefficients of the Articulation style are significantly affect knowledge codifiability, while Standardisation does not reveal significant effect on codifiability. Table 8.6 is also shows the result of regression between both styles Standardisation and Articulation and each of the knowledge codifiability forms: pictures/images, text/words and figures/codes. Table 8.6 shows Standardisation contributes significantly to knowledge as figures and texts (0.138, 0.237), respectively, however, the Articulation style contributes significantly to knowledge as pictures (0.238).

In general, H3o is accepted and H3 is rejected. Hypothesis H4o is rejected and H4 is accepted.

The next three hypotheses reveal the moderator effect of knowledge applicability among the knowledge availability, codifiability, absorption capacity and organisational performance relationships.

**H5o) Knowledge when it is available, it does not have a positive effect on organisation performance when it is strongly applied to whole organisation.**

**H5) Knowledge when it is available, it has a positive effect on organisational performance when it is strongly applied to whole organisation.**

**H6o) Knowledge when it is codified, it does not have a positive effect on organisational performance when it is strongly applied to whole organisation.**

**H6) Knowledge when it is codified, it has a positive effect on organisational performance when it is strongly applied to whole organisation.**

**H7o) Absorptive capacity does not have positive effect on the organisational performance when it is strongly applied to whole organisation.**

**H7) Absorptive capacity has positive effect on the organisation performance when it is strongly applied to whole organisation.**

Table 8.9 shows that the interaction terms of knowledge applicability shows a positive significant effect on organisational performance. In addition, the change in  $R^2$  and the F statistic are examined and it is significant in all steps. Therefore, H5o and H6o are rejected and both H5 and H6 are accepted. Table 8.10 also shows that the interaction term factor of knowledge applicability is significant when introduced as a moderator between absorptive capacity and organisational performance. Further, the change in  $R^2$  and the F statistic are examined, and are significant. Therefore, H7o is rejected and H7 is accepted.

The eighth, ninth, tenth, eleventh and twelfth research hypotheses propose the direct relationship between the four styles and organisational performance.

### **Unbalanced Approach**

**H8o: Adoption style does not affects positively organisation performance.**

**H8: Adoption style affects positively organisation performance**

**H9o: Systemisation style does not affect positively organisation performance.**

**H9: Systemisation style affects positively organisation performance**

**H10o: Standardisation style does not affect positively organisation performance**

**H10: Standardisation style affects positively organisation performance**

**H11o: Articulation style does not affect positively organisation performance**

**H11: Articulation style affects positively organisation performance**

### **Balanced Approach**

**H12o) The organisation with a less balance approach using knowledge management styles has a significant performance than the organisations with a high balance.**

**H12) The organisation with a higher balance approach using knowledge management styles has a significant performance than the organisations with less balance.**

Table 8.12 lists the multiple regression coefficient (B), t-statistics and the significance of t-statistics in the regression analysis. The multiple regression coefficient and t-statistics of the four styles were calculated to estimate the individual contribution of these styles to the regression model for organisational performance. Table 8.12 shows these coefficients of two styles adoption and articulation are significantly affect organisational performance. On the other hand, the table shows that the coefficient of

systemisation and standardisation do not significantly affect organisational performance. The null hypotheses H8o and H11o are rejected, while the alternative hypotheses H8 and H11 are supported by the current study. The null hypotheses H9o and H10o are accepted, whereas the alternative hypotheses H9 and H10 are rejected by the current study. It is concluded that the both Adoption and Articulation have a significantly positive effect on organisational performance, but Systemisation and Standardisation do not.

Table 8.13 shows the result of the regression analysis for the two models. The first model is run on the highest 76 balanced score styles, while the second model is run on the 76 least balanced score styles. The result in the table shows that the regression in model 1 is significant, while the regression in model 2 is not significant. Consequently, H12o is rejected and H12 is accepted. The next hypothesis discusses whether or not the four knowledge management styles are varied from industry to other.

**H13o) The industry type cannot make a significant difference among the four KMSs.**

**H13) The industry type can make a significant difference among the four KMSs.**

Table 8.15 shows that the four styles are significantly different from each other in terms of industry type. There are three main industry types: material-based, system-based and service-based. These three types make a significant difference among the use of the four styles. Subsequently, H13o is rejected and H13 is accepted.

## 8.10 Chapter Summary

A set of assumptions for multiple regression and MANOVA analysis were tested and met, and the influence of the few outliers is minimal. Multiple regression analysis indicates that the adoption and systemisation styles showed statistically significant positive association with knowledge availability. Consequently, hypotheses H1 and H2 are supported. On the other hand, multiple regression is showed that the standardisation and articulation styles are statistically significant with knowledge codifiability, but standardisation doest not support hypothesis H3. Hypothesis H4 is supported, and this confirms that the articulation style contributes positively to codifiability.

Knowledge applicability is shown significantly positive as a moderate variable between knowledge availability, knowledge codifiability, absorptive capacity and organisational performance. Therefore, hypotheses H5, H6, and H7 are supported

Multiple regression analysis indicates that the four styles, as a model, affect significantly organisational performance, while systemisation and standardisation styles are not. Therefore, hypotheses H9 and H10 are not supported. The adoption and articulation do not significantly affect the organisational performance, and thus support both hypotheses H8 and H11.

The MANOVA analysis shows that industry type in terms of complexity of product system makes a significant difference among the four knowledge management styles. Accordingly, hypothesis H13 is supported

Finally, the use of the Baron and Kenny (1986) method proves that knowledge creation, in terms of knowledge availability and codifiability with the moderating effect of knowledge applicability, mediate the relationship between the four knowledge management styles and organisational performance.

## CHAPTER 9. DISCUSSION AND CONCLUSIONS

### 9.1 Introduction

In the previous chapter, the regression and MANOVA analyses findings were presented. This final chapter begins with a summary of the research hypotheses and their results. This chapter then continues with a discussion of the contributions of this study in the context of past literature. Academic and managerial contributions are discussed. Finally, the limitation of this study and proposals for future research are considered.

### 9.2 Summary of the Main Findings

As shown in table 9.1, a summary of the research hypotheses and test results are provided under the heading of each research question. While ten research hypotheses (H1, H2, H4, H8, H8, H11, H10, H11, H12, H13) have been supported from the empirical test, three research hypotheses have not (H3, H9, H10).

**Table (9.1): A summary of the Research Hypotheses**

<u>Research Question 1:</u> How do knowledge management styles contribute to organisational performance and knowledge creation?		
	<b>Knowledge management styles vs. Knowledge creation</b>	<b>Proved</b>
H1:	The adoption KM style positively affects knowledge availability	Yes
H2:	The systemisation KM positively affects knowledge availability	Yes
H3:	The standardisation KM style positively affects knowledge codifiability	No
H4:	The articulation KM style positively affects knowledge codifiability	Yes
H8:	<b>Unbalanced approach of Knowledge management styles vs. Organisational performance: Direct relationship</b>	
	The adoption KM style positively affects organisational performance.	Yes



H9:	The systemisation KM style positively affects organisational performance.	No
H10:	The standardisation KM style positively affects organisational performance.	No
H11:	The articulation KM style positively affects organisational performance.	Yes
H12:	<b>Balanced approach of Knowledge management styles vs. Organisational performance: Direct relationship</b>	
	The organisations with the most balance between knowledge management styles have a significantly better performance than the organisations with less balance.	Yes
<u>Research Question 2:</u> Do knowledge application is a fundamental dimension when analysing the organisational performance?		
H5:	Knowledge when it is available, it has a positive effect on organisational performance when it is strongly applicable to whole organisation.	Yes
H6:	Knowledge when it is codified, it has a positive effect on organisational performance when it is strongly applicable to whole organisation.	Yes
H7:	Absorptive capacity is positively affect the organisational performance when knowledge is strongly applicable to whole organisation.	Yes
<u>Research Question 3</u> Does the industry type make a significant difference among these knowledge management styles?		
H13:	The industry type can make a significant difference among the four styles.	Yes

## **9.3 Discussion of the Survey Findings**

In this section, the findings of the survey are presented in accordance with the underlying research questions. The results of the hypotheses tests are discussed under the heading of the related variables and compared with previous findings in the literature.

### **9.3.1 Research Question 1 Part1: Concerning how the Four KM Styles contribute to Dimensions of K-Space (Hypotheses H1-H4)**

- Adoption and Systemisation vs. Availability

Hypotheses H1 and H2 were supported by the results of the study and thus indicate that deploying the adoption and systemisation styles, either separately or together, improves knowledge availability. The adoption and systemisation styles contribute well to strengthening knowledge availability at individual, group and whole organisation.

The responses to the study highlight some issues emerging from attempts to make knowledge available through deploying adoption and systemisation. The adoption style may employ formal and informal procedures to disseminate knowledge, making it available for use. In the systemisation style, knowledge is always disseminated formally through advanced technology that connects individual, group and whole organisation to knowledge resources. The dissemination of knowledge in both styles can be broad or narrow. In both styles, the dissemination is be broad when knowledge is freely available to anyone in the organisation, and narrow when it is available only on a “need-to-know” basis (Jordan & Jones, 1997).

If the belief is widely held that knowledge is a sustained resource of power, it will keep knowledge from being widely available in the organisation.

The KM view is that organisations should remove all potential obstacles that would hinder knowledge flow in the organisation. Some interesting comments by respondents in the study are as follows:

*Knowledge to some is power within organisation and it is becoming a weapon in the wrong hands. Knowledge requires unfettered access 'available to every one' to realise its true benefit and to allow new ideas to flourish. Knowledge dissemination and organisational structure can reinforce regimented and hierarchical structure to remain in force when they are clearly suboptimal "not the best" in performance term (Executive manager).*

In the adoption and systemisation styles, the ownership of knowledge varies from highly personal, when it is locked into individual domain, to highly dispersed when it is available to the whole organisation. In the adoption style, organisations tend to keep knowledge in a tacit form, while in the systemisation style, organisations tend to keep knowledge in a explicit form. The organisation should identify the cost and benefits that apply to each style or both.

*In my view knowledge management requires attention at both the IT systems level and people sharing information level. There also has to be some incentive. IT databases are not cost free to maintain and people sharing information are also not costless. The cost/benefits have to be identified as a system is made (Executive manager).*

Further investigation into which style contributes more on the knowledge availability domain, found that adoption contributes more to knowledge availability in all domains than the systemisation style. As shown in table (7.1), 67.1% of the study data is collected from material-based companies, this percentage indicates that study findings can be best explained in terms of that industry in relation to the four knowledge management styles. This result confirms that material-based industry has a rich culture of sharing knowledge, so that it becomes the organisation's property

Ardichvilli et al (2003). Much of the knowledge in material-based industry is tacit (Woo et al, 2003). It is more likely that employees will work well together and that will allow experienced workers to share their knowledge and experience with apprentices through a form of story telling and communities of practise (Brown & Duguid, 1991). Zhou and Fink (2003) find in their study of Australian organisations that human capital through the organisation culture is becoming greatly important for knowledge creation in organisations. This is confirmed by Edvinsson and Malone (1997, P123), who state that “without a successful human dimension to a company, none of the rest of the value creation activities will work, no matter how sophisticated the technology”.

- **Standardisation and Articulation vs. Codification**

Together, the standardisation and articulation styles strengthen knowledge codification as hypothesis H4 is supported, but do not support hypothesis H3. The responses to the study highlight some of the issues emerging from attempts to make knowledge explicit through deploying the standardisation and articulation styles. Both styles refer to knowledge acquisition and scope in problem solving. In the former style, knowledge acquisition is externally focused, while in the standardisation style it is internally focused. In the articulation style, the organisation deliberately scans the external environment for ideas and practises, while in the standardisation style it seeks employees and case-based knowledge.

The scope of problem solving in each style is quite different. In the articulation style, knowledge is focused on the search for incremental improvement to existing products while in the standardisation style knowledge is focused on getting radical and highly innovative solutions to problems.

As shown in table (7.1), 67.1% of the study data is collected from material-based companies, 12.5%, from system-based and 20.4% from service-based companies. These percentages indicate that the study findings can be best explained in terms of the characteristic of the material-based industries in regard to the four knowledge management styles. Materials-based companies usually have products they want to keep in their market for as long as they can. Because of this, they are continually scanning the external environment. The organisations within this industry articulate their new-found ideas in figures, words and images based on their understanding of the market. For example, to Du Toit (2003) it is important to scan the external environment to acquire a competitive knowledge in South Africa, where the industries are predominantly material-based. It is more expensive for these companies to develop a new product than it is in system-based or service-based industries, because material-based companies have to make costly changes, such as production lines or raw materials.

Although it is currently easy to scan for relevant explicit data and information, it is more difficult to make it fit the organisational context. Organisations should encourage their employees to have access to explicit knowledge resources, and give them the opportunity to articulate their knowledge at all forms of codification, where knowledge can be easily stored and accessed. Organisations are concerned about the cost of using technology to standardise expert knowledge versus the cost of using human knowledge brokers or knowledge stewards (Karhu, 2002) As reported in the survey:

*The storage and access of technical knowledge is always a concern. Market intelligence, competitors' information, and customers' feedback are easily stored and accessed (Top Manger, IT manager).*

*Organisation is information rich but the access to a categorisation is less robust. Considerable effort and resources are needed to capture and keep it current (Executive manager).*

Organisations should have policies and strategies that encourage their employees to have the willingness and capability to articulate what they have obtained from knowledge resources, so that they may be knowledge brokers or stewards themselves one day. A useful strategy is to let them choose one codification form and articulate their new-found knowledge in a creative way through software. These people should be promoted and rewarded if this strategy is done correctly. Consequently, the knowledge obtained is guaranteed to be articulated into some sort of organisational context instead of being lost. The success of the articulation strategy is heavily dependent on the attitude of the participants (Neilson & Lee, 1994).

Further analysis shows that the standardisation style contributes significantly to codifying knowledge in the form of codes/figures and text/words, but not in the form of pictures/images. On the other hand, articulation style contributes significantly to codifying knowledge in the form of pictures and images. Considering the finding of Al-hawari and Hasan (2004c) that the articulation style is the most important style in the material-based organisations. In addition, the biases in the sample toward the material-based industries as well as these industry organisations have a rich culture of facilitating collaboration among the employees. Accordingly, these organisations articulate their external knowledge in the form of pictures and images in order to underpin the collaboration process. In her book, *Viability*, Kristin Hooper Woolsey writes

*Collaborative drawings have a neutral quality that can be very effective. By focusing on a drawing, people tend to concentrate on ideas on the table, rather than the different personalities and social dynamics involved. They also keep discussion focused on specifics rather than on vague and nebulous generalities (Woolsey, 1996).*

### **9.3.2 Research Question 1 Part 2: Concerning how Unbalanced Four KM Styles affect Organisational Performance: Direct Relationship (Hypotheses H8-H11)**

The research findings regarding this question shows that the hypotheses are partly vindicated through the significance of two styles: adoption, which is related to an organisation's culture, and articulation, which is related to capturing external knowledge through employee understanding. As Hypotheses H9 and H10 are not supported, the relationship between systemisation, standardisation and organisational performance is not substantiated.

It should be noted that the majority of the organisations in the sample are material-based industry. Both the adoption and articulation styles recognise the importance of tacit knowledge. It is more likely that companies in material-based industries tend to use the adoption and articulation style than those in the system-based and service-based industries. Both the adoption and articulation styles are intended to stimulate employees to share knowledge on their own initiative without any formal procedures, as in the systemisation and standardisation styles. Choi and Lee find that companies based in human-oriented style, such as manufacturing, show higher corporate performance than those with a system-oriented style (Choi & Lee, 2003).

The direct relationship between systemisation, standardisation and organisational performance is not valid. Thus explains the need for an integrative framework in which

this relationship is mediated by other factors such as knowledge codifiability, availability, and applicability. In a study of Korean companies, Lee and Suh (2003) find that the majority of the companies tended to use combination and externalisation in the service or system-based industries. Al-hawari and Hasan (2004c) also find that the service and system based industries are relying on systemisation to manage their internal knowledge capability, but standardisation is not the style used in the service industry to standardise the employees knowledge. In Service and system industries, a company's main performance is to achieve acceptable customer satisfaction. In order to achieve customer satisfaction in the system and service based industries, specialists and money are needed. In this study, customer satisfaction is not recognised as a factor in organisational performance, probably due to the concentration of respondents in manufacturing companies where the main goal is achieving acceptable competitive advantage.

### **9.3.3 Research Question 1 Part 3: Concerning How a Balance in using the four KM Styles Affects Organisation Performance, Direct Relationship (Hypothesis H12)**

It is not easy for organisations to increase knowledge management practice in a short period of time. When organisations decide to increase their performance there is a need to improve their knowledge management capabilities first through practicing, as much as possible, a balance of KM styles from the human and technology oriented perspectives. The objective of knowledge management must be to allow the organisation to achieve this goal. This can be achieved by accumulating intellectual capital, technology, manpower and experience. When an organisation intends to increase its knowledge management practice, it must initially use its own specialists and qualifications combined with outside assistance. This is echoed in the comments of some managers in the survey :



*We are currently addressing our KM inadequacies through integrating HR activities (mentoring, performance, succession, planning etc). Initiating dedicated KM unit with in our business improvement team. Reviewing training, learning and development & research activities (Executive manager).*

#### **9.3.4 Research Question 2: Related to Knowledge Application as a Fundamental Dimension when Analysing the Organisational Performance (Hypotheses H5-H7)**

Hypotheses H5, H6 and H7 are proved showing that knowledge availability, codifiability and absorptive capacity are not enough to guarantee positive knowledge effects on organisational performance. Rather knowledge must be utilised and applied in the organisation.

In K-Space, abstraction is suggested as the fundamental dimension when analysing the degree of knowledge application in an organisation (Arora & Gambardella, 1994). The other dimensions of knowledge availability and codification forms do not induce a positive effect on organisational performance without a high value of the most important dimension, the application of knowledge to whole organisation.

Knowledge assimilation is not enough without knowledge application. This explains why so many companies spend too much money on R&D and training programs. This in term of organisational performance, the result is sometimes not as expected (Decarolis & Deeds, 1999). Although most companies recognise the importance of R&D for future competitiveness, they often struggle to assess its contribution to organisational performance (Christoph et al, 2002; OECD, 2002 ). In addition to R&D expenses, the training programmes for the employees and the managers are also costly, and it is often difficult to assess their contribution to an organisation's performance. This is often because the trained employees don't have a chance to apply what they

learned. Therefore, companies need more precise ways to assess organisational performance

### **9.3.5 Research Question 3: Does Industry Type make a Difference to the Effects of Four KM styles? (Hypothesis H13)**

In this research, industry type is used as a control variable. The confirmation of hypothesis H13 implies that the effect of the styles is different depending on the three industry types: material-based, system-based and service-based. The unanticipated bias in the sample to the material-based type affects the results of the other hypotheses, particularly H3, H9 and H10. It is important that industry be taken into consideration in any research of this kind.

## **9.4 The Contribution to Academic Research**

This study makes significant contributions across all areas of knowledge management research and practice. These contributions relate to (1) the development of a conceptual model that explains and predicts the effects of knowledge management processes on organisational performance and knowledge creation; (2) the empirical support for proposed hypotheses based on the integrative research framework and the literature; (3) the development of a new instrument; (4) the research focus on knowledge application to whole organisation as the most important factor related to knowledge creation; (5) its importance as a nation-wide general organisational study and; (6) the originality in combining an exploratory approach, followed by an empirical confirmatory analysis in a rigorous research methodology for KM.

### **9.4.1 Academic Research Contribution 1**

The first academic research contribution of this study derives from the development of a conceptual model for explaining and predicting the relationship between knowledge management styles and knowledge creation, and between knowledge management styles and organisational performance. Despite the current increase in the popularity of extensive research on knowledge management, few studies have proposed models and then empirically tested them. The existence of inconsistent results in knowledge management studies suggests few studies use or develops theories to explain the managers' style in relation to knowledge management processes. A review of the extant literature on knowledge management studies shows that although some KM strategies have been investigated, strategies in regards to organisational performance and knowledge creation have not been examined systematically and theoretically.

Research involving I-Space has also been criticised as having a lack of empirical proofs. The study presented here provides rigorous research to support I-Space propositions in regards to the economic value of information, and by extension knowledge, on organisational performance. Nonaka et al (1994) inspired this emphasis on knowledge rather than information by connecting the four modes of knowledge creation to innovation, but not to organisational performance except indirectly through innovation. Boisot (1998) proposes that the value of information in I-Space is a function of diffusion, abstraction and codification. Boisot and MacMillian model the effect of the three dimensions of I-Space on profit, but they do not empirically test their hypotheses in real organisations, nor did they extend the concept of profit to that of organisational performance (Boisot & MacMillian, 2001). K-Space extends the value of interest as a

dependent variable to organisational performance, and provides the academic researcher with an alternative model for knowledge creation when knowledge is available and codified. As the importance of abstraction dimension on organisational performance: knowledge availability and codifiability constructs are built based on their different levels that align along abstraction.

#### **9.4.2 Academic Research Contribution 2**

The second research contribution of this study is the empirical support for the hypotheses predicting the effect of knowledge management styles on organisational performance and knowledge creation. Because of the increasing importance of knowledge effectiveness, this research provides an essential focus in that area. In the process of the empirical analysis, the necessity of a balanced approach is established. Importantly, the results strongly support the necessity of integrated framework. A single study on a single country like Australia cannot provide a sound basis for a universally comprehensive conceptual model on the effects of knowledge management styles on organisational performance and knowledge creation. It is suggested that further diverse studies of equivalent groups in other industries and regions would be most beneficial.

#### **9.4.3 Academic Research Contribution 3**

The third academic contribution derives from the development of five new constructs. According to Schulz and Jobe (2001) as they quote Nonaka saying, “Measuring knowledge is risky business”. They add: “Empirical research on organisational knowledge is still in its infancy. In many areas, theory development has not yet advanced to a level that warrants elaborate scale development”. This study explores a

number of novel theoretical constructs for which no empirical precedent exists. Due to the exploratory character of this study, the scales developed and used are necessarily experimental, and the database is limited. The researcher argues that the empirical analysis more as an illustration of the theoretical ideas than a definitive test. Part of the deficiency in the conduct of knowledge management research is the lack of scales publicly available for benchmarking. Using the extant literature and those published instrument, a broad set of potential items are identified that can serve to measure an organisation's knowledge capabilities. These items have been refined through multiple steps into a simple survey that determines the specific attributes of potential constructs. For the research community, this can serve as a basis for a more in-depth studies, and for future research debates.

The scales for the four knowledge management styles and knowledge availability have been developed in this study. Although the four styles are adopted from Nonaka and Takeuchi's four modes of knowledge conversion, the contribution is to consider them as the basis for KM styles rather than KM processes, extending their definition to a more accurate set of styles for practical KM task domains. For example, the internally focused, externalisation process seeks employees' case-based knowledge; while the externally focused, internalisation process scans the external environment for ideas and practices. The knowledge obtained can be in codes, texts and pictures. Knowledge availability is a more comprehensive multidimensional construct, and is a critical part of knowledge management theory. When knowledge is measured, it should be measured in relation to different domains, i.e. individual, group and organisation (Davis & Wilson, 2003). The definition of knowledge availability includes functions of knowledge in each domain. Though the validity of the construct, further extensions through other functions

of knowledge in each domain can be made to enrich the construct. The low values of the loading factors of the knowledge availability items found here in the group/department domain increases the importance of having more valid items.

#### **9.4.4 Academic Research Contribution 4**

The fourth academic contribution is the recognition that knowledge application is the most significant factor for achieving acceptable performance. Before knowledge application was introduced as the moderator factor in the analysis, neither knowledge availability nor codifiability were seen to have significant effects on organisational performance. Notwithstanding, knowledge availability in the whole organisational domain was shown to have a significant effect on organisational performance, without the moderating effect of knowledge applicability. The reason for this could be that knowledge functions in that domain help in controlling the organisation, gathering intelligence information, and making the organisation's policy. These functions are naturally influential in achieving acceptable organisational performance. These results support the idea that there is often insufficient knowledge at the point of action (Wiig, 1995). Knowledge application at whole organisation is preferred to knowledge application at the individual, or group levels, because the whole organisation utilises knowledge to accomplish profitable and non-profitable performance.

The research also distinguishes between absorptive capacity and knowledge application. Absorptive capacity is desirable when the organisation spends money on R&D and employees training, but without implementation makes knowledge application insufficient at the point of action. K-Space reveals that knowledge application through

the abstraction dimension is the most important dimension in term of organisational performance.

#### **9.4.5 Academic Research Contribution 5**

The fifth contribution derives from the fact that the study targeted a national cross-section of Australian SMEs rather than big enterprises, as is the case with most studies on knowledge management practice. This research is ground-breaking because of the lack of studies that check the validity of knowledge management concepts in SMEs in the Australian context. As is shown in this study, most Australian organisations tend to be material-based rather than service or system based. The research reveals the importance of studying these industries in more detail in order to check the validity of their knowledge management concepts. This is particularly important in Australia, where an Interim Australian KM standard has recently been released (Handzic & Hasan, 2003). It is beneficial to distinguish knowledge management practices in the context of different industries, since the industry has an effect on which knowledge management style will be most effectively deployed within different industries.

#### **9.4.6 Academic Research Contribution 6**

The last contribution is derived from the lessons learnt from the methodology employed in the study. This research involved a rigorous two-stage methodology: an exploratory approach, where the literature in knowledge management practice and application was reviewed; this lead to the K-Space model, and the justified framework in order to explain the research questions. The second stage involved an empirical confirmatory

analysis of a substantial sample of real organisations in order to answer the research questions and hypotheses.

## **9.5 The Managerial Contribution**

In addition to academic outcomes, this research has contributed in a practical way to a deeper understanding of knowledge management in relation to managerial styles in real organisations. Many managers are facing difficulties in implementing knowledge management activities, because they are not clear of the effectiveness of these activities, and of the way that they affect organisational performance. This study helps managers and organisations to more clearly define their knowledge management strategies. This study builds and uses an approach that classifies and unifies these activities in one framework with knowledge creation, in terms of knowledge availability and codifiability mediating the relationship between KM styles and organisational performance. This approach helps to unveil the gaps between insufficient and sufficient knowledge in action. Some examples of this are now presented.

The success of knowledge management practice is dependent on the extent to which an organisation is willing to deploy the four dominant knowledge management styles. The ability and decision to deploy one or all of knowledge management styles depends on a manager's capability to analyse the importance of each style. Some managers prefer to deploy one style over another because of its low cost, or their experience in that way of managing. Many manager are familiar with both adoption and systemisation styles, but each of these styles is costly to deploy. The results of this research clarifies the benefits that can be used to justify the cost to senior management e.g. by deploying adoption and/or systemisation; knowledge becomes available to all knowledge availability



domains. Another manager may need to get guidance to implement the capability and desire to deploy the adoption style through a better understanding of the importance of encouraging employees to have a willingness to share their knowledge as individuals, groups or even as a whole organisation.

Managers who tend to deploy advanced technology, such as knowledge base systems, databases, and electronic documents as a tool for knowledge diffusion, should understand how that technology could be used to make knowledge available. This research makes it clear for managers that it may be advantageous to turn the employees into knowledge brokers or stewards, so the company will not have to employ extra experts to standardise their knowledge and make it applicable for the technology.

The articulation and standardisation styles contribute significantly to knowledge creation by codifying knowledge. The articulation style suits organisations that frequently scan the external environment for new knowledge or challenges, while the standardisation style suits organisations that frequently seek internal innovation. The articulation style is most useful in material-based industries such as manufacturing, agriculture and construction organisations, whereas standardisation is best suited to service and system-based industries where knowledge is sought internally.

It is important for managers to remember that it is not enough to influence organisational performance by merely making knowledge available and codifiable. Managers should have a policy to continually apply the knowledge that has been created, made available or codified. They should not sink a million dollars into training or R&D without having a policy on how this newly created knowledge will be applied.

The research reveals the importance of deploying a balanced approach in regard to the use of the four knowledge management styles. Although the four styles have different uses in different industries, this should not stop managers from setting up a balanced approach of these styles within their organisation. Setting up this approach takes time and money. It can be achieved by accumulating capital, technology, manpower and experience. However, when organisations intend to increase their knowledge management capability, they should use their own qualified specialists before they get outside assistance.

## **9.6 Limitations of the Study**

There are four main limitations that could arise from the research methods used. They are: (1) the cross-sectional research design, (2) the source of the sampling frame, (3) the measurement instruments, and (4) the geographical coverage.

The first limitation is the cross-sectional design of the mail survey. This cross sectional study represents a slice of time, and does not show how the manager's behaviour may change over time. Further study employing a longitudinal design would ascertain whether or not the manager's attitude toward knowledge management had changed overtime.

The second limitation derives from the fact that an electronic database is used as the source of sampling. This database list is incomplete, as some records have not been updated for some time, i.e., recent addresses change.

The third limitation is that although the majority of the constructs of the survey instrument that were developed or modified have good psychometric properties, further refinement could be done of the constructs on the four KM styles; (e.g. conducting focus group interviews with some managers could improve the reliability and validity of these constructs). The improvement of the validity of the knowledge availability construct is also desirable. This is due to the fact that only the functions of knowledge were used to measure how knowledge is available in all domains. The need for reliable and valid measurement instruments is critical since the success of any future research agenda in knowledge management studies is dependent on those instruments being available.

The last limitation is derived from the geographical location of the current study (Australia). Although the proposed integrated research framework is found reliable and valid in predicting knowledge management's effect on organisational performance and knowledge creation, further study in different countries would most likely strengthen and validate the findings on some of the hypotheses. The limitations of this study create many possibilities for future research. Further studies seeking to overcome these above-mentioned limitations may be of interest to academics and managers in this area.

## **9.7 Areas for Future Research**

This section suggests related areas of research where additional investigation may be fruitful.

As mentioned in Section 9.6, the current study used a cross-sectional design, and it would be valuable to conduct a longitudinal study to see whether or not the variables and their relationships are consistent over time.

It is probably important to investigate the relationship between the four KM styles in the context of different industries. The current comparative research is limited to three industry types, with the material industry dominating. A wide variety of industries would improve the generalisability of the research findings. Further research could investigate how one or more of the four styles may be brought into sharper focus in different industries.

Organisations that have a more balanced set of KM styles are likely to have significantly better performances than those that are less balanced. The research could also benefit from a deeper analysis of factors other than knowledge such as cost, organisational culture and employee trust. All these factors could play a role in changing the significance of some of the hypotheses testing. Since culture and trust are important in enhancing knowledge transfer (Al-hawari & Hasan, 2004a, 2004b; Dayasindh, 2001), a relevant comment in one of the responses to the questionnaire was:

*Our organisational uses knowledge when it needs to. However it is my view that there is a culture of protecting knowledge, especially within departments. Consequently, synergies between departments aren't as good as it could be. I see that the a above is more prevalent where you have professions {IT specialists, accountants, technician) who see themselves as the expert holds of knowledge in the organization (Executive manager).*

Since organisational knowledge can take many forms, Sanchez and Heen distinguish among three forms, practical knowledge, theoretical knowledge and strategic knowledge (Sanchez & Heene, 1997). Whitehill divides these forms to encoded knowledge (know-what), habitual knowledge (know-how), and scientific knowledge (know-why) (Whitehill, 1997). According to the most prevalent form of knowledge, the most effective set of KM styles could be one, or a combination of styles. Future contributions could be made to the research by checking whether or not the KM styles, effectively deployed in an organisation, are related to the prominent form of knowledge.

The current study was conducted only in Australia, and so future cross-cultural research would be valuable. It is assumed that there will be, to some degree, a difference in the factors affecting the deployment of the four styles across different cultures. Therefore further research should be directed toward examining the behaviour of people from different ethnic backgrounds in Australia.

Finally, explicit research could be done to refine the survey instrument as discussed in Section 9.6. For example, expanding the measures of knowledge availability and codifiability could aim to enrich these constructs. This is particularly true, if elements of technology, sales/marketing and strategic knowledge are recognised in the expansion of the knowledge codification construct. As mentioned previously, the production of this new instrument is a major outcome of this research and, if continually refined through rigorous study, would be useful to use to researchers and manager/practitioners alike.

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**Appendix (I): Cover Letter for the Research Ethics Committee**

**UNIVERSITY OF WOLLONGONG  
INFORMATION SHEET FOR RESEARCH  
PARTICIPANTS**

**“A study of the effectiveness of knowledge management strategies on  
organisation performance”**

**Dear Planning Director or Resource Management Professional:**

Thank you for showing an interest in this research. Please read this information sheet carefully before deciding whether or not you wish to participate. Participation in the study is voluntary.

**Purpose:** the researcher is conducting a survey as a partial fulfilment of the requirements for the degree of Doctor of Philosophy in Information Systems in University of Wollongong in Australia. My doctoral research concerns the internal knowledge management strategies of an organisation. Knowledge and its management have emerged as substantial issues to organisations who are facing environmental uncertainties and changes. This is especially true for organisations that are highly dynamic in the current open economy due to the communication revolution.

Knowledge management is the set of strategies implemented by knowledge catalysts within the organisation and recognised as the effective process to remain competitive into the future through its effect on organisational performance. The purpose is not to locate knowledge everywhere, but to apply it within an organisation to enhance the organisational performance.

**Description:** The survey will provide understanding of how an organisation manages knowledge. The result will be valuable to you and your organisation as you continue to struggle with the knowledge requirement of the new economy.

The survey will seek your opinion about various practices and technologies employed in your organisation. As well some background and demographic questions are requested in order to profile the organisations involved in this study.

The survey will take less than **20 minutes** to complete and has **eight pages**. All survey responses are strictly confidential.

In return for your participation in this project, you will receive a summary of the result of this large-scale study. Your help and cooperation are appreciated.

If you are willing to help me out please fill out the survey to the best of your ability and return it in **the postage paid envelope provided**.

**Confidentiality:** all responses will be treated in strict confidence by the Department of Information Systems, the University of Wollongong and the Researcher. Any result reported will be done in aggregate to protect the anonymity of you and your organisation.

**Complaints:** if you have any complaints about the conduct of the study, then please contact Complaint Officer, University Of Wollongong/ Illawarra Area Health Service Human Research Ethics Committee on .

PhD student

Primary Supervisor

E-mai

*Please note that this study has been reviewed by the Human Research Ethics Committee of  
the University of Wollongong*

**Appendix (II): Main Questionnaire**  
**A study of the effectiveness of knowledge management strategies on  
organisation performance**  
**Questionnaire**

**Please note that all questionnaires will remain anonymous, and the data collected will be kept confidential.**

1- Please indicate your organisational primary industry

IT Suppliers	Agriculture & Mining	Manufacturing	Utilities & Construction	Wholesale & Retail
Transport & Storage	Communication	Finance & Business	Community services	Personal & Other Services

## INSTRUCTIONS

*For most questions simply circle the number that corresponds to your answer, as in the examples below.*

Example A:	What is your sex?		1 Male		2. Female	
Example B:	My organisation	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
		1	2	3	4	5
... Employees are allowed to rotate their job with others in the organisation.						

## Section 1: Participant's opinions about some knowledge management strategies

### A. The Adoption Knowledge Management Style

Please indicate the extent to which you agree with the following statements regarding your organisational strategies that make the individuals practise and share their knowledge with others:

My organisation ('s)		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	.... Vision is made clear, and well known, to your employees.	1	2	3	4	5
2	.... Holds group discussions with formal protocols such as; avoiding questions with the answers YES or NO, echoing ideas and solutions, etc.	1	2	3	4	5
3	.... Holds group sessions that have a variety of participants with their own knowledge	1	2	3	4	5
4	.... Holds group sessions the participants' feelings are respected even when there is disagreement with their viewpoint.	1	2	3	4	5
5	...Holds group sessions where smiles and fun are encouraged.	1	2	3	4	5
6	.... Invites employees to brainstorming sessions in order to solve problems.	1	2	3	4	5
7	.... Tells success stories about other companies.	1	2	3	4	5
8	... Employees <b>do not</b> have a willingness to share their knowledge with each other.	1	2	3	4	5
9	.... Knowledge is spread outside the company by the experts/spokespersons.	1	2	3	4	5
10	... Encourages the transfer of knowledge from mentors to novice employees.	1	2	3	4	5

### B. The Systemisation Knowledge Management Style

Please indicate the extent to which you agree with the following statements regarding the technology within your organisation:

	My organisation('s). ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	.... Has an advanced communication system	1	2	3	4	5
2	.... Stores a knowledge in electronic documents	1	2	3	4	5
3	... Stores a knowledge in data base system	1	2	3	4	5
4	... <b>Doest not</b> store a knowledge in Hyper text / WebPages	1	2	3	4	5
5	.... Stores a knowledge in knowledge base system	1	2	3	4	5

### C. The Standardisation Knowledge Management Style

Please indicate the extent to which you agree with the following statements regarding knowledge formalisation within your organisation:

	My organisation('s) ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	.... Expert knowledge is captured and/or documented.	1	2	3	4	5
2	.... Holds electronic discussions capturing the knowledge obtained from them.	1	2	3	4	5
3	.... Employees are willing to document their knowledge	1	2	3	4	5
4	.... Strives for all employees to have access to captured knowledge.	1	2	3	4	5

#### D. The Articulation Knowledge Management Style

Please indicate the extent to which you agree with the following statements regarding knowledge interpretation within your organisation:

In my organisation. ...		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	.... Past knowledge is captured and/or documented.	1	2	3	4	5
2	... Knowledge that is obtained from competitors is captured and/or documented.	1	2	3	4	5
3	... Knowledge that is obtained from customers is captured and/or documented.	1	2	3	4	5
4	.... Knowledge that is obtained from the partners <b>is not</b> captured and/or documented.	1	2	3	4	5
5	.... Employees are encouraged to get on line training on how to capture/document what they are learning.	1	2	3	4	5
6	.... There is an incentive to document relevant legislation and social issues that affect your market.	1	2	3	4	5
7	.... Employees are able to acquire knowledge using the latest technology.	1	2	3	4	5
8	... Customer feedback and comments about your products and services are captured, documented, processed and analysed.	1	2	3	4	5

## Section 2: participant's opinions about the knowledge usefulness in the organisation

### A. Knowledge Availability

Please indicate the extent to which you agree with the following statements regarding knowledge existence in your organisation:

In my organisation...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 ... Knowledge helps the employees to know their duties and tasks	1	2	3	4	5
2 ...Knowledge helps the employees to know how to act in uncertain situation	1	2	3	4	5
3 ...Knowledge helps the employees to recognise the gap between their expected and their actual performance.	1	2	3	4	5
4 ... Knowledge helps the employees to close the gap and learn from mistakes.	1	2	3	4	5
5 .... Knowledge helps departments to recognise the gap between their expected and actual performance.	1	2	3	4	5
6 ... Knowledge helps departments to realise the effects of uncertainty and its impact on their performance.	1	2	3	4	5
7 .... Knowledge helps to set new goals in a changing environment.	1	2	3	4	5
8 .... Knowledge helps to assess and reviewed proposed new goals.	1	2	3	4	5
9 .... Knowledge helps to assess new development as opportunities and threats.	1	2	3	4	5
10 .... Knowledge <b>does not</b> help to have regular measures to counter the imbalance between desired and current goals.	1	2	3	4	5



**B: Knowledge Applicability**

Please indicate the extent to which you agree with the following statements regarding knowledge utilization in your organisation:

	My organisation. ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	... Has a process for applying knowledge learned from mistakes	1	2	3	4	5
2	... Has a process for applying knowledge learned from experiences	1	2	3	4	5
3	... <b>Has not</b> process for using knowledge for the development of new products and/or services.	1	2	3	4	5
4	... Has a process for using knowledge to solve new problems.	1	2	3	4	5
5	... Matches sources of knowledge to problems and challenges.	1	2	3	4	5
6	... Uses knowledge to adjust strategic direction as needed.	1	2	3	4	5
7	... Uses knowledge to improve efficiency	1	2	3	4	5
8	... Is able to locate and apply knowledge to changing competitive condition.	1	2	3	4	5
9	... Makes knowledge accessible to those who need it.	1	2	3	4	5
10	... Takes advantage of new knowledge	1	2	3	4	5
11	... Quickly applies knowledge to critical competitive needs.	1	2	3	4	5
12	... Quickly identifies sources of knowledge in solving problems.	1	2	3	4	5

### Section 3: participant's opinions about knowledge representation in the organisation

#### A. Knowledge Codifiability

Please indicate the extent to which you agree with the following statements regarding knowledge representation form in your organisation:

My organisation. ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 ...Represents a knowledge in numbers and codes	1	2	3	4	5
2 ... Represents a knowledge in words and text	1	2	3	4	5
3 ... Represents a knowledge in pictures and images	1	2	3	4	5

### Section 4: participant's opinions about the organisation performance

#### A. Organisation performance

Please indicate the extent to which you agree with the following statements regarding your organisational innovativeness and successfulness over the last year

Compared to key competitors, your organisation:	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 Is more successful	1	2	3	4	5
2 Has greater market share	1	2	3	4	5
3 Has a faster growth rate	1	2	3	4	5
4 Is more profitable	1	2	3	4	5
5 Is more innovative	1	2	3	4	5

#### B. Absorptive Capacity

Please indicate the extent to which you agree with the following statements regarding your organisation expenses on research & development and training over the last year.

Compared to the annual sales, Your organisation...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 ... Research & Development expenses are high.	1	2	3	4	5
2 ... Training expenses is high	1	2	3	4	5

## **Section 5: PARTICIPANT BACKGROUND INFORMATION**

*Please note that this information will only be used in aggregate form for statistical analysis. Your personal information will in no way be used as an example and will be strictly confidential.*

*Please circle the number representing appropriate response for the follow:*

1. Your age (years)

(1) Under 20    (2) 20-35    (3) 36-50    (4) 51-65    (5 ) Over 65

2. Your sex

(1) Female                      (2) Male

3. Number of years worked in the organisation

(1) Less than 1    (2) 1-2    (3) 3-5                      (4) 6-10    (5) Over 10

4. Job status

(1) Middle management    (2) Top management    (3) Executive management

5. Roughly, my total yearly income before taxes and other deduction.

(1) Less than \$ 70,000    (2) \$70,001-100,000    (3) \$ 100,001-130,000

(4) \$ 130,001-160,000    (5) \$ Over 160,000

6. Your highest completed level of education.

(1) High school    (2) College degree    (3) Bachelor degree

(4) Graduate diploma    (5) Master degree    (6) Doctoral degree

**Thank you for your time and effort in completing this questionnaire.**

### **Appendix (III): The Ethics Committee Approval**

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#### **FINAL APPROVAL**

**In reply please quote: SD:KM HE03/113**

Further Enquiries: Karen

Dear Mr Al-hawari

I am pleased to advise that the following Human Research Ethics application has been **approved**. As a condition of approval, the Human Research Ethics Committee requires that researchers immediately report anything which might warrant review of ethical approval of the protocol, including: serious or unexpected adverse effects on participants, proposed changes to the protocol, unforeseen events that might affect continued ethical acceptability of the project. You are also asked to submit a final report when the project is completed or if the project is not commenced.

Ethics Number: HE 03/113

Project Title: The development and evaluation of a k-space framework for the study of knowledge management

Name of Researchers:

This certificate relates to the research protocol submitted in your original application and includes all approved amendments to date.

Please note that research projects of long duration must be reviewed annually by the Committee and it will be necessary for you to apply for renewal of this application if this project is to continue beyond one year.

Yours Sincerely,

Assoc. Prof.

**Chairperson**

**Human Research Ethics Committee**

Please see print copy for Appendix (iv): The Reminder Letter

### Appendix (V): Codebook

Q.No	Code name	Variable name	Wording (+)	Wording (-)	Reverse *
1	In_type	Industry type	N/A	N/A	
2	ADOPT1	Company vision	+		
3	ADOPT2	Group discussion with a protocols	+		
3	ADOPT3	Group sessions with variety of participants	+		
4	ADOPT4	Group sessions with participant respecting	+		
5	ADOPT5	Group sessions with smiles and fun	+		
6	ADOPT6	Brainstorming sessions	+		
7	ADOPT7	Success story	+		
8	ADOPT8	Willingness of employees to share a knowledge		-	Yes
9	ADOPT9	Knowledge spreading	+		
10	ADOPT10	Knowledge transferring from mentors to novice	+		
11	Sys1	Advanced communication system	+		
12	Sys2	Knowledge in electronic documents	+		
13	Sys3	Knowledge in data bases	+		
14	Sys4	Knowledge in hyper text and WebPages		-	Yes
15	Sys5	Knowledge in knowledge base system	+		
16	Stand1	Expert knowledge capturing	+		
17	Stand2	Electronic discussion knowledge capturing	+		
18	Stand3	Willingness of employees to document their knowledge	+		
19	Stand4	Accessing the captured knowledge	+		
20	Artic1	Past knowledge capturing	+		
21	Artic2	Competitors knowledge capturing	+		
22	Artic3	Customers knowledge capturing	+		
23	Artic4	Partners knowledge capturing		-	Yes
24	Artic 5	Online training	+		
25	Artic6	Legislation and social science	+		

26	Artic7	Latest technology	+		
27	Artic8	Feedback & comments processing	+		
27	Avail1	Duties and tasks [Employees]	+		
28	Avail2	Acting in uncertain situations [Employees]	+		
29	Avail3	Recognising the gaps [employees]	+		
30	Avail4	Close the gaps and learn from mistakes [employees]	+		
31	Avail 5	Recognising the gaps [Department/ groups]	+		
32	Avail 6	Realising the effects of uncertainty [Department/ groups]	+		
33	Avail 7	Setting new goals for changing environment [Organisation]	+		
34	Avail 8	Assessing proposed new goals [Organisation]	+		
35	Avail 9	Assessing new development opportunities [Organisation]	+		
36	Avail10	Regular measures [Organisation]		-	Yes
37	Appl1	Applying knowledge learned from mistakes	+		
38	Appl2	Applying knowledge learned from experience	+		
39	Appl3	Applying knowledge for the development of new products/ services	+		
40	Appl4	Applying knowledge to solve new problems	+		
41	Appl5	Applying knowledge to match the sources with problems and challenges	+		
42	Appl6	Applying knowledge to adjust strategic direction as needed	+		
43	Appl7	Applying knowledge to improve efficiency	+		
44	Appl8	Applying knowledge to change competitive conditions	+		
45	Appl9	Knowledge is accessible to	+		

		those who need it			
46	Appl10	Applying knowledge to take advantage of new things	+		
47	Appl11	Applying knowledge quickly to critical competitive needs	+		
48	Appl12	Applying knowledge quickly to identify sources in solving problems.	+		
49	Cod3	Representing knowledge in codes & numbers	+		
50	Cod2	Representing knowledge in words & text	+		
51	Cod1	Representing knowledge in pictures & images	+		
52	Per1	The successful of organisation	+		
53	Per2	Market share	+		
54	Per3	Growth rate	+		
55	Per4	Profitability	+		
56	Per5	Innovativeness	+		
57	Ac1	Research & development expenses	+		
58	Ac2	Training expenses	+		
59	Age	Age	N/A	N/A	
60	SEX	SEX			
61	EMPYEARS	Number of years worked in organisation	N/A	N/A	
62	JOBS	Job status	N/A	N/A	
63	Salary	Yearly salary [Australian Dollar]	N/A	N/A	
64	Educ	Highest completed level of education	N/A	N/A	
	Size	Number of employees in the company	N/A	N/A	
	Revn	The annual revenue of the organisation	N/A	N/A	



## Appendix (VI): Descriptive Statistics for All the Variables

Descriptive Statistics						
	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ADOPT1	3.8684	.95379	-.893	.197	.378	.391
ADOPT2	2.9474	1.02801	-.042	.197	-.766	.391
ADOPT3	3.8947	.82316	-1.462	.197	2.853	.391
ADOPT4	3.8092	.91154	-.834	.197	.728	.391
ADOPT5	3.4079	.89410	-.395	.197	.108	.391
ADOPT6	3.6382	1.03929	-.698	.197	-.135	.391
ADOPT7	3.1250	.97187	.053	.197	-.682	.391
ADOPT8	3.5987	1.01159	-.604	.197	-.400	.391
ADOPT9	3.2566	.98664	-.452	.197	-.118	.391
ADOPT10	3.8092	.87446	-.942	.197	.899	.391
SYS1	3.4145	1.02579	-.419	.197	-.693	.391
SYS2	3.9671	.76702	-1.193	.197	2.790	.391
SYS3	3.8882	.84218	-1.200	.197	2.106	.391
SYS4	3.4868	1.16793	-.600	.197	-.698	.391
SYS5	3.2109	.99472	-.563	.200	-.442	.397
STAND1	3.3289	.88980	-.528	.197	-.450	.391
STAND2	2.6908	.95066	.329	.197	-.703	.391
STAND3	3.2961	.78764	-.249	.197	-.804	.391
STAND4	3.5724	.89592	-.780	.197	.532	.391
ARTIC1	3.5921	.85626	-.836	.197	.345	.391
ARTIC2	3.3553	.87199	-.579	.197	-.559	.391
ARTIC3	3.7483	.81009	-1.033	.197	1.389	.392
ARTIC4	3.4503	.84608	-.746	.197	.210	.392
ARTIC5	2.8421	.96361	.413	.197	-.649	.391
ARTIC6	3.1053	.99107	-.007	.197	-.942	.391
ARTIC7	3.5263	.98295	-.710	.197	-.215	.391
ARTIC8	3.6776	1.03324	-.596	.197	-.397	.391
AVAIL1	4.1316	.69705	-1.017	.197	2.875	.391
AVAIL2	4.0592	.80753	-1.256	.197	2.583	.391
AVAIL3	3.8684	.85105	-.658	.197	.365	.391
AVAIL4	3.9276	.83072	-.776	.197	.738	.391
AVAIL5	3.9474	.77877	-.675	.197	.920	.391
AVAIL6	3.6053	.88518	-.528	.197	.055	.391
AVAIL7	3.9671	.79250	-.588	.197	.165	.391
AVAIL8	4.0066	.68568	-.633	.197	1.048	.391
AVAIL9	4.0329	.76702	-.859	.197	1.001	.391
AVAIL10	3.6600	.85003	-.413	.198	-.042	.394
APP1	3.2829	.92370	-.237	.197	-.774	.391
APP2	3.4079	.87916	-.604	.197	-.142	.391
APP3	3.5395	.91262	-.860	.197	.553	.391
APP4	3.4145	.79272	-.644	.197	.115	.391
APP5	3.3158	.80906	-.639	.197	-.020	.391
APP6	3.7237	.87039	-.712	.197	-.090	.391
APP7	3.8882	.74184	-.903	.197	1.722	.391
APP8	3.5789	.76795	-.625	.197	.377	.391
APP9	3.6316	.90389	-.727	.197	.106	.391
APP10	3.6118	.89183	-.400	.197	-.562	.391
APP11	3.3618	.93885	-.297	.197	-.480	.391
APP12	3.4539	.85999	-.710	.197	.425	.391
COD3	2.9737	1.00296	-.266	.197	-1.078	.391
COD2	3.9868	.57528	-.635	.197	2.287	.391
COD1	3.4539	.92671	-.673	.197	-.079	.391
PER1	3.7133	.85402	-.786	.198	.982	.394
PER2	3.5400	.98737	-.197	.198	-.632	.394
PER3	3.4899	.89758	.002	.199	-.479	.395
PER4	3.3933	.94049	-.177	.198	-.354	.394
PER5	3.5467	.95949	-.504	.198	.152	.394
AC1	2.8212	1.10807	.122	.197	-.837	.392
AC2	2.7351	.95709	.277	.197	-.617	.392
AGE	3.1126	.66876	-.133	.197	-.753	.392
SEX	1.8013	.40033	-1.526	.197	.332	.392
EMPYEARS	3.6424	1.32838	-.528	.197	-.956	.392
JOBS	2.1533	.84135	-.024	.198	-.729	.394
SALARY	3.1565	1.35839	.044	.200	-1.236	.397
EDUC	3.3245	1.44014	-.138	.197	-.887	.392
SIZE	301.0134	157.87170	.224	.199	-1.710	.395
REVEN	1.9E+08	4.2E+08	6.270	.212	43.950	.420

## Appendix (VII): Knowledge Applicability Scale

**Table (VII.1) Correlation Matrix for the Knowledge Applicability Scale**

Correlation Matrix												
	APP1	APP2	APP3	APP4	APP5	APP6	APP7	APP8	APP9	APP10	APP11	APP12
Correlation APP1	1.000	.721	.368	.544	.438	.361	.530	.318	.459	.424	.393	.396
APP2	.721	1.000	.442	.545	.507	.295	.436	.442	.449	.389	.414	.437
APP3	.368	.442	1.000	.476	.467	.339	.305	.279	.323	.308	.312	.403
APP4	.544	.545	.476	1.000	.600	.474	.406	.463	.464	.398	.491	.499
APP5	.438	.507	.467	.600	1.000	.350	.335	.493	.359	.327	.415	.459
APP6	.361	.295	.339	.474	.350	1.000	.516	.489	.501	.561	.472	.452
APP7	.530	.436	.305	.406	.335	.516	1.000	.300	.412	.484	.410	.443
APP8	.318	.442	.279	.463	.493	.489	.300	1.000	.634	.466	.525	.502
APP9	.459	.449	.323	.464	.359	.501	.412	.634	1.000	.561	.619	.600
APP10	.424	.389	.308	.398	.327	.561	.484	.466	.561	1.000	.549	.508
APP11	.393	.414	.312	.491	.415	.472	.410	.525	.619	.549	1.000	.730
APP12	.396	.437	.403	.499	.459	.452	.443	.502	.600	.508	.730	1.000
Sig. (1-tailed)	APP1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
APP2	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
APP3	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
APP4	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
APP5	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
APP6	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
APP7	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
APP8	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000
APP9	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
APP10	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
APP11	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
APP12	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	

a. Determinant = 1.754E-03

**Table (VII.2) KMO and Bartlett's test for the Knowledge Applicability Scale**

**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	927.521
	df	66
	Sig.	.000

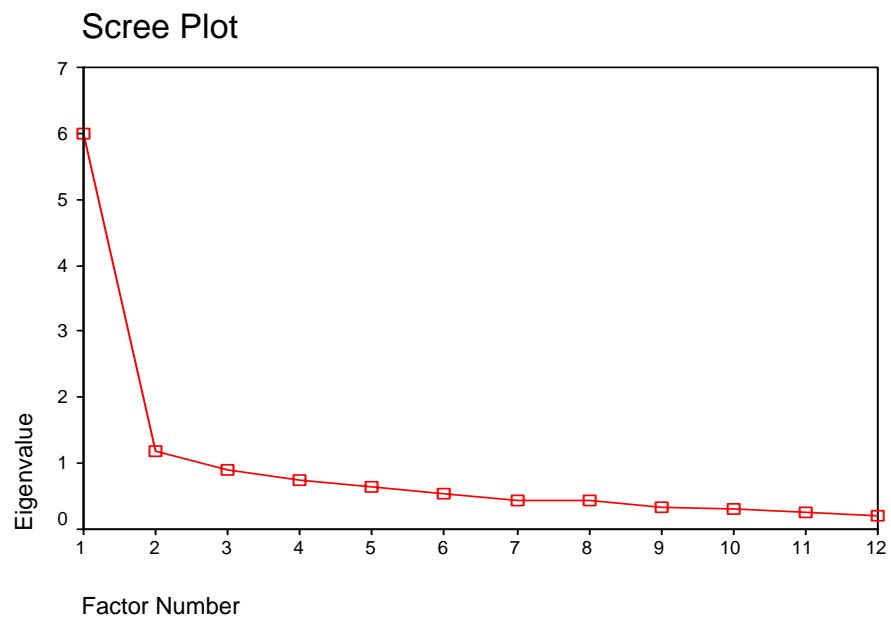
**Table (VII.3): Anti-image Correlation for the Knowledge Applicability Scale**

**Anti-image Matrices**

	APP1	APP2	APP3	APP4	APP5	APP6	APP7	APP8	APP9	APP10	APP11	APP12
Anti-image Covariance												
APP1	.383	-.208	2.235E-02	-7.50E-02	-2.45E-02	-8.71E-03	-.111	7.982E-02	-6.54E-02	-3.31E-02	2.999E-03	2.384E-02
APP2	-.208	.384	-8.76E-02	-3.51E-02	-4.19E-02	7.866E-02	-2.64E-02	-8.81E-02	3.891E-03	-8.63E-03	-4.78E-03	-1.25E-02
APP3	2.235E-02	-8.76E-02	.661	-8.31E-02	-.118	-6.27E-02	5.538E-03	3.378E-02	-2.01E-02	-1.93E-02	4.099E-02	-6.94E-02
APP4	-7.50E-02	-3.51E-02	-8.31E-02	.458	-.143	-8.77E-02	1.129E-02	-1.71E-02	-9.92E-03	2.710E-02	-4.08E-02	-1.95E-02
APP5	-2.45E-02	-4.19E-02	-.118	-.143	.514	1.485E-02	-1.28E-02	-.129	3.718E-02	1.442E-02	-1.02E-02	-4.34E-02
APP6	-8.71E-03	7.866E-02	-6.27E-02	-8.77E-02	1.485E-02	.507	-.153	-9.81E-02	-2.76E-02	-.129	-1.75E-02	3.553E-03
APP7	-.111	-2.64E-02	5.538E-03	1.129E-02	-1.28E-02	-.153	.561	5.087E-02	-1.44E-03	-7.55E-02	4.329E-04	-5.71E-02
APP8	7.982E-02	-8.81E-02	3.378E-02	-1.71E-02	-.129	-9.81E-02	5.087E-02	.455	-.165	-3.06E-02	-2.69E-02	-7.75E-03
APP9	-6.54E-02	3.891E-03	-2.01E-02	-9.92E-03	3.718E-02	-2.76E-02	-1.44E-03	-.165	.410	-6.95E-02	-6.75E-02	-6.61E-02
APP10	-3.31E-02	-8.63E-03	-1.93E-02	2.710E-02	1.442E-02	-.129	-7.55E-02	-3.06E-02	-6.95E-02	.518	-7.20E-02	-1.87E-02
APP11	2.999E-03	-4.78E-03	4.099E-02	-4.08E-02	-1.02E-02	-1.75E-02	4.329E-04	-2.69E-02	-6.75E-02	-7.20E-02	.386	-.188
APP12	2.384E-02	-1.25E-02	-6.94E-02	-1.95E-02	-4.34E-02	3.553E-03	-5.71E-02	-7.75E-03	-6.61E-02	-1.87E-02	-.188	.389
Anti-image Correlation												
APP1	.836 <sup>a</sup>	-.543	4.445E-02	-.179	-5.52E-02	-1.98E-02	-.240	.191	-.165	-7.45E-02	7.805E-03	3.185E-02
APP2	-.543	.853 <sup>a</sup>	-.174	-8.37E-02	-9.44E-02	.178	-5.69E-02	-.211	9.812E-03	-1.94E-02	-1.24E-02	-3.25E-02
APP3	4.445E-02	-.174	.910 <sup>a</sup>	-.151	-.203	-.108	9.094E-03	.116	-3.86E-02	-3.31E-02	3.116E-02	-.137
APP4	-.179	-8.37E-02	-.151	.930 <sup>a</sup>	-.295	-.182	2.228E-02	-3.74E-02	-2.29E-02	5.564E-02	-9.70E-02	-4.63E-02
APP5	-5.52E-02	-9.44E-02	-.203	-.295	.897 <sup>a</sup>	2.908E-02	-2.39E-02	-.267	.146	2.794E-02	-2.28E-02	-9.71E-02
APP6	-1.98E-02	.178	-.108	-.182	2.908E-02	.890 <sup>a</sup>	-.286	-.204	-6.06E-02	-.251	-3.96E-02	1.477E-02
APP7	-.240	-5.69E-02	9.094E-03	2.228E-02	-2.39E-02	-.286	.912 <sup>a</sup>	.101	-2.99E-03	-.140	9.303E-04	-.122
APP8	.191	-.211	.116	-3.74E-02	-.267	-.204	.101	.861 <sup>a</sup>	-.382	-6.30E-02	-6.42E-02	-1.84E-02
APP9	-.165	9.812E-03	-3.86E-02	-2.29E-02	.146	-6.06E-02	-2.99E-03	-.382	.907 <sup>a</sup>	-.151	-.170	-.166
APP10	-7.45E-02	-1.94E-02	-3.31E-02	5.564E-02	2.794E-02	-.251	-.140	-6.30E-02	-.151	.940 <sup>a</sup>	-.161	-4.16E-02
APP11	7.805E-03	-1.24E-02	3.116E-02	-9.70E-02	-2.28E-02	-3.96E-02	9.303E-04	-6.42E-02	-.170	-.161	.896 <sup>a</sup>	-.487
APP12	3.185E-02	-3.25E-02	-.137	-4.63E-02	-9.71E-02	1.477E-02	-.122	-1.84E-02	-.166	-4.16E-02	-.487	.897 <sup>a</sup>

a. Measures of Sampling Adequacy(MSA)

**Figure (VII.1): Screen Plot for the Knowledge Applicability Scale**



## Appendix (VIII): Organisational Performance Scale

**Table (VIII.1): Correlation Matrix for the Organisational Performance Scale**

Correlation Matrix <sup>a</sup>						
		PER1	PER2	PER3	PER4	PER5
Correlation	PER1	1.000	.625	.581	.569	.552
	PER2	.625	1.000	.383	.521	.291
	PER3	.581	.383	1.000	.400	.503
	PER4	.569	.521	.400	1.000	.402
	PER5	.552	.291	.503	.402	1.000
Sig. (1-tailed)	PER1		.000	.000	.000	.000
	PER2	.000		.000	.000	.000
	PER3	.000	.000		.000	.000
	PER4	.000	.000	.000		.000
	PER5	.000	.000	.000	.000	

a. Determinant = .158

**Table (VIII.2): KMO and Bartlett's for the Organisational Performance**

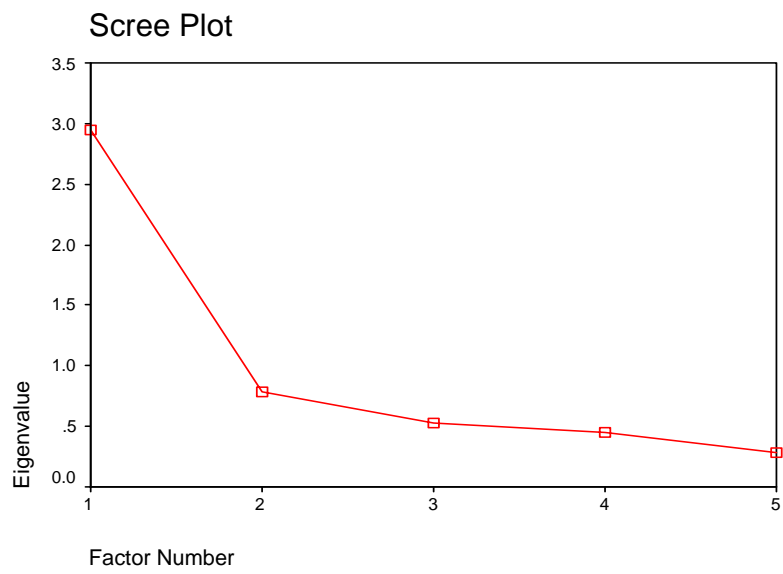
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.798
Bartlett's Test of Sphericity	Approx. Chi-Square	268.104
	df	10
	Sig.	.000

**Table (VIII.3): Anti-image Correlation of Organisational Performance Scale**

Anti-image Matrices						
		PER1	PER2	PER3	PER4	PER5
Anti-image Covariance	PER1	.390	-.204	-.148	-.111	-.158
	PER2	-.204	.560	-2.22E-02	-.157	7.527E-02
	PER3	-.148	-2.22E-02	.611	-3.67E-02	-.162
	PER4	-.111	-.157	-3.67E-02	.614	-8.27E-02
	PER5	-.158	7.527E-02	-.162	-8.27E-02	.627
Anti-image Correlation	PER1	.756 <sup>a</sup>	-.437	-.303	-.228	-.320
	PER2	-.437	.761 <sup>a</sup>	-3.80E-02	-.268	.127
	PER3	-.303	-3.80E-02	.844 <sup>a</sup>	-5.99E-02	-.262
	PER4	-.228	-.268	-5.99E-02	.863 <sup>a</sup>	-.133
	PER5	-.320	.127	-.262	-.133	.797 <sup>a</sup>

a. Measures of Sampling Adequacy(MSA)

**Figure (VIII.1): Screen Plot for the Organisational Performance Scale**



### Appendix (IX): Mann-Whitney test

	AGE	SEX	EMPYEARS	JOBS	SALARY	EDUC	THREE_TY
Mann-Whitney U	736.000	695.500	674.500	791.000	627.000	746.000	711.000
Wilcoxon W	1556.000	1515.500	1494.500	1571.000	1368.000	1607.000	1531.000
Z	-.860	-1.911	-1.437	-.087	-1.536	-.721	-1.189
Asymp. Sig. (2-tailed)	.390	.056	.151	.931	.125	.471	.235

**Appendix (X): Cook's Distance values of the predictors of Knowledge  
Availability vs. Adoption and Systemisation**

	.00765	.00186	.00241
.01909	.00002	.00713	.00031
.02690	.00063	.00020	.00016
.00476	.00167	.01711	.00081
.06060	.00000	.01711	.00646
.02756	.00000	.00001	
.03338	.00035	.00000	
.00693	.00867	.00014	
.00779	.00045	.01649	
.00829	.04164	.00021	
.00312	.00038	.00021	
.00344	.00000	.00176	
.00000	.00026	.00012	
.00283	.00019	.00552	
.00035	.00030	.00054	
.05347	.00001	.00142	
.04153	.00000	.00080	
.08040	.00000	.00164	
.08040	.00013	.01857	
.00151	.00034	.01857	
.02111	.00034	.00021	
.00128	.00718	.00033	
.01814	.00007	.00001	
.00080	.00362	.00065	
.00705	.00004	.00232	
.00227	.00047	.00913	
.00000	.00047	.00992	
.00000	.01060	.00002	
.00016	.00009	.00001	
.01588	.00002	.00607	
.00537	.00162	.00144	
.00537	.00080	.00092	
.03929	.00080	.00021	
.08542	.00221	.01023	
.01952	.00004	.00154	
.00264	.00052	.00154	
.09405	.00030	.00068	
.00717	.00076	.00265	
.00126	.00608	.00025	
.00015	.00047	.00035	
.01764	.01771	.00001	
.01764	.00175	.00016	
.00040	.00296	.00446	
.00100	.00006	.00323	
.00254	.00938	.00001	
.00630	.01449	.00595	
.00167	.01449	.00631	
.00336	.01111	.00065	
.00527	.01111	.01142	



**Appendix (XI) : Centered leverage values of the predictors of Knowledge  
Availability vs. Adoption and Systemisation**

	.00044	.00316	.01023
.09088	.04366	.01263	.00166
.03266	.00170	.01263	.00450
.01995	.02015	.00342	
.05130	.02015	.00023	
.03903	.00284	.00278	
.00576	.01642	.02779	
.08428	.01863	.00917	
.03920	.02150	.00917	
.03067	.03157	.01257	
.02901	.00576	.02901	
.02938	.01762	.01257	
.02650	.01944	.01610	
.02150	.00450	.00671	
.06461	.00166	.00184	
.09864	.00023	.02686	
.04419	.00023	.02321	
.04439	.00666	.02321	
.04439	.00954	.00213	
.00184	.00954	.00538	
.02799	.00423	.00080	
.00666	.00264	.00213	
.04947	.00184	.02479	
.00184	.03562	.01905	
.09743	.02650	.03094	
.00381	.02650	.01798	
.01747	.01234	.03012	
.01747	.03989	.00184	
.00116	.00044	.00483	
.03504	.00057	.00170	
.00251	.00184	.00342	
.00251	.00184	.01927	
.06425	.01697	.01320	
.04197	.00362	.01320	
.03623	.00278	.00880	
.08548	.00450	.00698	
.04108	.00023	.00671	
.02682	.00278	.01074	
.01678	.02229	.00166	
.01968	.03563	.00080	
.02252	.00450	.00278	
.02252	.00075	.02442	
.02015	.00166	.01665	
.01970	.02682	.05609	
.03053	.02357	.00213	
.02980	.02357	.02630	
.00778	.02193	.02593	
.03658	.02193	.02593	
.02905	.00603	.01516	
.04622	.02037	.02357	

**Appendix (XII): Cook's Distance values of the predictors of Knowledge  
Codifiability vs. Standardisation and Articulation**

	.00222	.00431	.00070
.02888	.00363	.00134	.00005
.18086	.00291	.00055	.01213
.04510	.00070	.00942	
.00038	.00070	.00032	
.00227	.00077	.02138	
.00607	.00277	.02138	
.01650	.00277	.00245	
.04077	.00012	.00000	
.00258	.00010	.00002	
.00559	.00357	.00006	
.03210	.00172	.00218	
.00198	.00172	.00036	
.00807	.00219	.00002	
.00009	.00205	.00758	
.00607	.00117	.02310	
.00206	.00291	.00069	
.00206	.00227	.05832	
.00352	.00227	.00209	
.00956	.04493	.00769	
.00037	.00357	.00540	
.00222	.00036	.00200	
.00956	.00014	.00598	
.00083	.01180	.00167	
.00057	.00205	.00167	
.00081	.00205	.	
.00172	.00000	.01312	
.00073	.00061	.00120	
.00065	.00351	.00222	
.00097	.00351	.00401	
.00881	.00205	.00626	
.00672	.00617	.01563	
.00672	.00551	.01563	
.03891	.00203	.03017	
.00860	.01918	.01220	
.00036	.00613	.00241	
.00101	.00310	.00710	
.00022	.02155	.00006	
.01479	.00541	.00036	
.00015	.00700	.01099	
.00006	.00070	.00109	
.00967	.00222	.00109	
.00010	.00022	.00301	
.00010	.00080	.00220	
.00014	.00080	.00000	
.00167	.00249	.00020	
.00167	.00014	.02324	
.00167	.00020	.00002	
.10409	.00656	.00002	
.00769	.00205	.	

**Appendix (XIII): Centered leverage values of the predictors of Knowledge  
Codifiability vs. Standardisation and Articulation**

	.00521	.00898	.02279
.05050	.02601	.01296	.00549
.05063	.00511	.03070	.03652
.04686	.00318	.02368	
.10328	.00318	.00204	
.02232	.00468	.00984	
.01276	.05326	.00984	
.02904	.05326	.00468	
.05685	.00468	.00916	
.11361	.01012	.04389	
.01276	.01709	.00521	
.07312	.01994	.00161	
.03219	.01994	.00161	
.02117	.00146	.00860	
.00318	.00042	.00655	
.01276	.01137	.03882	
.03652	.00511	.04368	
.03652	.00019	.03174	
.00695	.00019	.01425	
.02017	.02770	.01296	
.03145	.01709	.02517	
.00521	.00399	.03509	
.02017	.00184	.06359	
.03535	.04991	.00984	
.01276	.00318	.00984	
.02117	.00318		
.01994	.01696	.02544	
.01276	.00511	.03949	
.00695	.00359	.00521	
.06514	.00359	.01088	
.03063	.00318	.03362	
.02300	.01994	.01926	
.02300	.00688	.01926	
.11804	.00184	.03019	
.02608	.02196	.02232	
.00161	.00184	.00875	
.00521	.00617	.01012	
.00042	.03379	.00521	
.04550	.00095	.00399	
.01960	.01357	.00468	
.00521	.00318	.00549	
.06249	.00521	.00549	
.02353	.00042	.00184	
.02353	.05471	.00549	
.00184	.05471	.00916	
.00984	.01350	.00146	
.01096	.01463	.05675	
.01096	.00199	.00860	
.03219	.03154	.00860	
.01296	.00042		

**Appendix (XIV): Cook's Distance values of the predictors of Performance vs.  
Knowledge Management Styles**

	.00097	.00260	
	.00975	.00272	.00135
.02146	.01973	.00826	.00214
.00876	.00147	.01450	.00049
.00001	.00003	.00049	
.20990	.00003	.02499	
.01170	.00051	.00582	
.01548	.01225	.00582	
.00048	.01225	.00107	
.01125	.00064	.00089	
.01568	.00003	.00206	
.00774	.01021	.00029	
.00849	.00121	.00819	
.00355	.00121	.00043	
.00044	.00018	.00425	
.00555		.00006	
.00012	.00190	.00441	
.01716		.00000	
.01716	.00053	.00013	
.00190	.00053	.00097	
.00202	.01268	.00092	
.01185		.01685	
.00025	.01283	.01128	
.00099	.00007	.05902	
.01191	.00002	.00136	
.00076	.00107	.00136	
.01098	.00107		
.00123	.00282	.00112	
.00121	.00064	.01537	
.00177	.00003	.00013	
.00015	.00003	.00206	
.00859	.00089	.02816	
.00348	.00019	.00013	
.00348	.02647	.00013	
.11349	.00317	.01032	
.00007	.00227	.00046	
.00126	.00002	.00154	
.00431	.00461	.01106	
.00004	.00219	.00207	
.00035	.00394	.02731	
.00210	.00136	.00629	
.00052	.00038	.01084	
.00466	.00066	.01084	
.01458	.00001	.00179	
.01458	.01360	.00075	
.00000	.01360	.01360	
.00390	.00032	.00601	
.00545	.00042	.00135	
.00545	.01005	.00173	
.12220	.00545	.00173	

**Appendix (XV): Centered leverage values of the predictors of  
Performance vs. Knowledge Management Styles**

	.01690	.00655	
	.00646	.01173	.06790
.09700	.03879	.01740	.01364
.07875	.01023	.03189	.03708
.06372	.01160	.04913	
.13081	.01160	.03392	
.06588	.00511	.02397	
.06715	.05409	.02397	
.04096	.05409	.00843	
.09972	.00703	.01121	
.12181	.01241	.04780	
.04151	.02059	.00657	
.16007	.02381	.00488	
.06536	.02381	.00488	
.03969	.00343	.02489	
.03728	.00142	.02553	
.03759	.01324	.04196	
.05428	.02387	.04809	
.05428	.00294	.03200	
.01878	.00294	.02514	
.03553	.02937	.01413	
.08526	.02364	.02844	
.01298	.00718	.05233	
.04283	.00795	.11359	
.04760	.05272	.02121	
.01552	.02778	.02121	
.02326	.02778		
.02768	.01831	.03654	
.02777	.00796	.06459	
.01223	.00378	.00568	
.07650	.00378	.01265	
.03161	.00399	.05097	
.02446	.02006	.02716	
.02446	.03726	.02716	
.16163	.01888	.06083	
.03082	.04870	.05510	
.00413	.00219	.01270	
.00561	.01125	.01119	
.04192	.03440	.01660	
.05148	.00600	.03109	
.02793	.02473	.02009	
.03054	.00358	.01365	
.08195	.00568	.01365	
.04509	.00417	.01510	
.04509	.05894	.01420	
.00321	.05894	.02907	
.01237	.02828	.03536	
.03176	.08642	.08143	
.03176	.00608	.05031	
.04079	.04150	.05031	

## Appendix (XVI): Significant Relationships in Regression Models

