School of Information Systems
Curtin Business School

Organisational Factors Enhancing the Use of Information Technology for Knowledge Management: A Study of Malaysian Listed Organisations

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This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University of Technology

November 2010

Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature:…………………………..

Date:………………………………..

Acknowledgement

I would like to express my thanks to the Most Gracious and Most Merciful God for blessing me with the wisdom, the health, the strength, and the patience throughout this PhD journey.

I wish to express my profound appreciation to my supervisor, Dr. Ashley Aitken, and my co-supervisor, Associate Professor John Venable, for their contributions through their insightful suggestions and guidance in this research. Their patience and professionalism inspired me to complete the thesis.

My sincere gratitude goes to the Public Service of Malaysia, the Ministry of Higher Education Malaysia, and the University of Malaya for giving me this opportunity and financially supporting my doctoral study. Thank you for your trust and confidence in me.

I am particularly indebted to all interviewees and respondents for their willingness to share their time, knowledge, and experience. Their generosity and honesty is greatly appreciated.

My special thanks to the people who once offered some help and concern to my study: Mr. Carl Jacob, Professor Mohammed Quaddus, and Ms. Jenny Lalor.

My warmest thanks to all my friends for their encouragements. Special thanks go to the research students in the Technology Park research facility for sharing their knowledge and offering their help and words of cheer. These will be remembered in my heart.

I am also particularly indebted to my parents, my parents-in-law, my sisters and brothers and to my entire families who always offered support and love.

Foremost, I am very grateful to my loving husband and my two sons. Without their love, understanding, sacrifice, patience, support, and confidence, I would never have achieved this goal.

Abstract

Managing knowledge appears to be key in improving organisations' competencies in the face of global competition. In the case of Malaysian organisations, extant studies revealed a disparity between perceived importance of information technology (IT) and its actual utilisation to support knowledge management (KM). In order to achieve a knowledge-based economy, Malaysian organisations need to embrace the use of IT to support their KM initiatives to ensure that knowledge is diffused and applied in the best possible way to support further innovation and drive economic growth. Hence, the acceptance and use of IT in Malaysian KM is of paramount concern.

This research addressed this issue by examining IT utilisation by Malaysian organisations to support KM. Research has shown that failures in deploying IT-based systems to support KM are in part attributed to the inadequate attention to other factors, such as structures, processes, and culture of an organisation. Thus, the main objective of this study was to understand the key organisational factors enhancing the use of IT to support KM in the Malaysian listed organisations. Furthermore, most of the studies on IT use for KM were conducted in the Western context. The current research was conducted in the Malaysian context, using a model that accounted for key variables, the relevancy and appropriateness of such in the particular context being verified in the preliminary investigation phase of the research.

The technology acceptance model (TAM) provides the theoretical framework for this study's investigation. In addition to the two major constructs of perceived usefulness and perceived ease of use in TAM, six variables of organisational factors, garnered from a review of relevant literature and validated by a series of interviews in Malaysian listed organisations—including management support and commitment, knowledge sharing culture, rewards and incentives, knowledge classification, and policies and procedures of using IT for KM—were incorporated in the research model proposed for this study. Based on the findings from the preliminary investigation phase, another organisational factor was identified, namely, having appropriate KM processes to manage knowledge in an organisation, and thus was added to the refined research model. A survey was conducted among

830 IT and KM managers from the Malaysian listed organisations to collect quantitative data. The data collected were analysed using the structural equation modelling (SEM) approach with partial least squares (PLS) technique to test the hypotheses developed and assess the research model.

The major findings of this research have confirmed the influence of KM processes, knowledge classification, knowledge sharing culture, and perceived benefits of using IT for KM as the major determinants of IT use to support KM in the organisations studied. However, the positive effects of rewards and incentives, policies and procedures of using IT for KM, and perceived ease of use, on the extent of IT use for KM were not detected. Furthermore, the results demonstrated the effect of management support and commitment on the use of IT for KM was only indirect through its mediation on knowledge classification and knowledge sharing culture. The results also suggested that the research model explained almost two-thirds (65.6%) of the variance in IT use for KM.

This research provides significant and original contributions to the existing knowledge in the acceptance and use of IT to support KM area. The unique theoretical contributions of this study include the demonstration of an extension of the TAM to investigate the influence of organisational factors on the extent of IT use to support KM, in particular, in the context of Malaysian organisations. The results of the study have important practical and theoretical implications for employers, governments, information system professionals and information system researchers. Most importantly, an understanding of the organisational factors enhancing the extent of IT use for KM provides guidelines for the Malaysian organisations in developing better KM and IT strategies in order to promote and encourage the use of IT to support the organisations' KM initiatives.

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Thesis-Related Publications

Refereed Conference Papers:

Aman, F., and A. Aitken. 2010. Information technology for knowledge management in Malaysia: The effects of organisational factors. In *5th International Conference on Knowledge Management, 25-27 May 2010*. Kuala Terengganu, Malaysia.

Aman, F., and A. Aitken. 2009. Organisational factors for information technology implementation in knowledge management: A Malaysian perspective. In *The 14th Asia Pacific Management Conference, 19-20 November 2009*. Surabaya, Indonesia.

Aman, F., and A. Aitken. 2009. Organisational elements influencing effective use of information technology to support knowledge management. In *Curtin Business School (CBS) Doctoral Colloquium 2009, 1-2 October 2009*. Perth, Australia.

Refereed Journal Paper:

Aman, F., and A. Aitken. 2010. Factors influencing IT adoption for KM in Malaysia. *Industrial Management & Data Systems* (under review).

CHAPTER 1: INTRODUCTION

1.1 OVERVIEW

Realising that sustained economic growth and competitiveness can only come from greater application and utilisation of knowledge, developing countries such as Malaysia are seeking rapid development of their information technology (IT)-based environment. The establishment of the Multimedia Super Corridor (MSC) and the National Information Technology Agenda (NITA) in 1996 were among the first initiatives towards developing a knowledge-based economy for Malaysia (Wee 2001b). The MSC project was initiated in 1996 as part of Malaysia's long term vision to become a fully-developed nation and knowledge-rich society. When the MSC was first announced in 1995, it was estimated that the government would spend RM28 billion (approximately USD9 billion) to develop the infrastructure and facilities required to attract international high technology companies (Mustapha and Abdullah 2004). In 2003, the Malaysian government also launched the Second Science and Technology Policy (STEP2) to further strengthen the development of science and technology by stimulating greater technological development and promoting a more innovation-led economic growth (Economic Planning Unit 2005).

Further, to enhance private sector involvement and commitments in research and development (R&D) activities, three grant schemes were established under the Ministry of Science, Technology and Innovation (MOSTI). The schemes are the Industry Research and Development Grant Scheme, the Multimedia Super Corridor Research and Development Grant Scheme, and the Demonstrator Application Grant Scheme (Economic Planning Unit 2005). These efforts are consistent with the country's aims to achieve sustainable rapid growth and remain globally competitive in order to address the increasing globalisation of demand and the utilisation of IT as a competitive weapon.

However, the recent Tenth Malaysia Plan (Economic Planning Unit 2010b) has reported that the national innovation agenda, part of the knowledge-based economy initiatives, has not achieved the desired level of progress. A declining capacity of knowledge generation organisations was also reported, which is denoted by the decrease in the number of researchers from 21.3 per 10,000 of the labour force in 2004 to 20.3 per 10,000 of the labour force in 2008. Similarly, the gross expenditure on R&D has also dropped from 0.69% of Gross Domestic Products (GDP) in 2004 to 0.21% of GDP in 2008. Thus, in order to drive the knowledge-based economy initiatives, studies on the acceptance and use of technology to strengthen Malaysia's innovation system is essential in providing guidance on a series of actions that the government and organisations may take into consideration.

This chapter introduces the study by providing background information relating to the need for organisations to manage their knowledge, and how IT plays an important role in supporting the management of knowledge. This background information is provided in the second section of this chapter. The third section of this chapter discusses the importance of managing knowledge in the Malaysian organisations and highlights the lack of the use of IT to support effective knowledge management (KM) in these organisations, which leads to the identification of the research problem of the study. This is followed by a section that explains the need for the study by highlighting the areas that need to be addressed, which include the proliferation of IT use to manage knowledge in the Malaysian organisations. Next, the research major and minor questions for the study are formulated, followed by a discussion of the philosophical assumptions that guide this research. This is followed by a section that discusses the theoretical framework that provides the foundation for the study's investigation. Next, the research methodology employed to answer the research question identified is briefly described and the hypotheses to be tested in the study are presented. This is followed by a discussion of the significance of the study, which encompasses both the theoretical and practical contributions made by the study. The definitions of the key terms used in the study are also explained, and, lastly, the delimitations of scope and key assumptions of the study are stated and the structure of this thesis is outlined.

Figure 1-1 provides an overview of the sections presented in this chapter.

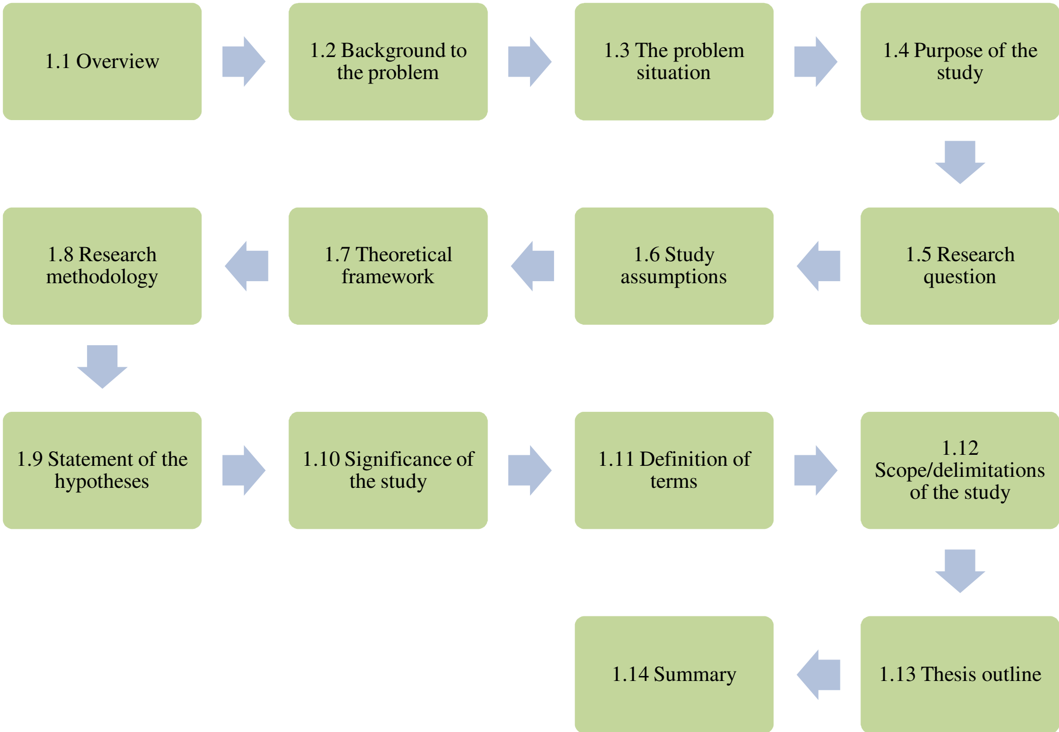


Figure 1-1 Overview of the sections in Chapter 1

1.2 BACKGROUND TO THE PROBLEM

The emergence of the globalised economy has motivated organisations to treat knowledge as a significant organisational resource and a valuable strategic asset that can help them achieve sustainable advantage over their competitors. In order to remain competitive, organisations must efficiently and effectively locate, capture, share, and apply knowledge to solve problems and create opportunities. Knowledge in the organisational context includes both the experiences and understanding of the people in the organisation, as well as the knowledge artefacts, such as solutions to problems, design rules, best practices, and lessons learned that are available within and outside of the organisation (Marwick 2001).

Given the strategic significance of knowledge, how to manage organisational knowledge for achieving sustainable competitive advantage has become a critical strategic issue (Grant 1996a, 1996b; Nonaka 1994). Hence, the challenge for organisations is how to generate and leverage collective knowledge in order to create value that could lead to their competitive advantages (Tomas and Hult 2003; Zhang 2007). Consequently, this challenge translates to the need for effective KM.

KM is defined broadly as the process, and/or efforts, of systematically acquiring, organising, distributing, and applying knowledge to achieve strategic aims of an organisation (Alavi and Leidner 1999a; Marwick 2001). The fundamental objectives of KM are to avoid reinventing the wheel, protect against valuable knowledge loss, and leverage collective organisational knowledge for more informed decision making (Kankanhalli and Tan 2004). Realising that KM is the only strategy for an institution to succeed in a knowledge-based economy, many organisations have implemented KM initiatives in order to leverage this resource for their competitive advantages (Alavi 2000; Al-Busaidi and Olfman 2005). For instance, many organisations have been devising ways to tap into and manage the knowledge possessed by their employees in order to produce quality services and products that meet customers' increasingly sophisticated demands (Tan 2004).

KM is of particular importance to information systems (IS) research since the functionalities of IT play a critical role in organisations' capability to effectively manage knowledge. As described by Prieto and Easterby-Smith (2006), it was in the mid-1990s that organisations began to become very interested in the nature of knowledge, which was partly attributed to the advances in IT that offered the capability of managing knowledge as a corporate resource. The rapid development in IT provides the exceptional capacity for organisations to disseminate knowledge between individuals and across teams and organisations. Regardless of the type of KM strategy adopted by an organisation, IT can play an important role in the organisation's ability to create new knowledge and apply existing knowledge effectively (Alavi and Leidner 2001; Sher and Lee 2004) and, thus, more organisations are using IT as strategic enablers of their formal KM initiatives (Alavi, Kayworth, and Leidner 2006).

IT is defined as 'a generic term for the convergence of computers, hardware, software, telecommunications, Internet, electronics and the resulting technologies' (Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez 2006, p. 17). In the context of KM, IT is perceived as a knowledge platform (Tiwana 2002), or the infrastructure to KM (Chou 2003). IT is identified as a major determinant of KM success by numerous IS researchers (Gold, Malhotra, and Segars 2001; Khandelwal and Gottschalk 2003; Kulkarni, Ravindran, and Freeze 2007; Purvis, Sambamurthy, and Zmud 2001; Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez 2006) and is recognised as both a key contributor and an enabler to the field of KM that brings strategic benefits (Davenport and Prusak 1998; Gold, Malhotra, and Segars 2001; Lee and Choi 2003). For example, IT enables KM to maximise the return on organisational knowledge by supporting the continuous creation, accumulation and sharing of knowledge, which in turn enables organisation to implement new business strategies and build new products and services faster (Lesser and Prusak 2001; Sher and Lee 2004).

Given that advances in IT have made it easier to acquire, store, and disseminate knowledge, many organisations are employing IT to facilitate their KM initiatives and achieve their KM objectives (Kankanhalli et al. 2003). For example, IT-based systems such as groupware, email, intranet, knowledge repositories, workflow software, and decision support systems are employed to allow organisations to deliver products and services that are higher in quality, which consequently enhances their competitive advantages and profits (Holsapple and Joshi 2002; Lynn, Reilly, and Akgun 2000; Sher and Lee 2004). Other common IT-based systems to support KM include organisation-wide intranets and extranets, search and retrieval systems, content management and collaboration software, data warehousing and mining software, groupware, and artificial intelligence software, such as expert systems (Kankanhalli and Tan 2004).

The use of IT in KM, however, has had mixed results, with some KM initiatives being more successful than others (Davenport, De Long, and Beers 1998). Markus, Majchrzak, and Gasser (2002) emphasise the need for a clearer understanding of how IT-based systems support knowledge work, as there are still issues and concerns inhibiting the effective use of IT in KM. Similarly, Khandewal and Gottschalk (2003) indicate that a small amount of empirical research has been conducted on IT support for KM and, thus, highlight the need for more studies in this area.

In relation to the factors that inhibit effective use of IT in KM, McDermott (2000) highlights that the high number of failures in implementing IT-enabled systems to support KM can be explained by the inadequate attention to human and organisational issues. Expressing a similar view, Hardy and Connect (2008) claim that the failure of IT to support KM can be attributed to the fact that IT-based systems have yet to develop as human-oriented communication tools, which can produce measurable benefits for KM. This limitation of IT has caused organisations to struggle with using IT effectively for KM.

Considering that KM is a multidisciplinary concept that incorporates organisational learning, organisational behaviour, organisational strategy, and sociology, research suggests that organisations should look beyond the deployment of IT and take into account other organisational factors, such as structures, processes, and incentives that can work together in shaping the effective use of IT for KM (Kulkarni, Ravindran, and Freeze 2007; Sambamurthy and Subramani 2005). Thus, a more holistic approach that aims for a balance between IT and human-oriented factors should be considered in the implementation of IT for KM.

The next section briefly discusses the problem situation identified in the study.

1.3 THE PROBLEM SITUATION

Based on the discussion in the previous section, KM is undoubtedly a crucial activity that needs to be effectively employed by organisations the world over. In Malaysia, there is an increasing awareness that knowledge resources are essential to the development of Malaysian organisations, and that KM is a valuable strategic tool that helps the management in these organisations to make useful decisions mainly for the formulation of new and alternative strategies (Salleh, Richardson, and Narayanan 2003). In addition, KM is identified as a key factor in achieving organisational success with many studies of Malaysian KM highlighting the importance and benefits of KM to local organisations (Bontis, Keow, and Richardson 2000; Hegde and Shapira 2007; Helmi 2002; Gan, Ryan, and Gururajan 2006; Rahman 2004). These studies argue that it is very important for Malaysian organisations to manage knowledge effectively to maximise performance and accelerate growth, in order to address the lag of product development and innovation across the nation.

Among the identified important factors, perhaps the most critical reason to effectively manage knowledge in Malaysian organisations, is the apparent need to develop new areas of growth in knowledge-intensive areas in line with the nation's shift to a knowledge-based economy (Gan, Ryan, and Gururajan 2006; Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004). Malaysia's K-economy Master Plan has defined K-economy as an economy in which the generation and exploitation of knowledge, such as creativity and innovation, play the predominant role in generating and sustaining economic growth (ISIS 2002). In a knowledge-based economy, importance must be placed on the generation and exploitation of knowledge to create new value in the economy (Ahmed 2006). The development of a knowledge-based economy is crucial for the country to sustain rapid economic growth and increase its international competitiveness. Moreover, it will not be sufficient to generate future growth for the Malaysian economy if the country continues to rely on a production-based economy that is mainly composed of manufactured goods and export of traditional commodities (Gan, Ryan, and Gururajan 2006; Wee 2001b).

The changes that affect the business environment, such as globalisation, transformation of a production-based economy into a knowledge-based economy, and the trend for international organisations to be more IT savvy have brought new challenges to Malaysian organisations. Consequently, it has become imperative for Malaysian organisations to enhance their use of IT in order to reap and sustain competitive advantage from KM (Zailani, Ong, and Shahnon 2006). In addition, Ahmed (2006), in his study of information and communication technologies (ICT) and the human capital role in achieving a knowledge-based economy in Malaysia, indicates that achieving a knowledge-based economy through the use of IT, in terms of geometric progression, is faster than achieving it through human capital or skilled labour. For example, an organisation would arguably attain a higher innovative capability when IT is utilised to enable knowledge to be dispersed more easily and leveraged within the organisation (Ahmed 2006).

Furthermore, the literature on Malaysian KM also identifies certain issues that could potentially be resolved by the augmentation of IT usage in the local organisations' KM. For instance, Malaysian organisations have been focusing on a human-oriented KM strategy that may prove to be unsustainable in the long term if it is not backed-up by the use of IT to codify and preserve tacit knowledge into an explicit form (Tan

2004). The transformation of a human-oriented KM strategy to one that focuses more on codification and preservation of knowledge through the use of IT, is also crucial to overcome the challenges of retaining talented employees, the loss of whom leads to knowledge loss, faced by many Malaysian organisations (Salleh, Richardson, and Narayanan 2003).

In relation to the use of IT in KM, a study by Syed-Ikhsan and Rowland (2004) indicates that Malaysian organisations generally perceive IT as an important element in their organisations' KM. In a similar vein, Tan (2004) reported that Malaysian managers perceive KM as mandatory for the success of their organisations, and that managing the use of IT for KM is critical for a successful KM. However, a number of studies indicate a considerable disparity between the perceived importance of IT tools and the actual utilisation of these tools to support KM activities in Malaysian organisations (Ahmed 2006; Salleh and Ahmad 2006). To further substantiate this piece of information, empirical evidence has shown that although IT was rated as the most important enabler for KM in Malaysian organisations, the actual adoption and utilisation of IT to support KM in this country were still low, and, consequently, did not reflect the perceived importance of IT as an enabler of KM (Chong, Chong, and Wong 2007).

Thus, based on the preceding discussion of the use of IT in the Malaysian organisations' KM, the following research problem was identified in this study:

Research Problem: 'The low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations'

In this thesis, the terms 'IT adoption' and 'IT use' are used interchangeably to describe the implementation stage in which IT components are already deployed in an organisation, as opposed to the deployment stage in which they are being introduced. Based on the research problem identified, the purpose of this study is further described in the following section.

1.4 PURPOSE OF THE STUDY

Despite the availability of some research on Malaysian KM in the past few years, none has specifically looked at the use of IT or, more specifically, IT-based systems, to support KM in Malaysian organisations. The need to address this gap in the literature is especially crucial as numerous extant studies indicate that IT is considered to be an important enabler to Malaysian KM initiatives (Ahmed 2006; Chong, Chong, and Wong 2007; Syed-Ikhsan and Rowland 2004). Moreover, the discussion in the previous section has demonstrated the need to enhance the utilisation of IT to support KM in Malaysian organisations, as the disparity between the level of perceived importance of IT for KM and the extent of actual IT use for KM in these organisations needs to be addressed. Motivated by these concerns, and acknowledging that effective deployment of IT for KM requires a comprehensive approach that incorporates technical and socio-cultural factors, this study, thus, aims to investigate the organisational factors that could enhance the level of IT use for KM in Malaysian organisations.

In particular, this study will be looking at the adoption of IT for KM in Malaysian publicly listed organisations (Bursa 2008). This is driven by the fact that prior studies of Malaysian KM have targeted specific industries in isolation (Chong, Chong, and Wong 2007; Gan, Ryan, and Gururajan 2006; Kumar 2003; Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004; Tat and Hase 2007; Wei, Choy, and Yeow 2006; Wong and Elaine 2005; Zailani, Ong, and Shahnon 2006; Zoo and Aziz 2006). Thus, it is considered that a study of Malaysian KM in a more general context, which is across the sectors, would be useful. Consequently, Malaysian listed organisations are chosen as the subjects of this study as they cover a wide range of industries and are generally large companies and thus, have typically invested in IT infrastructure to support their operations. The next section specifies the research question formulated to address the research problem identified in the previous section.

1.5 RESEARCH QUESTION

Based on the need to understand the organisational factors that could enhance the use of IT for KM in Malaysian organisations as acknowledged in the previous section, the major research question for this study is formulated as follows:

Research Question: 'What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?'

The major research question leads to the development of two minor questions in order to provide a focus for this study's investigation:

- Research minor question 1: what are the organisational factors that enhance the use of IT to support KM?
- Research minor question 2: how do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?

Thus, the research major and minor questions corresponding to the research problem were identified in this section. These questions will serve as the basis for data collection and analysis to address the research problem. The next section presents the theoretical framework that serves as a foundation for the investigation of this study.

1.6 THEORETICAL FRAMEWORK

The technology acceptance model (TAM) was originally conceived by Fred Davis in 1986, based on Fishbein and Ajzen's (1975) theory of reasoned action (TRA) (Davis 1986). TAM suggests that the perceived usefulness of IT and perceived ease of use are major determinants that affect an individual's attitude and intention to use IT. In addition, perceived ease of use is also suggested to have an impact on perceived usefulness. TAM is used as the theoretical basis for this study as the model has been specifically applied to IT-based systems for KM adoption, in information systems research (Kuo and Lee 2009; Money and Turner 2005; Quaddus and Xu 2005; Vitari et al. 2007; Wu and Li 2007).

In the process of selecting an appropriate technology acceptance model for this study, another model that was also considered was the Unified Theory of Acceptance and Use of Technology (UTAUT), which was developed by a group of researcher in 2003 (Venkatesh et al. 2003). Although this more recent model represents a more comprehensive and rigorous development of a model of technology acceptance (Venkatesh et al. 2003), TAM was largely regarded to be a sufficient and comprehensive model that could serve the purpose of providing the basic framework for the current study. As the research objective was to investigate the organisational factors influencing the use of IT for KM, it was decided that the augmentation of a number of organisational factors into TAM should provide the basic and sufficient framework as a foundation for this research investigation. A more detailed discussion that provides the justifications as to why UTAUT was not chosen as a more appropriate model for this research is provided in section 3.5 of Chapter 3 (Research Problem and Framework) of this thesis.

The application of TAM in KM systems' user acceptance has revealed that the relationship between an individual's intention to use and systems' usage was low when the individual has been introduced to the systems for a substantial period of time (Money and Turner 2005). Thus, as this study investigates the use of IT-based systems for KM that are already being implemented in an organisation, it is proposed that the TAM constructs relevant to this study are perceived usefulness, or benefits, of using IT for KM and perceived ease of use of IT for KM, which will determine the adoption or use of IT-based systems to support KM in Malaysian organisations. Perceived usefulness is defined as an individual's subjective assessment on 'the degree to which using a particular system would enhance his or her job performance', whereas perceived ease of use is defined as 'the degree to which a person believes that using a particular system would be free of effort' (Davis 1989, p. 320). The justification of adapting the TAM in this study's investigation is discussed further in Chapter 3 of this thesis (Research Problem and Framework).

In order to provide a more comprehensive model of IT use for KM, the research model proposed in this study extends TAM by incorporating the organisational factors that could enhance the extent of IT use for KM, either directly or indirectly through perceived usefulness, or benefits, and perceived ease of using IT for KM. Extant studies on the use of IT for KM, which include the studies of acceptance of IT-based systems to support KM, are reviewed in order to identify the organisational factors that could enhance the extent of IT use for KM in an organisation. Most of the studies reviewed have provided a list of factors impacting the use of IT for KM, based on theoretical or empirical support. Some of the factors were found to have similar meaning, and hence were grouped as one. In general, the organisational factors identified can be grouped into five dimensions: i) management support and commitment, ii) a knowledge sharing culture, iii) rewards and incentives mechanism for sharing knowledge, iv) having a knowledge classification system, and v) institutionalisation of IT use for KM into normal work practice.

A series of preliminary interviews in Malaysian listed organisations were conducted to investigate the relevancy of the identified organisational factors in their use of IT to support their KM initiatives. Further, findings from the interviews indicate another factor that is believed to enhance the use of IT for KM in these organisations, which is having the appropriate KM processes to manage knowledge in an organisation. Thus, this factor is also included in the proposed research model. Figure 1-2 displays the conceptual research model of this study, whereas a more detail research model (with hypothesised relationships between variables) is presented in Chapter 3 of this thesis (Research Problem and Framework).

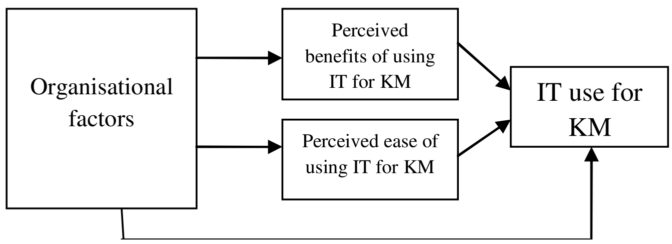


Figure 1-2 The conceptual model for the study

Although the dimensions identified may not seem to be exhaustive of all the organisational factors mentioned in the literature, the ones identified are considered to be the most important based on the numbers of citations made in the literature, as well as their ratings, based on their importance, made by the respondents in the preliminary interviews conducted in a number of Malaysian listed organisations. Thus, it was decided that the set of organisational factors identified provides a fundamental foundation to support primary research in the area of IT use for KM in Malaysia.

The next section briefly discusses the research approach adopted to address the research problem identified in the study.

1.7 RESEARCH METHODOLOGY

The selection of the research approach was guided by the positivist research paradigm adopted for this study and influenced by the research problem identified. The quantitative research approach within the positivist research paradigm is appropriate for research problems that call for the identification of factors that influence an outcome, identification of best predictors of outcomes, or for testing existing theories (Creswell 2008). Thus, the quantitative research approach is considered appropriate for this study, which aims to test the influence of the organisational factors, derived from extant relevant literature, on the extent of IT adoption, or use, to support KM in Malaysian listed organisations.

In addition, the conditions described by Yin (1994) were also considered in determining the research methodology for this study. The survey methodology, which mainly falls under the quantitative research approach, emerged as a suitable methodology for this study as it focuses on contemporary events, does not require control of behavioural events, and addresses the type of research questions that focus on the 'what' questions. Hence, the survey methodology was used to collect data to empirically test the relationships implied by the research model and hypotheses developed in this study.

The survey methodology designed to collect data required for this study was comprised of a number of phases that include: i) preliminary interviews to investigate the relevancy of the research model's constructs in the Malaysian context and factors that could constitute the constructs' dimensions, ii) development of measurements of the constructs based on existing instruments and from preliminary interview findings, iii) validity and reliability testing of the instrument in a pilot study of the survey, and iv) administration of the finalised survey instrument. The finalised survey questionnaire was administered using a web-based online survey to the target population of this study, which was comprised of IT and KM managers in Malaysian listed organisations.

In the analysis phase, data collected from the survey were statistically analysed to understand and interpret the results obtained for this study. The structural equation modelling (SEM) approach with partial least squares (PLS) technique was used for the quantitative data analysis and graphical presentation of the results. There are two parts in the SEM data analysis approach, namely the measurement and structural model analyses. The measurement model was evaluated for individual item reliability, internal consistency, and discriminant validity. The structural model was analysed to obtain the standardised path loadings between constructs, the significance of path loadings, the R^2 values of the dependent constructs and the results of hypotheses testing.

Several measures were also taken to address the validity and reliability concerns of this study's research design so that the research instrument used in the study would accurately and consistently measure the constructs investigated in this study (Hair et al. 2003). Ethical considerations for this study were also addressed based on the five areas of research ethics, which are avoidance of harm, informed consent, voluntary participation, intent of the study, and privacy invasion (Cavana, Delahaye, and Sekeran 2001; Singleton, Straits, and Straits 1999). Ethics approval was also obtained from Curtin University of Technology prior to collecting data for this study. Details of the research approach adopted in the study are further discussed in Chapter 4 of this thesis (Research Methodology and Design).

The below sub-section provides a brief overview of the philosophy that guided the research methodology utilised in this study.

1.7.1 Study assumptions—Philosophy behind research

The research paradigm adopted for this study was the positivist research paradigm. It provided the philosophical assumptions in the design of the research. Positivism is the default paradigm for most scientific research that assumes a one true reality that can be discovered by means of rigorous, mostly quantitative and empirical, study (Corbetta 2003; Creswell 2008; Guba and Lincoln 1994).

The key philosophical assumptions of positivism research are (Creswell 2008):

i. a deterministic philosophy in which causes determine outcomes;

ii. a reductionistic philosophy that narrows and focuses on the relationships between selected variables to be investigated;

iii. knowledge that is developed is based on empirical observation and measurement of the objective reality; and

iv. theories are tested, verified, and refined in order to understand a phenomenon.

In line with the deductive approach in the positivist research paradigm, this study is designed to test the hypothesised relationships between the variables identified, which are developed by applying logical reasoning from the findings of prior studies and also by linking them to a theory of technology acceptance. Other characteristics of this study that are inherent from the positivist research paradigm include that the researcher in this study observes the problem domain of Malaysian listed organisations as a spectator and remains neutral throughout the study (Creswell 2008); and that data is obtained from a sample, from which the findings are generalised to a population (Shanks, Arnott, and Rouse 1993). Finally, the positivist research paradigm is considered to be appropriate since it is predicated on explaining and predicting phenomena (Neuman 2003) and, thus, has the ability to help explain the real world phenomenon of the use of IT for KM in the organisations studied in this research.

The research paradigm that provides the philosophical assumptions for the study is discussed in more detail in Chapter 4 of this thesis (Research Methodology and Design). The next section presents the hypotheses developed in relation to the research question formulated in the study.

1.8 STATEMENT OF HYPOTHESES

Hypotheses between the constructs identified in this study were developed based on the underlying theoretical model (TAM) that is used in this study, and a review of relevant literature and findings from the preliminary interviews. The following hypotheses are proposed in this study:

Hypothesis 1: Perceived benefits of using IT for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 2a: Perceived ease of use of IT to support KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 2b: Perceived ease of use of IT to support KM has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations.

Hypothesis 3a: Management support and commitment has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 3b: Management support and commitment has a positive influence on the knowledge sharing culture in Malaysian listed organisations.

Hypothesis 3c: Management support and commitment has a positive influence on the extent of knowledge classification in Malaysian listed organisations.

Hypothesis 4: Rewards and incentives has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 5: Knowledge sharing culture has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 6a: Having a knowledge classification system has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 6b: Having a knowledge classification system has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations.

Hypothesis 7a: The policies and procedures for IT use for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 7b: The policies and procedures for IT use for KM has a positive influence on the perceived ease of using IT for KM in Malaysian listed organisations.

Hypothesis 8: Having appropriate KM processes has a positive influence on the level of IT use for KM in Malaysian listed organisations.

The development of the above hypotheses is discussed in detail in Chapter 3 (Research Problem and Framework) and Chapter 4 (Research Methodology and Design), whereas the results of the hypotheses testings are presented in Chapter 5 (Data Analysis and Results).

The following section outlines the significance of the study in terms of its contribution to both research and practice.

1.9 SIGNIFICANCE OF THE STUDY

By investigating the organisational factors that enhance the level of IT use for KM in Malaysian listed organisations, this study adds to the existing body of literature in KM, in particular Malaysian KM, as well as contributes to both business and IT practitioners, particularly in Malaysian listed organisations. The significance of this study in terms of its contribution to research and practice is outlined in the sub-sections below:

1.9.1 Contribution to research

The outcome of this research is expected to add to the existing body of knowledge relating to the use of IT to support KM. This study makes five major contributions as well as a number of minor contributions to research.

Extending the use of TAM to investigate IT adoption for KM. The original theoretical contributions of this study include its demonstration of the applicability of TAM in the IT for KM domain by following on from the work of previous researchers. In line with the recent works of KM systems' acceptance (Kuo and Lee 2009; Money and Turner 2005; Ong et al. 2005; Wu and Li 2007; Xu and Quaddus 2007; Vitari et al. 2007), this study extends the applicability of TAM in explaining the adoption or use of IT to support KM. In particular, the applicability of TAM is extended in the domain of Malaysian organisations. This study extends the number of constructs in TAM by incorporating other organisational factors, identified from literature review and preliminary investigation phase, as external variables that directly and indirectly influence the adoption of IT use for KM through the mediation of the two primary TAM constructs of perceived usefulness and perceived ease of use.

Demonstrating the application of TAM within the Malaysian context. There is a possibility that the theoretical basis for adoption of IT formulated in a Western country's context might not work equally as well in its entirety within a non-Western country's context. Arguably, users from a different region, culture, infrastructure, and economic status may demonstrate differences in technology assessment and this therefore affects their decision to use IT. Thus, the next theoretical contribution of this study is the demonstration of the application of TAM within a non-Western country's context, and is possibly the first to demonstrate its application in the investigation of IT use for KM within a Malaysian context.

Responding to prior suggestion of focussing beyond the deployment of IT for KM. Another theoretical contribution of this research is it provided a response to the suggestion of prior KM research that focus should be placed beyond the deployment of IT by taking into account other factors, such as structures, processes, and culture within an organisation that can shape an effective use of IT for KM success (Kulkarni, Ravindran, and Freeze 2007). This research responded to this suggestion by extending the TAM, while retaining its parsimony and technology use focus, with the inclusion of a number of organisational factors that could enhance the use of IT for KM identified from the relevant literature and preliminary interviews conducted in the Malaysian listed organisations.

Addressing the scarcity of IT use for KM research in Malaysia. The review of the literature indicates that there has been limited study of IT adoption or use for KM in Malaysian organisations. Specifically, there is a lack of study of the factors that could enhance the use of IT to support KM in these organisations. While the studies of IT for KM or KM systems literature tend to draw from the experience in developed countries, the use of IT for KM in developing countries, such as Malaysia, has received little attention in the literature.

Furthermore, despite the evident benefits offered by IT capabilities in KM, Malaysian listed organisations have not fully utilised these capabilities to support their KM, which had raised doubt in the success of these organisations in achieving effective KM. Thus, this research, motivated by the gap between the perceived importance of implementing IT for KM and the actual utilisation of IT for KM in Malaysian organisations, fills this research gap by highlighting the issues on the enhancement of IT use for KM in Malaysia and empirically establishing the organisational factors impacting the level of IT use for KM.

Developing new scales for organisational factors' constructs. Lastly, this study contributes to filling the knowledge gap by developing scales for testing the research model. Although most of the measuring items in the survey instrument used in this study were adapted from prior research of KM systems, rewording of items within variables was required to suit the use of the IT for KM study. In particular, new scales were developed to measure these constructs: management support and commitment; knowledge classification; and policies and procedures in the context of IT use for KM. Thus, this survey instrument could be used and adapted by other similar studies.

In addition to the major contributions discussed above, this study also has minor contributions for research which include:

i. identification of the organisational factors that could enhance the level of IT use for KM through a synthesis of previous studies of IT use for KM;

ii. identification of additional organisational factors that could enhance the level of IT use for KM through a series of interviews in Malaysian listed organisations; and

iii. identification of an appropriate research methodology for this study through a compilation and analysis of the research methodologies adopted by previous similar studies.

1.9.2 Contribution to practice

This sub-section outlines the study's contribution to practice. The contribution stems from three sources of insight found concerning, firstly, the current level of IT use for KM across Malaysian listed organisations, secondly, a better understanding of organisational factors influencing IT use for KM and, finally, a guide to effectively incorporate IT in KM strategies.

Insight into the current level of IT use to support KM across Malaysian listed organisations. Firstly, this study provides an insight into the current extent of IT use to support KM across Malaysian listed organisations. By providing a broad picture of the level of IT use for KM across the industries, the practitioners would be able to identify the KM areas that are still absent or lacking IT support and could thus take adequate measures to improve the level of support for these areas. The trend of IT adoption by these organisations could also be used by business and, in particular, IT practitioners to gauge if the rate of their IT adoption is adequate to drive their desired level of competitiveness.

Better understanding of the organisational factors influencing IT use for KM. Secondly, the findings of this study move forward the body of knowledge about IT use for KM by contributing the further understanding of the way in which IT should be implemented to support KM in Malaysian listed organisations. The results of this study offer a better understanding of the current organisational issues associated with the use of IT to support KM and lead to recommendations of what could be done in order to enhance IT's role as an enabler of KM in these organisations. In particular, the management in these organisations could identify the organisational factors that are still deficient in their organisations and then focus their efforts to formulate strategies for the enhancement of these factors. Thus, the findings of this study provide guidance on how managers may influence the extent of IT use to support KM within their organisations.

Guidance on how to incorporate IT in KM strategies. Lastly, the findings of this research provide a guide to IT and KM practitioners on incorporating IT in their KM strategies to ensure a higher chance of successful KM. The guide may also be applied to other similar contexts, for example, in other Asian developing countries.

Organisations that are interested in achieving competitive advantage by leveraging knowledge would be interested in the results, as this would guide them in making informed decisions in fostering the required preconditions for successful IT use to support KM.

The guide could also be used to assist in the formulation of IT use for KM policies or guidelines that can be effectively utilised by relevant industry organisations or government agencies—such as the Multimedia Development Corporation (MDC), the Ministry of International Trade, and the Ministry of Human Resource—to promote and cultivate an effective organisational environment in these organisations to ensure that maximum potential of KM can be leveraged by the utilisation of IT in these organisations. Having discussed the contributions of this study towards research and practice, the next section provides the definitions to the key terms used in this study.

1.10 DEFINITION OF TERMS

This section introduces definitions of the key terms used in this study. This is important as definitions adopted by researchers tend to vary, so there is a need to define them and to establish positions taken in this study (Perry 1998). These definitions are discussed and justified more in the subsequent chapters of this thesis.

Information technology (IT) is 'a generic term for the convergence of computers, hardware, software, telecommunications, Internet, electronics and the resulting technologies' (Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez 2006, p. 17). In the context of KM, IT is perceived as a knowledge platform (Tiwana 2002), or the infrastructure to KM (Chou 2003).

Knowledge is defined as 'justified personal belief that increases an individual's capability to take effective action' (Alavi and Leidner 1999b, p. 5).

Organisational knowledge is defined as the experiences and understanding of the people in the organisation and the knowledge artefacts, such as documents and reports containing solutions to problems, design rules, best practices, and lessons learned that are available within and also outside of the organisation (Marwick 2001).

Knowledge management (KM) is defined as the process, and/or efforts, of systematically acquiring, organising, distributing, and applying knowledge to achieve strategic aims of an organisation (Alavi and Leidner 1999a; Marwick 2001).

KM system refers to a class of information systems to manage organisational knowledge, which are IT-based systems developed to support KM activities (Alavi and Leidner 2001).

KM activities are defined as the activities that allow organisations to manage knowledge (e.g. on-the-job training, brainstorming, online forum discussions, learning from observation, as well as the development and implementation of IT-based systems for KM) (Alavi and Leidner 2001).

KM processes are defined as the organisational processes that support the flow of knowledge in an organisation, from creation, storage, transfer and application of knowledge (Gold, Malhotra, and Segars 2001).

Knowledge creation is defined as the seeking and acquiring of entirely new knowledge, and the combination of existing knowledge into new knowledge (Liebowitz 2001; McElroy 2003).

Knowledge storage is defined as the recording of knowledge in a medium from which it can later be accessed by individuals or groups in an organisation (Meehan and Richardson 2002).

Knowledge transfer is defined as the sharing, transferring, disseminating, deploying, and diffusing of knowledge between individuals, groups, or organisations (McElroy 2003; Ruggles 1997; Von Krogh, Ichijo, and Nonaka 2000; Wiig 1993).

Knowledge application is defined as the exploitation of individual and organisational knowledge, which has been created, stored and shared/transferred, which creates value to the organisation (Gold. Malhotra, and Segars 2001; Meehan and Richardson 2002).

Perceived benefits of using IT for KM is defined as the perception that one believes that contributing to and using available KM systems in an organisation improve his or her job performance, productivity, effectiveness, and ease of doing the job (Davis 1989).

Perceived ease of using IT for KM is defined as the perception that one believes that using IT-based systems to support their KM activities would be free of effort (Davis 1989).

Management support and commitment for KM is defined as the support and commitment to KM by management, exhibited by the allocation of funds, resources, training, dedicated personnel for the use of IT for KM, and the communication of the importance of using IT for KM (Davenport, DeLong, and Beers 1998; Jennex and Olfman 2004; Moffett, McAdam, and Parkinson 2004; Purvis, Sambamurthy, and Zmud 2001).

Knowledge sharing culture is defined as a culture that believes in the importance of knowledge for an organisation's success, values employees' experiences, encourages the sharing of knowledge between individuals and groups, and fosters the use of IT to support knowledge sharing in an organisation (Alavi and Leidner 1999a; Denison 1996).

Rewards and incentives for KM is defined as the standardised rewards and incentives system to encourage KM activities and/or the use of IT to support these activities in an organisation (Benbya and Belbaly 2005; Davenport, De Long and Beers 1998).

Knowledge classification is defined as the enterprise-wide classification system or taxonomy for knowledge in an organisation (Butler, Heavin, and O'Donovan 2007; Davenport, De Long, and Beers 1998).

Organisational factors refer to those internal factors that are controllable by an organisation (Lewis, Agarwal, and Sambamurthy 2003).

Structural equation modelling (SEM) is a multivariate data analysis technique used to estimate a series of interrelated dependence relationships simultaneously (Bagozzi 1981; Hoyle 1995).

Partial least squares (PLS) is a second-generation multivariate analysis technique used to estimate the parameters of causal models (Igbaria, Guimaraes, and Davis 1995)

The scope or delimitations of the study are discussed in the following section.

1.11 SCOPE/DELIMITATIONS OF THE STUDY

Given that the study of IT use for KM has a broad focus it is considered appropriate that this study is constrained in terms of scope and extent. This section outlines three delimitations of scope related to this study.

Publicly listed organisations in Malaysia. This research shall focus on the use of IT for KM in the publicly listed organisations in Malaysia. This was done to provide a study that is broader in context and that encompasses the various major industries in Malaysia. Although the generalisability of the findings of this research is limited by this selection of organisations, the findings of this study would be more representative of Malaysian organisations' capability as a whole in achieving an IT-enabled knowledge-based economy, as the selected organisations contribute to a significant portion of the nation's economy (Economic Planning Unit 2010a).

Organisational factors focus and perspective. This study emphasises the organisational-related aspects of the use of IT for KM. It looks at the research problem with the key aim of understanding and therefore improving the organisational factors influencing the extent of IT use to support KM in the organisations studied. Thus, with the exceptions of the TAM constructs of perceived benefits and perceived ease of use of using IT for KM, other technological-related factors, such as system design, accessibility, output flexibility, and environmental-related factors, such as demand uncertainties are considered to be beyond the scope of this study.

The stage of IT use or adoption in the organisations studied. In this study the term IT use or IT adoption are used interchangeably to describe an IT implementation stage in which IT components are already being deployed in an organisation. Other implementation stages such as decision-making, where an initial decision is made to adopt the IT, and evaluation, where IT solutions that are implemented are evaluated, are beyond the scope of this study. Thus, this study is looking at the extent of use of IT that is already deployed in the organisations studied.

The scope of the study was discussed in this section. The next section provides an overview of the chapters presented in this thesis.

1.12 THESIS OUTLINE

This thesis is organised into seven chapters. Chapter 1 addresses the research issues and the motivation of this study. It introduces the study by providing a background of the importance of managing knowledge in the current intensive global competition and globalised economy and how IT plays an important role in organisations' capability to manage knowledge effectively. An overview of the KM practices in Malaysia and the motivation to conduct this study in Malaysia are discussed. The purpose of the research, research questions and the philosophical assumptions held in the research are set out. This chapter also briefly discusses the theoretical framework, research methodology, significance, and scope or delimitation of the research.

Chapter 2 provides a review of extant literature related to the key research topic areas of this study, which are knowledge in organisation, KM and its processes, and IT support for KM. The objectives of this chapter are to examine the role of IT in an organisation's KM and to gain an understanding of the current issues and concerns with regards to the implementation of IT to support an organisation's KM.

Chapter 3 begins with a review of previous research related to KM practices, and the role of IT for KM in the Malaysian organisations' context. It presents a critical review which reveals knowledge gaps in IT adoption for KM in Malaysian organisations literature and argues that it is important to focus on the organisational factors influencing IT use for KM in these organisations. This chapter also describes the research questions that have arisen from the research problem identified. It then investigates the existing literature on the TAM application for KM systems and on the use of IT-based systems to support KM in order to identify the important variables for this study and, thus, form the research model. The research model is developed along with the discussion of related hypotheses to be tested.

Chapter 4 describes the research approach that is composed of the research paradigm, methodology, and method employed in this study. The survey methodology, which is comprised of several phases that include preliminary interviews, development of the constructs' measurement, the pilot survey, and actual survey administration is presented. This chapter also provides an overview of the SEM approach employed in the data analysis. Issues and implications brought about by the validity and reliability of the research design, and ethical considerations, are also discussed in this chapter.

Chapter 5 presents the empirical results of the data analysis. The analysis of survey responses and the demographics of survey respondents are presented, which are followed by an introduction to SEM approach with PLS technique that is used to analyse the collected data. Next, the evaluation of the measurement model including the validity and reliability of the survey instrument are discussed. The results of the structural model evaluation and the discussion of the results of hypotheses testings are also presented.

Chapter 6 provides the discussion of the findings of the study, in relation to the hypotheses tested, by comparing and contrasting it with existing literature. This chapter also provides the discussion of the application of TAM in the research context by comparing and contrasting it with other similar applications in the literature. In addition, the discussion of survey respondents' comments and the performance of the study's research model, compared with previous studies, are also presented in this chapter.

Chapter 7 provides the conclusions on the research questions based on the research findings and discussion. Next, the refined research model based on the research findings is presented, followed by the discussion of the limitations of the study. The theoretical and practical implications, including the recommendations and strategies to succeed in IT adoption for KM, are also discussed and outlined in this chapter. Lastly, the recommendations for future research on the topic of the study are proposed.

Figure 1-3 provides an overview of the chapters presented in the thesis.

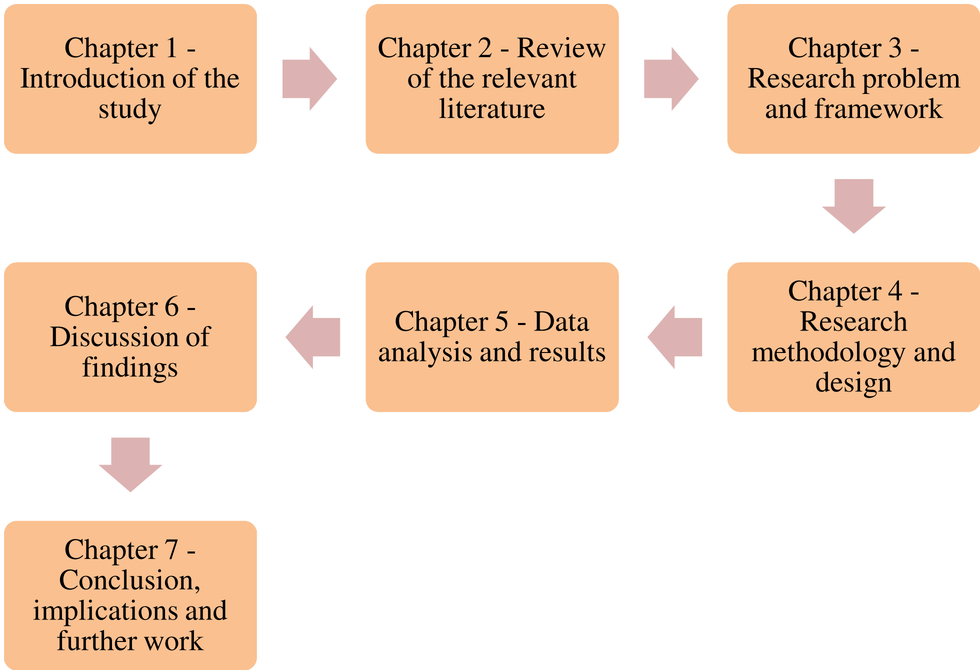


Figure 1-3 Overview of the chapters in the thesis

1.13 SUMMARY

This chapter has laid the foundation for this study within the framework of the research problem identified. It began by providing background information relating to KM and the role of IT as an enabler to the management of knowledge. Next, the research problem of this study, which had stemmed from the discussion of Malaysian KM and the use of IT to support Malaysian KM, was identified as '**the low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations**'.

Based on the research problem identified, the chapter then described the purpose of this study by highlighting the areas that need to be addressed and presented the research major and minor questions regarding the use of IT to support KM in Malaysian organisations. These research questions examine the organisational factors that could enhance IT use for KM and how these factors affect the extent of IT use in Malaysian KM. Next, a discussion of the philosophical assumptions that guide this research was presented, which was followed by a discussion of the theoretical framework that provides the foundation for this study's investigation, as well as a summary of the research methodology employed to investigate the research questions developed in this study.

In addition, this chapter also outlined the significance of the study, justified by the study's potential contribution to both theory and practice. This was followed by sections that provided the definitions of the key terms used in this study, as well as the delimitations or scope of this study. The final section of this chapter outlined and presented an overview of the various chapters in this thesis.

The next chapter reviews the relevant literature related to the key research topic areas of this study, which are knowledge in an organisation; KM and its processes; and IT support for KM.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter reviews extant literature related to the key research topic areas of this study, which are knowledge in an organisation, KM and its processes, and IT support for KM. The aim of this chapter is to examine the role of IT as an enabler to organisations' KM initiatives.

This chapter is divided into seven sections. The first section introduces the chapter and is followed by a section providing an understanding of knowledge in an organisation as well as the classifications of knowledge. The third section discusses KM and the KM processes that support the flow of knowledge in an organisation. The fourth section inspects the role of IT as an enabler to KM initiatives by supporting the codification and personalisation approaches in KM. The fifth section examines the role of IT in supporting the four main KM processes of creating, storing, transferring and applying knowledge, as well as reviews the available IT-based systems to support these processes. Finally, the sixth section highlights the issues and concerns regarding the use of IT to support KM in an organisation and is followed by a summary section.

Figure 2-1 provides an overview of the sections presented in this chapter.

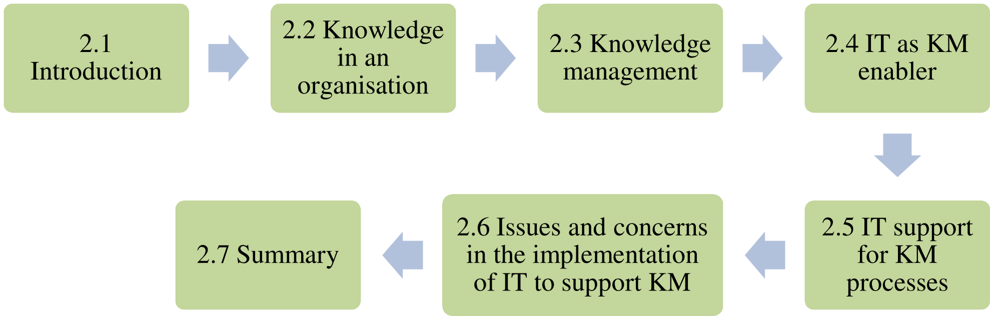


Figure 2-1 Overview of the sections in Chapter 2

2.2 KNOWLEDGE IN AN ORGANISATION

Knowledge is a multifaceted phenomenon which has been debated in various disciplinary contexts, such as philosophy, sociology, social psychology and cognitive science, economics, and management (Patriotta 2003). Researchers from different disciplines attempt to approach the field of knowledge from different views which results in creating knowledge as a broad and abstract notion (Davenport and Prusak 1998). For the purpose of this study, this thesis views knowledge from the organisational perspective. Thus, this section attempts to provide an understanding of what is considered knowledge in an organisation by reviewing the types and the various classifications of organisational knowledge.

As the perspective of this study is from an organisational context, an applied oriented definition of knowledge is considered to be more suitable to be adopted in the study, rather than those of theoretical or philosophical oriented definitions. Thus the definition of knowledge by Alavi and Leidner (1999b), which is based on the work of Nonaka (1994) and Huber (1991), is adopted in this thesis. Based on an applied orientation, knowledge is conceived as 'justified personal belief that increases an individual's capability to take effective action' (Alavi and Leidner 1999b, p. 5).

Further, a common approach in IS research in defining knowledge is by distinguishing knowledge from information and data (Alavi and Leidner 2001; Becerra-Fernandez and Sabherwal 2001; Spiegler 2003; Tuomi 1999). Data can be defined as symbols, raw numbers, images, words or sounds which are derived from observation or measurement. Information is then defined as processed or interpreted data. Knowledge, on the other hand, is the result of adding a further layer of intellectual analysis over data or information, where meaning is attached and linked with existing systems of beliefs and/or bodies of knowledge and hence becomes an individual's personalised information (Becerra-Fernandez, Gonzalez, and Sabherwal 2004; Hislop 2005; Spiegler 2003). Thus, pertinent relationships exist between the concepts of data, information, and knowledge as each concept actually builds upon the other.

However, researchers argue that it is often difficult to distinguish these three terms as different people may develop different interpretations of the same data, information, and knowledge (Alavi and Leidner 2001; Davenport and Prusak 1998; Spiegler 2003). For example, what is perceived as data and information in a certain circumstance may be perceived as knowledge in another circumstance. Moreover, the terms 'knowledge' and 'information' are often used inter-changeably in the literature, which is possibly causing the confusion regarding the definitions of knowledge (Kakabadse, Kakabadse, and Kouzmin 2003). Nevertheless, in a broad sense, these concepts represent the objects of KM, in which data and information can provide the building blocks of knowledge. As far as the empirical research of this thesis is concerned, a fundamental definition of knowledge should be based on a pragmatic description of knowledge that can be made explicit in a survey questionnaire and able to provide adequate understanding to the respondents under the given restrictions of time and attention. Thus, a definition of knowledge from the organisational perspective is considered to be appropriate in this study, and is discussed further in the next sub-section.

2.2.1 Organisational knowledge

Building upon and extending the resource-based theory of the firm, the knowledge-based view of the firm emphasises that knowledge-based resources that are firm-specific and difficult to imitate are sources of long-term sustainable competitive advantage for organisations (Grant 1996b; Spender 1996). According to this perspective, knowledge in an organisation is embedded and carried through multiple entities, such as processes, products, documents, systems, rules, culture, routines, practices, as well as individual employees (Davenport and Prusak 1998; Grant 1996b; Myers 1996; Spender 1996).

In addition, some broad definitions of organisational knowledge as described by Davenport and Prusak (1998, p.70), range from 'complex, accumulated expertise that resides in individuals and is partly or largely inexpressible' to 'much more structured and explicit content'. In accordance to these definitions, Marwick (2001) defines organisational knowledge as the experiences and understanding of the people in the organisation, as well as the knowledge artefacts, such as documents and reports containing solutions to problems, design rules, best practices, and lessons learned that are available within and also outside of the organisation. Thus, this definition is adopted as the working definition of organisational knowledge in this study as it is considered to be a more explicit definition that can be communicated and comprehended well in the study's survey questionnaire.

The next section describes the classification of organisational knowledge.

2.2.2 Classification of organisational knowledge

The preceding definitions of organisational knowledge are in accordance with the categorisation of tacit and explicit knowledge that is most frequently mentioned in KM research. The first researcher who made a distinction between the two dimensions of knowledge was Michael Polanyi (1997) who describes explicit knowledge as knowledge that is transmittable in formal and systematic language, whereas tacit knowledge has a personal and embedded quality and thus, is hard to formalise and communicate. Drawing on this distinction, Nonaka and Takeuchi (1995) extend the importance of tacit and explicit knowledge into the organisational context. Tacit knowledge in an organisation is embedded in the expertise and experience of individuals and groups, whereas explicit knowledge is codified in organisational rules, routines, and procedures.

Further, research has also described that tacit knowledge in an organisation can range from directly communicable and potentially explicable, such as expertise, know-how and work practices, to non-communicable and potentially non-explicable, such as good judgement, wisdom, talent, and intuition (Becerra-Fernandez and Sabherwal 2001; Haldin-Herrgard 2000). Drawing on the idea that certain tacit knowledge can be transformed into explicit knowledge, research proposes that this type of knowledge is classified as implicit knowledge (Aurum, Daneshgar, and Ward 2007). In other words, implicit knowledge is tacit knowledge that is possible but has yet to be articulated into explicit form. Similar to tacit knowledge, implicit knowledge is perceived as more difficult to identify and manage than explicit knowledge (Aurum, Daneshgar, and Ward 2007).

Abiding by the same distinction, explicit knowledge in an organisation was more recently described as knowledge that is retained for future reference, which includes text-based reports (e.g. project, technical, and research), manuals (e.g. policies, operations, and troubleshooting), or media artefacts (e.g. diagrams, audio, and video clips)—(Kulkarni, Ravindran, and Freeze 2007). Further, explicit knowledge in an organisation can have different levels of structures of unstructured explicit knowledge and structured explicit knowledge (Rodríguez-Elias et al. 2008). Examples of unstructured explicit knowledge include documents such as reports, memos, or emails. On the other hand, structured explicit knowledge is found in systematically categorised documents that can be identified, processed, and managed by computers. Examples of structured explicit knowledge include HTML, XML, and documents deposited in knowledge databases that can be retrieved by other systems, such as an expert system, using mathematical formulations. Table 2-1 lists the classifications of organisational knowledge according to its types or structures.

Table 2-1 Organisational knowledge structure

Knowledge Type/Structure	Example and description
Tacit	Skills, wisdom, intuition, expertise—knowledge that depends on the experiences of people, and is hard to make explicit
Implicit	Know-how—knowledge that is relatively easy to make explicit, such as procedures, methods, and techniques
Explicit Unstructured	Audio or video—media to store and share knowledge Images—can be used to represent knowledge visually Free text—knowledge expressed in free text, such as reports and memos
Explicit Structured	Graphics—knowledge that is presented graphically Semi-structured text—contains identifying characteristics such as titles and types of paragraphs, for example, HTML. Structured text—stores more detailed knowledge in the documents to facilitate their management by computers, for example, XML Categorised knowledge—used in web search services such as knowledge search tools on online portals Mathematically structured knowledge—stored in knowledge database and can be retrieved by expert systems using mathematical formulations

Source: Adapted from Rodríguez-Elias et al. (2008)

In order to understand what constitutes knowledge in an organisation, it is also useful to classify organisational knowledge according to the domain that is related to the processes and activities that the knowledge is used for. For example, knowledge in an organisation can be about its employees, its customers, or the products or services that are provided by the organisation. Table 2-2 provides a list of organisational knowledge domains and their respective descriptions.

Table 2-2 Domains for organisational knowledge

Knowledge domain	Description	Example
Business	Knowledge related to the business strategy	knowledge about the clients, the suppliers and the business markets
Organisational	Knowledge related to the operation of the company, such as its structure	human and material resources
Managerial	Knowledge related to aspects of the management of the company	projects planning, policies, and standards
Product-service	Knowledge related to the specific aspects of the company's products or services	production processes or documents
Technical	Knowledge required for performing the productive activities of the company	methodologies or usage of tools

Source: Adapted from Rodríguez-Elias et al. (2008)

It can be summarised in this section that organisational knowledge can be classified according to its type, whether tacit, implicit, and explicit (structured and unstructured). In addition, knowledge in an organisation can also be categorised according to the domain of processes and activities that the knowledge is used for in the organisation. The next section presents a discussion of the management of the organisational knowledge.

2.3 KNOWLEDGE MANAGEMENT

Given the strategic importance of knowledge, managing organisational knowledge to achieve sustainable competitive advantage has become a critical strategic issue (Davenport and Prusak 1998; Grant 1996b; Spender 1996). KM can be generally defined as “the set of systematic and disciplined actions that an organisation can take to obtain the greatest value from the knowledge available to it” (Marwick 2001, p.814).

Further, a more detailed definition of KM is provided as ‘a systemic and organisationally specified process for acquiring, organising, and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work’ (Alavi and Leidner 1999b, p. 6). This definition outlines the objectives of KM to transform tacit and/or implicit knowledge to explicit knowledge, as well as to transfer explicit knowledge from individuals to groups within an organisation.

Based on the preceding definitions of KM, it appears that KM involves the processes of creating, preserving and re-using the knowledge that is available within an organisation. Accordingly, research has also described KM as an integrated process incorporating a set of KM activities with the objective to create, store, transfer and apply knowledge using suitable technologies and within appropriate cultural environments (Aurum, Daneshgar, and Ward 2007). The following sub-sections discuss the processes involving the various KM activities, outlined by the definition of KM.

2.3.1 KM processes

KM processes are described as the processes that support the flow of knowledge within an organisation, and organisations with effective KM must have these processes effectively supported and managed (Maier and Remus 2002).

In order to analyse the role of IT in an organisational KM, Alavi and Leidner (2001) propose a systematic KM framework that consists of four main KM processes of knowledge creation, knowledge storage, knowledge transfer, and knowledge application. In addition to this framework, other KM frameworks have also been proposed by various KM researchers (Davenport and Prusak 1998; Lee, Lee, and Kang 2005; Meehan and Richardson 2002; Nissen 2002; Qureshi, Hlupic, and Briggs 2004; Rao 2005; Tyndale 2002). Although these KM frameworks are composed of different stages, some of which are more detailed than others, these stages can be grouped under four similar underlying concepts of creation, storage, transfer, and application as shown in Table 2-3. Thus, the framework that consists of knowledge creation, storage, transfer, and application stages is considered to be a broad and sufficient KM framework to be used as the basis to investigate the use of IT for KM in this study.

Table 2-3 Knowledge management frameworks and their terminology

Model	Creation	Storage	Transfer	Application
(Davenport and Prusak 1998)	Generate	Codify/coordinate	Transfer	n/a
(Tiwana 2002)	Acquire	n/a	Share	Use
(Alavi and Leidner 2001)	Create	Store/retrieve	Transfer	Apply
(Meehan and Richardson 2002)	Create	Store	Share	Leverage
(Edwards 2003)	Create/acquire	Retain	Share/transfer	Use
(Qureshi, Hlupic, and Briggs 2004)	Create/collect	Organize	Deliver	Use
(Lee, Lee, and Kang 2005)	Create	Accumulate	Sharing	Internalise/use
(Nissen 2002)	Create	Organize/ Formalize	Distribute	Apply/evolve
(Dalkir 2005)	Capture/create	Assess	Share/ disseminate	Acquire/ contextualise/ apply
(Rao 2005)	Create	Codify	Retrieve	Apply
(Tyndale 2002)	Capture/generate/ gather	Organize/ filter/codify	Distribute/ transmit	Apply/review

Source: Adapted from Rodríguez-Elias et al. (2008)

While these activities or processes are conceived as individual processes that are separated from each other (Qureshi, Hlupic, and Briggs 2004; Nissen 2002), other researchers argued that these processes should be seen and treated as interrelated processes as opposed to processes that are independent and isolated from each other (Holsapple and Joshi 1999). Thus, these different processes should be a part of a continuous flow through the distinct stages of the KM life cycle in an organisation (Rodríguez-Elias et al. 2008).

The following sub-sections provide a discussion of the four main KM processes, as identified in this section, namely, knowledge creation, storage, transfer, and application processes in more detail.

2.3.1.1 Knowledge creation

Nonaka and Takeuchi use the distinction between tacit and explicit knowledge and propose that 'organisational knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge' (Nonaka and Takeuchi 1995, p. 61). Their SECI theory describes that organisational knowledge creation revolves around the conversions from tacit to explicit knowledge and vice versa. Tacit and explicit knowledge in an organisation is created through four knowledge conversion processes: socialisation, externalisation, combination and internalisation. Explicit knowledge is created through a combination process that generates new explicit knowledge through merging and synthesising sets of explicit knowledge. Explicit knowledge becomes tacit knowledge through an internalisation process of learning and understanding. Tacit knowledge is created through a socialisation process that produces new tacit knowledge through the social interaction and sharing of experiences between individuals. Tacit knowledge is converted into explicit knowledge through an externalisation process that explicates tacit knowledge into explicit form.

Since the SECI theory, knowledge creation has also been defined as the process of enabling existing knowledge (Von Krogh, Ichijo, and Nonaka 2000), the combination of existing knowledge into new knowledge (Liebowitz 2001), and the acquisition of new knowledge (McElroy 2003). Thus, in the context of organisational KM, knowledge creation processes are represented by organisational processes that facilitate the seeking and acquiring of entirely new knowledge, and the combination of existing knowledge into new knowledge.

Further, Rodriguez-Elias et al. (2008) describe knowledge creation as the process that consists of activities that allow the generation of knowledge either by individuals or groups in an organisation, as well as the acquisition of knowledge from external sources, such as customers, suppliers, competitors and the business markets. Thus, knowledge creation also occurs in the transfers of knowledge between individuals, groups within an organisation, as well as at inter-organisational levels. Examples of knowledge creation processes in an organisation include collaborative problem solving, joint decision making, and collaborative creation of documents, such as procedures and manuals (Becerra-Fernandez and Sabherwal 2006). For instance, knowledge that results in better understanding of products and their markets' outlook can be created from the sharing and combining of knowledge about the products with knowledge about the business market (Becerra-Fernandez and Sabherwal 2006).

In essence, knowledge creation processes support the development of new knowledge in an organisation by focusing on the creation of new products, better ideas, new skills, and more efficient processes (Folkens and Spiliopoulou 2004). Further, it is essential that knowledge created in an organisation is preserved and stored so that it will be available whenever it is needed. This leads to the next KM process, the knowledge storage process.

2.3.1.2 Knowledge storage

Organisations often lose competencies due to mergers, restructuring exercises, or simply with time (Folkens and Spiliopoulou 2004). Thus, preserving potentially valuable knowledge by storing and making it accessible is a crucial exercise for an organisation in order to enable its future use. Meehan and Richardson (2002) describe that storing knowledge in an organisation occurs when employees record, gather, and make their own personal and organisational knowledge available and accessible to others. This knowledge would otherwise remain tacit and be retained in the heads of employees. Similarly, Qureshi, Hlupic, and Briggs (2004) define knowledge storage as the recording of knowledge in a medium from which it can later be accessed. This medium can be private and public documents, books, manuals, reports and electronic files, such as files on company database servers, networks, and intranets.

Further, in order to enable knowledge that was captured and stored to be easily retrieved and understood by others, this stored knowledge should be clearly defined and properly categorised according to its type and structure (Meehan and Richardson 2002). In addition, relationships among the stored knowledge items can be established by means of synthesising, analysing, generalising, and associating the items. Knowledge should also be maintained and frequently updated to eliminate obsolete knowledge. This is crucial so that confusion and undesirable business outcomes that can result from the reuse of knowledge that is no longer applicable can be avoided (Rodríguez-Elias et al. 2008).

In brief, knowledge storage processes support the retention of knowledge assets in an organisation by focussing on the externalisation process, which is the extraction of an individual's tacit knowledge and its codification to an explicit form. Examples of activities facilitating the externalisation process include the development of work procedures, manuals, and documents containing best practices and lessons learned. This codified knowledge is then made available and accessible to others in the organisation, for example by storing it in a central knowledge repository. The next sub-section discusses the process of transferring the stored knowledge.

2.3.1.3 Knowledge transfer

In order for an organisation to leverage stored knowledge for KM effectiveness, it is important that the organisation has mechanisms to facilitate the dissemination and exchange of knowledge within the organisation. The knowledge transfer process, which is defined as the dissemination of knowledge in an organisation (McElroy 2003; Von Krogh, Ichijo, and Nonaka 2000), and is also referred to as the process of sharing knowledge (Ruggles 1997; Wiig 1993), serves as the mechanism to facilitate the exchange of knowledge within an organisation. This KM process includes a broad range of activities that focus on transferring, disseminating, deploying, and diffusing knowledge between individuals, groups, or organisations.

There are two perspectives of the knowledge transfer process, which include the explicit and tacit knowledge transfer (Rodríguez-Elias et al. 2008). Explicit knowledge can be stored in shared repositories or databases for the knowledge to be used by or transferred to other individuals within or outside an organisation. On the other hand, tacit knowledge transfer takes place in socialisation processes, where people can increase their own experience and share that experience with others, such as in discussion or chat groups. Other examples of activities that facilitate socialisation include apprenticeships, employee rotation across departments, conferences, brainstorming retreats, and cooperative projects across departments. These socialisation processes can be facilitated by the use of communication and collaborative technologies.

Further, according to Purvis, Sambamurthy, and Zmud (2001), knowledge transfer is supported by four distinct categories of organisational processes that include:

(i) rules and directives—processes that codify tacit knowledge into explicit instructions,

(ii) work processes—processes that encompass both tacit and explicit knowledge that are embedded into work flows,

(iii) routines—processes that coordinate the work of employees in an organisation by facilitating the performance of regular tasks, and

(iv) collaborative projects and face-to-face meetings—processes that assist with the transfer of tacit knowledge between individuals and groups in an organisation.

Finally, the next sub-section discusses the processes of applying the created, stored, and transferred knowledge.

2.3.1.4 Knowledge application

In order to achieve KM effectiveness, an organisation must also acquire the ability to make use of knowledge. Knowledge application refers to the actual use of the knowledge, which can be used to adjust strategic directions, solve new problems, and improve organisational efficiency (Gold, Malhotra, and Segars 2001). Meehan and Richardson (2002) define knowledge application as employees' exploitation of individual and organisational knowledge, as well as knowledge about customers, competitors, and markets, which has been captured, stored and shared.

The definition of knowledge application is extended by Qureshi, Hlupic, and Briggs (2004, p. 27) as 'bringing knowledge to bear on a task that creates value for an organisation'. This value is generated when knowledge is applied and leveraged. For example, applying knowledge to solve problems or make effective decisions can create values in the form of effective business outcomes to an organisation.

Organisational processes that support knowledge application include directions, which refer to the process that directs the action of employees, by using knowledge possessed by the management or superior, without having to transfer that knowledge to the employees (Grant 1996a). Examples of directions include directive orders from management, the help desk, and support centres. Routines are also another example of organisational processes that facilitate knowledge application. Routines refer to the process of utilising knowledge embedded in work processes, manuals, procedures, policies, and rules that guide individuals' actions and behaviour (Becerra-Fernandez and Sabherwal 2006).

Knowledge application is argued to be integrated into the other KM processes of creation, storage, and transfer of knowledge (Rodríguez-Elias et al. 2008). The application of knowledge, for example in solving problems or making decisions, requires that knowledge be created or acquired, and transferred or shared from available knowledge sources, such as a knowledge database or a consultant. Then, this application of knowledge generates new knowledge in the form of knowledge discovered during problem solving, such as lessons learned, which should also be preserved to make it accessible and transferable to others who may need it in the future. In short, besides being a process that is dependent on the knowledge that is made available by the other knowledge creation, storage, and transfer processes, knowledge application activities also initiate these processes to take place in an organisation.

The ability to exploit organisational knowledge enables organisations to develop and sustain competitive advantages (Davenport and Prusak 1998; Alavi and Leidner 1999a). Hence, it is fundamental that organisational processes supporting the flow of knowledge, from creation, storing, transfer and application, are efficiently managed and supported.

This section presented a discussion of KM and the four main KM processes to support the flow of knowledge in an organisation. The next section discusses IT as an enabler to the exploitation of knowledge in an organisation.

2.4 INFORMATION TECHNOLOGY AS A KM ENABLER

The advances in IT, which provide the promise of being able to manage knowledge as a corporate resource, have piqued organisations' interest in the nature of knowledge (Prieto and Easterby-Smith 2006). Many KM researchers contend that IT is both a key contributor and an enabler to the field of KM (Alavi and Leidner 2001; Choi and Lee 2003; Davenport and Prusak 1998; Gold, Malhotra, and Segars 2001; Sher and Lee 2004). For example, research has argued that regardless of the type of KM strategy adopted by an organisation, IT plays an important role in supporting the organisation's ability to create new knowledge and apply existing knowledge effectively (Alavi and Leidner 2001; Davenport and Prusak 1998). Moreover, research has indicated that KM initiatives that undervalue IT will most likely fail (Mohamed, Stankosky, and Murray 2006).

Specific IT-based systems that are developed to support and enhance the organisational processes of creating, storing, retrieving, transferring, and applying of knowledge, as opposed to information or data, within and outside of an organisation are known as knowledge management systems or KMS (Alavi and Leidner 2001; Becerra-Fernandez and Sabherwal 2001; Ruggles 1997; Quaddus and Xu 2005). Thus, the focus of this study is on the usage of IT-based systems for KM, which is defined as the usage of any IT-based system that automates the input, storage, retrieval, transfer, and application of knowledge.

The two basic approaches in using IT to provide support for an organisation's KM strategy are the codification and personalisation approaches (Kankanhalli et al. 2003; Hansen, Nohria, and Tierney 1998). These approaches are discussed in the following sub-sections.

2.4.1 The codification approach

The codification approach of using IT for KM is also described as a strategy that focuses on the computer (Hansen, Nohria, and Tierney 1998). The main role of IT in this approach is to facilitate employees in sharing, accessing and applying knowledge through a common storage, such as a knowledge repository (Kankanhalli et al. 2003). In this approach, explicit knowledge is extracted from the people who have it, codified into structured form (e.g. documents, procedures), stored in knowledge repositories which can then be accessed and reused by other people for various purposes. Thus, a key IT component of this approach is electronic knowledge repositories that allow codified knowledge to be accessed without having to contact the person who originally has the knowledge.

The codification approach is suitable for organisations aiming for benefits from the economic reuse of organisational knowledge. For example, the codification approach is suitable for consultancy companies and computer manufacturers, where the nature of the task is highly automated and repetitive, and thus would benefit from the extensive codification and storing of reusable knowledge (Hansen, Nohria, and Tierney 1998). Moreover, organisations hiring less experienced workers could also benefit from the availability of codified knowledge that can be accessed and reused in the codification approach.

2.4.2 The personalisation approach

Apart from explicit knowledge, tacit knowledge is also considered vital to be diffused in an organisation because organisations can only learn and innovate by leveraging the tacit knowledge of its employees (Choo 1998; Nonaka and Takeuchi 1995). Despite the argued limitation on the capability of IT to diffuse tacit knowledge (Haldin-Herrgard 2000; Roberts 2000), research has described that rather than storing knowledge in repositories, IT supports the sharing of tacit knowledge by facilitating individuals to locate each other so they can communicate and transfer the complex knowledge that is hard or impossible to be made explicit (Hansen, Nohria, and Tierney 1998).

This approach of connecting people to share knowledge is known as the personalisation approach. An example of the personalisation approach in an organisation is the use of online knowledge expert directory services on an intranet. Knowledge is then shared by means of having face-to-face meetings, telephone conversations, or by using IT-based systems such as email, online discussion forums, videoconferencing and collaboration software.

In the personalisation approach, IT assists the direct and personal communications in sharing tacit knowledge with the primary tasks being to produce large, complex, and fairly unique solutions (Hansen, Nohria, and Tierney 1998; Sarvary 1999). Thus, the personalisation approach is suitable for organisations aiming to leverage their employees' knowledge, ideas, and experiences in achieving business growth, such as in highly customised services or in high innovative industries (Damodaran and Olphert 2000). This also indicates that the personalisation approach is the better choice of KM strategy for organisations with subject matter experts who can transfer their skills and expertise to other people through personal communication such as in one-on-one mentoring.

In addition, the choice of KM strategy also determines the amount of IT support for KM that is needed by an organisation. Heavy IT support that includes a large library of knowledge and its search engines is critical for the codification approach, whereas the personalisation approach requires a more moderate amount of IT support in the form of a system that allows employees to locate other people having the specific knowledge that they need. Table 2-4 provides an overview of factors that could affect the choice of KM strategy and the amount of IT investment required in an organisation.

Table 2-4 KM strategy and corresponding IT investment

	Codification	Personalisation
Nature of Product	Matured, standardised, automated, and repetitive	Innovative, customised, complex and unique
Type of Employees	Less experienced	Special skilled experts
KM Strategy	People-to-content Develop an electronic knowledge management system that codifies, stores, disseminates, and allows reuse of explicit knowledge	Person-to-person Develop networks for linking people so that tacit knowledge can be shared
IT Investment	Invest heavily in IT to allow people to exchange reusable codified explicit knowledge	Invest moderately in IT to facilitate conversations and the exchange of tacit knowledge

Source: Adapted from Hansen, Nohria, and Tierney (1998) and Maier and Hadrich (2006)

In summary, as listed in Table 2-4, the amount of IT investment for KM in an organisation will depend on several factors, which include the choice of its KM strategy, the type of people employed, and the nature of products or services being offered by the organisation. The next section examines the role of IT in supporting the four main KM processes of creating, storing, transferring, and applying organisational knowledge.

2.5 IT SUPPORT FOR KM PROCESSES

IT can provide the cost-effective functionalities for building knowledge platforms through systematic acquisition, storage, and distribution of organisational knowledge (Purvis, Sambamurthy, and Zmud 2001; Sher and Lee 2004). Apart from specific IT-based systems to support KM, like the KMS, research argued that many of the technologies that support the management of knowledge have been available for many years (Davenport and Prusak 1998; Moffett, McAdam, and Parkinson 2004). For example, organisations frequently possess tools that have the potential to become important knowledge flow enablers (Bontis, Fearson, and Hishon 2003). In fact, many technologies or tools initially developed for other purposes, such as for supporting collaborative work and decision making, have been adopted as KM tools (Marwick 2001; Rao 2005).

Nevertheless, certain IT-based systems are not being used as knowledge flow facilitators as organisations have not come to realise that these systems can actually be used to manage or disseminate their knowledge (Rodríguez-Elias et al. 2008). As KM projects are often more likely to succeed if organisations take advantage of their current IT infrastructure (Davenport and Prusak 1998), organisations should look into their existing IT infrastructure that could potentially support their KM.

In determining the role of IT in KM, Alavi and Leidner (2001) indicate that IT plays a role in supporting the flow of knowledge in an organisation with aims to support and enhance organisational processes that support the flow of knowledge through its capture, storage, retrieval, and application. This view is consistent with the views of Meso and Smith (2000) and Marwick (2001) who have also categorised IT support for KM based on the four critical KM activities: knowledge use (application), knowledge search (share or transfer), knowledge creation, and knowledge packaging (organisation or storing). Thus, the major role of IT in an organisation's KM appears to provide support for the four critical KM processes that include the creation, storage, transfer and application of knowledge.

A wide range of IT-based systems is available to support an organisation's KM initiative. The following sub-sections examine the various enabling IT-based systems which facilitate the processes of creating, storing, transferring, and applying knowledge in an organisation.

2.5.1 IT for knowledge creation

As an enabler for KM, IT is regarded as an essential element for knowledge creation (Choi and Lee 2003; Davenport and Prusak 1998; Gottschalk 2000), which facilitates the rapid collection, storage, and exchange of knowledge in an organisation. The primary role of IT in the knowledge creation process is to make the right knowledge available to users in an organisation, which will result in the users' better understanding (Hislop 2002; Lee and Choi 2003; Marwick 2001; Roberts 2000; Wang, Klein, and Jiang 2007).

Further, IT support for the knowledge creation process lies in its ability to facilitate the combination process, which is the process of discovering new explicit knowledge, as well as the socialisation process, which is the process of discovering new tacit knowledge (Becerra-Fernandez and Sabherwal 2006). This is consistent with the view of Choi and Lee (2003) who indicate that apart from the use of IT to connect people with reusable codified knowledge, an equally important role of IT is in supporting KM by facilitating communication to create new tacit knowledge.

Examples of IT-based systems facilitating the combination process include knowledge-discovery or data-mining systems, business intelligence systems, innovation support tools, and repositories of knowledge. These tools can facilitate the sorting, adding, combining, and categorising of explicit knowledge that can lead to new knowledge. On the other hand, IT-based systems that facilitate the socialisation process include videoconferencing, electronic discussion forums, knowledge maps, email, live chat, and collaboration software.

The role of IT in knowledge creation can also be seen in its ability to boost organisational learning as well as encouraging individual learning (Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez 2006). In organisational and individual learning, IT extends the human capacity of knowledge creation through the speed, memory extension and communication facilities. For example, organisational and individual learning require the support of IT-based systems for knowledge generation, such as systems that enable brainstorming, and knowledge acquisition, such as online training systems.

2.5.2 IT for knowledge storage

IT support for knowledge storage lies in its ability to support the externalisation of knowledge, which is the conversion of tacit and/or implicit knowledge into explicit form (Becerra-Fernandez and Sabherwal 2006). Examples of IT-based systems that support this process include online knowledge repositories and document/content management systems that preserve codified tacit knowledge and make it accessible and transferable to others. In addition, intelligent IT-based systems, such as expert systems and case-based reasoning systems, extend these functions by storing codified knowledge that can be filtered, integrated, and analysed through knowledge engineering processes as needed by the users.

In supporting the preservation of codified knowledge, it is imperative that IT-based systems, such as a document/content management system, provide the support for knowledge maintenance that includes knowledge updates, versions management, and obsolete knowledge identification. Other features, such as access control to the documents/contents for security purposes, audit of activity and changes in the managed document/contents, and content and index search facilities are also necessary for these systems to provide efficient storage and preservation of knowledge.

2.5.3 IT for knowledge transfer

IT support for the knowledge transfer process can be seen in its ability to facilitate exchange, which is the sharing of explicit knowledge, and socialisation, which is the sharing of tacit knowledge (Becerra-Fernandez and Sabherwal 2006). Explicit knowledge transfer can be facilitated by IT-based systems such as groupware and collaboration software. In addition, IT-based systems, such as knowledge portals and databases for best practices and lessons learned, can also facilitate the transfer of explicit knowledge by providing timely access to knowledge in computerised repositories and portals (Dalkir 2005; Zhang 2007).

Besides centralised repositories, knowledge sharing can also be promoted and supported by a decentralised network of knowledge repositories through a peer-to-peer (P2P) sharing network. In a decentralised network, the P2P sharing network allows users to have their own local knowledge repositories that can be shared with others through file sharing, videoconferencing and audio communication (Zhang 2007).

On the other hand, tacit knowledge transfer requires the support of communication and collaborative technologies that enable socialisation processes to take place. As described earlier, IT-based systems for socialisation processes include videoconferencing, electronic discussion forums, email, live chat, and collaboration software. For example, socialisation processes can take place in real time, online meetings that provide a virtual space for participants to share their experiences by listening to presentations, conducting discussions and exchanging documents relevant to a certain task (Marwick 2001). As Nonaka (1994) noted, shared experiences are critical to the formation and sharing of tacit knowledge. In addition, IT-based systems such as videoconferencing systems also connect people from different geographical locations in virtual face-to-face meetings, and thus allows tacit knowledge to be shared by more widely spread people in rich media (Dewett and Jones 2001; Zhang 2007).

An organisation-wide intranet emerges as a very useful IT-based system for the knowledge transfer process by providing the communication facilities to eliminate barriers that naturally occur between different parts of an organisation, as well as allowing previously disconnected flows of knowledge to be integrated with reduced costs and time (Gold, Malhotra, and Segars 2001; Khandelwal and Gottschalk 2003; Mohamed, Stankosky, and Murray 2006). For example, organisation-wide intranets facilitate contact between individuals that seek knowledge and those who possess it by supporting electronic bulletin boards, discussion groups, and corporate directories (Alavi and Leidner 2001; Andreu and Ciborra 1996; Zhang 2007).

2.5.4 IT for knowledge application

IT facilitates the knowledge application process by supporting the process through which individuals can utilise knowledge possessed by other individuals without actually acquiring the knowledge in the first place, such as by following directions and routines (Becerra-Fernandez and Sabherwal 2006). IT-based systems facilitating directions include expert systems embedded with experts' knowledge, decision support systems, and troubleshooting systems that are based on case-based reasoning, whereas IT-based systems that facilitate routines include workflow systems and enterprise resource-planning (ERP) systems. Moreover, as knowledge application integrates all the other knowledge processes as discussed in section 2.3.1.4, IT-based systems that support the knowledge application process should also support the other processes in the KM framework (Rodríguez-Elias et al. 2008).

In the context of applying knowledge for problem-solving, research has shown that IT speeds up an organisation's capability to solve problems (Gray 2000). For example, the use of both knowledge repositories and knowledge maps improves employees' ability to search for and find knowledgeable individuals within an organisation. This ability makes searching for knowledge more effective and hence improves the variety of knowledge available to solve problems, which results in more accurate and complete analysis of complex problems, improves the effectiveness of solutions to problems, and ultimately enhances an organisation's ability to adapt to its constantly changing business environment (Gray 2000).

Following the above discussions in this section, it seems that IT use for KM, which is the focus of this study, can thus be conceptualised by the use of IT to support the four main KM processes of creating, storing, transferring, and applying organisational knowledge. The next section examines the different types of IT-based systems that can be used to facilitate the management of organisational knowledge.

2.5.5 IT-based systems for KM

In addition to the systems that are developed to support specific KM functions, certain IT-based systems that are used to support KM can be from the existing or the derivative systems that are used to support other functions, such as operation functions, in an organisation. A number of past studies suggest that IT-based systems to support KM can be categorised into 11 categories that are based on the technology on which they were developed, as follows (Carvalho and Ferreira 2006; Tyndale 2002):

(i) Intranet—is an organisation-wide knowledge distribution network that uses Internet tools and technology with typical uses including giving users access to documents and software, publishing organisational news and communications, and providing front end to organisation's databases.

(ii) Document/content management systems—are typically deployed using the Internet and intranet infrastructure and are primarily used in the collection, storage, and distribution of the artefacts of knowledge contained in an organisation.

(iii) Data mining tools—aid the processes of selecting, exploring, and modelling large amounts of data in discovering new patterns that lead to the generation of new knowledge.

(iv) Groupware systems—are designed to facilitate the work of groups or communities of practice and are based on computer networks such as email, newsgroups, videophones and chat.

(v) Work flow—automates standardised business processes by delivering work or task items to appropriate users and invoking appropriate applications and utilities to complete the task.

(vi) Artificial intelligence-based systems—are programs that act on behalf of the human users to perform the difficult tasks of gathering knowledge by locating and accessing knowledge from various online sources, filtering irrelevant knowledge, and integrating and synthesising knowledge.

(vii) Business intelligence—provides access to organisational knowledge that was gathered, stored, and analysed in order to help users make better business decisions, such as decision support applications.

(viii) Knowledge map systems—allow users to locate experts from expert directories to enable direct communication between individuals in an organisation.

(ix) Innovation support tools—aid users to contribute new ideas to generate new knowledge about an organisation's products or services by supporting brainstorming, concept, and mind mapping.

(x) Competitive intelligence tools—perform automatic collection of knowledge from multiple sources and distribute them according to users' preferences

(xi) Knowledge portal—acts as a gateway that provides linkages to many related sources of knowledge.

In addition to classifying IT-based systems for KM based on the technology, many studies have also classified these systems according to the KM processes that they are supporting (Banerjee 2005; Haggie and Kingston 2003; Qureshi, Hlupic, and Briggs 2004; Rao 2005; Tiwana and Ramesh 2001; Tyndale 2002). Many of these tools can actually support more than one KM process or even all of the four main KM processes. For example, IT-based systems in the intranet-based category can support the creation, storage, transfer, and application of knowledge in an organisation. Table 2-5 lists these systems with respect to the four main KM processes that they support.

Table 2-5 Category of IT-based systems for KM and supported KM processes

Category of IT-based systems	KM Processes Supported	Examples of Software
Intranet-based systems	Knowledge creation, storage, transfer, and application	WikiWikiWeb, UseMod, and TWiki
Document/content Management systems	Knowledge creation, storage, and transfer	Excalibur Retrieval Ware, File Net, and Telligent Community
Data mining	Knowledge creation, storage, and transfer	Rapid Miner, SAS Enterprise Miner, and Angoss Knowledge Seeker
Groupware/collaboration software	Knowledge creation, storage, transfer, and application	Lotus Family (Notes, Sametime) and MS Suite (Exchange, Outlook, SharePoint, Messenger)
Work flow	Knowledge creation, storage, transfer, and application	ARIS Toolset (IDS Scheer)
Artificial intelligence-based systems	Knowledge creation, storage, transfer, and application	Neugents (Computer Associates)
Business intelligence	Knowledge creation, storage, transfer, and application	Business Objects and Oracle 10g BI
Knowledge maps	Knowledge creation, storage, transfer, and application	Gingo (Trivium) and Lotus Discovery Server
Innovation support tools	Knowledge creation, storage, transfer, and application	Goldfire Innovator (Invention Machines)
Competitive Intelligence tools	Knowledge creation, storage, transfer	Knowledge Works (Cipher Systems) and VigiPro (CRIQ/CGI)
Knowledge portals	Knowledge transfer	Hummingbird and Plumtree

Source: Adapted from Carvalho and Ferreira (2006) and Tyndale (2002)

It can be summarised in this section that there are a wide range of IT-based systems that can be used to support the flow of knowledge through the stages in the knowledge life cycle. Furthermore, the transformation of tacit and explicit knowledge, through knowledge conversion processes, can also be supported by the appropriate categories of KM software. Next, the last section of this chapter highlights the issues and concerns regarding the use of IT to support KM in an organisation.

2.6 ISSUES AND CONCERNS IN THE IMPLEMENTATION OF IT TO SUPPORT KM

The discussion of IT as an enabler of KM in the preceding sections, clearly shows that IT is both a key contributor and an enabler to the field of KM as indicated by previous studies (Davenport and Prusak 1998; Gold, Malhotra, and Segars 2001; Lee and Choi 2003). IT provides the necessary support for the continuous creation, accumulation and sharing of knowledge, which in turn enables KM to maximise the return on organisational knowledge, by implementing new business strategies and building new products or services faster (Lesser and Prusak 2001; Sher and Lee

2004). Given this valuable ability of IT, many organisations are thus employing IT to facilitate the sharing and integration of their knowledge (Kankanhalli et al. 2003).

The use of IT in KM, however, has had mixed results, with some KM initiatives more successful than others (Davenport, De Long, and Beers 1998). Although IT is recognised as an enabler for KM, there are, however, issues and concerns inhibiting the effective use of IT in KM that necessitate a clearer understanding of how IT supports knowledge work (Markus, Majchrzak, and Gasser 2002). This need was also conceded by Khandewal and Gottschalk (2003), who indicated that only a little empirical research has been conducted on IT support for KM.

In relation to the factors that inhibit effective use of IT in KM, research has highlighted that the high number of failures in implementing IT-based systems to support KM can be explained by a lack of attention to human and organisational factors (McDermott 2000). A similar view is expressed by Hardy and Connect (2008) who state that the reason IT fails to support KM processes is because it has not yet developed as a human-oriented communication tool that can produce measurable benefits. Their study outlines several factors that could lead to the failure of using IT for KM, such as the lack of attention to knowledge content, which results in outdated content that cannot be reused, as well as the designs of IT-based systems that are based on data and/or information models that lead to failure in processing and managing knowledge.

KM, being fundamentally a multidisciplinary concept that incorporates organisational learning, organisational behaviour, and organisational strategy should aim for a balance between technological and human-oriented factors in its initiatives (Alavi and Leidner 1999b). Thus, research has suggested that effective IT use to support KM should involve far more than just technological issues and should encompass other broad cultural and organisational issues (Alavi and Leidner 1999b; Al-Busaidi and Olfman 2005). Effective resolutions of cultural and organisational issues remained as the major concerns in the deployment of IT for KM as research suggest that the deployment must be complemented by a set of organisational mechanisms that could encourage and promote the sharing and reuse of organisational knowledge (Alavi and Leidner 1999b; Kulkarni, Ravindran, and Freeze 2007). Consequently, organisations should consider a more holistic approach in implementing IT for KM that goes beyond the deployment of IT and takes into account other cultural and organisational factors associated with user motivation to share and reuse knowledge (Kulkarni, Ravindran, and Freeze 2007; Sambamurthy and Subramani 2005).

In determining the link between IT support for KM and KM success, research argued that the extent of IT support for KM in an organisation is simply related to general IT use and that there is no relationship between IT support for KM and KM success (Gottschalk 2000). Similarly, research has also indicated that there is no direct correlation between IT investments and KM, as well as evidence of a relationship between IT support for KM and KM success (Hislop 2002; Malhotra 2004). Despite the absence of a direct link between IT support for KM and KM success, numerous KM researchers contend that in the context of KM, IT can be used to enhance organisations' KM capabilities (Alavi and Leidner 2001; Gold, Malhotra, and Segars 2001; Khalifa and Liu 2003; McDermott 2000; Tanriverdi 2005; Wang, Klein, and Jiang 2007) by allowing organisations to create, share, store and apply knowledge more efficiently and effectively.

Based on the discussion in this section, it is evident that IT is essential in initiating and carrying out KM activities in an organisation, and that the role of IT in KM success lies in its ability to effectively support KM processes. In addition, in order to effectively deploy and utilise IT to support KM in an organisation, issues concerning the cultural and organisational motivations of sharing knowledge should be taken into consideration.

2.7 SUMMARY

This chapter reviewed the literature relevant to the key research topic areas of this study, which are knowledge in an organisation, KM and its processes, and IT support for KM to understand the role of IT as an enabler to an organisation's KM initiatives. This chapter provided an understanding of knowledge from the organisational perspective, a description of what constitutes knowledge in an organisation, and classifications of knowledge according to its types and the domains where the knowledge is used in an organisation. Next, a discussion of KM and the KM processes that support the flow of knowledge in an organisation was presented. This was followed by an inspection on the role of IT as an enabler to KM initiatives by supporting the codification and personalisation approaches. The ability of IT to support the four main KM processes of creating, storing, transferring, and applying knowledge was also examined. This was followed by a review of the available IT-based systems to support these processes and a classification of these tools according to their technologies. The last section highlighted certain issues and concerns regarding the deployment of IT to support KM in an organisation, which set the foundation for the investigation of this study's research problem.

The next chapter discusses KM and the use of IT for KM in the Malaysian context, formulates research questions, and develops an initial research model to address the research problem raised from the discussion.

CHAPTER 3: RESEARCH PROBLEM AND FRAMEWORK

3.1 INTRODUCTION

Following the examination of the role of IT as an enabler to organisations' KM initiatives in the previous chapter (Chapter 2), this chapter reviews extant literature related to KM, as well as the use of IT for KM in the Malaysian context. The aims of this chapter are to examine the use of IT to support KM in the Malaysian context, identify KM issues that can be addressed by IT adoption, specify a research problem, and propose a research model in order to address the research problem.

This chapter is divided into seven sections. The first section introduces the chapter and is followed by a section that provides an overview of the importance of KM to Malaysian organisations, as well as the current KM practices in these organisations. The third section examines IT's role in Malaysian KM and KM issues that can be addressed by the use of IT. The fourth section identifies the research problem that emerges from the discussion of the use of IT in Malaysian KM, and specifies a research question to address the research problem. The fifth section discusses the theoretical background that serves as a framework for this research, which is followed by a section that proposes a research model for this study.

Figure 3-1 provides an overview of the sections presented in this chapter.

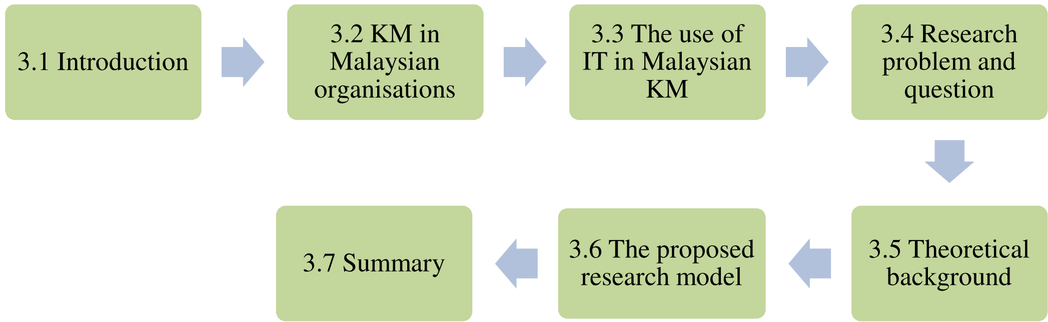


Figure 3-1 Overview of the sections in Chapter 3

3.2 KM IN MALAYSIAN ORGANISATIONS

KM is undeniably an essential activity that needs to be effectively exercised by organisations the world over. In Malaysia, KM has been identified as a key factor in achieving organisational success (Gan, Ryan, and Gururajan 2006; Rahman 2004). For example, a study of KM in Malaysia's 25 award winning companies (Tan 2004) indicates that these companies perceive managing knowledge as one of the most important factors that contributes to their companies' competitiveness, and that they have taken the appropriate measures to determine the type of knowledge that they need.

The literature of Malaysian KM was reviewed in order to understand the background and the focus of the investigation of past research. A summary of the reviewed studies is provided in Table 3-1.

Table 3-1 Studies on Malaysian KM

Author	Area of Study
Salleh, Richardson, and Narayanan (2003)	Studies the level of KM with respect to companies' competitiveness and employee attitudes in Malaysian oil & gas and power industries.
Kumar (2003)	Investigates KM approaches adopted by Malaysian electrical and electronics based industry.
Syed-Ikhsan and Rowland (2004)	Examines the availability of KM strategy in one public organisation in Malaysia.
Rahman (2004)	Examines the KM initiatives in Malaysian electronic industry, educational institutions, SMEs, private companies, and government ministries, departments, and agencies.
Tan (2004)	Investigates the mechanisms of KM adopted by winners of Malaysian Enterprise 25 awards.
Wong and Elaine (2005)	Examines the critical success factors (CSFs) in adopting KM in SME companies in Malaysia.
Chong (2006)	Examines the level of perception and implementation of 11 KM success factors of ICT companies in Malaysia.
Wei, Choy, and Yeow (2006)	Assesses the perceived importance and actual implementation of five preliminary KM success factors in the Malaysian telecommunication industry.
Zoo and Aziz (2006)	Examines how knowledge is acquired, stored, transferred, applied and protected by Malaysian companies in the oil and gas industry.
Gan, Ryan, and Gururajan (2006)	Reports the 'soft' enablers of KM in Malaysian Multimedia Super Corridor (MSC) status companies.
Zailani, Ong, and Shahnon (2006)	Investigates the influence of ICT on KM in Malaysian SMEs.
Tat and Hase (2007)	Examines the existing knowledge practices, use of KM as a strategic tool, and factors affecting the use of KM in the Malaysian aerospace industry.
Chong, Chong, and Wong (2007)	Assesses the perceived importance and actual implementation of four KM strategies, i.e. culture, leadership, information technology, and measurement, in the Malaysian telecommunication industry.

The review revealed that numerous studies have been carried out to investigate KM initiatives in a number of specific industries. These include studies on KM initiatives in the aerospace industry (Tat and Hase 2007), the telecommunication industry (Chong, Chong, and Wong 2007; Wei, Choy, and Yeow 2006), the oil and gas industry (Salleh, Richardson, and Narayanan 2003; Zoo and Aziz 2006), ICT industry (Chong 2006), electrical and electronics based industry (Kumar 2003), public sector organisation (Syed-Ikhsan and Rowland 2004), and small and medium enterprises (Wong and Elaine 2005; Zailani, Ong, and Shahnon 2006). With the exception of the study conducted by Rahman (2004), which was an investigation on the electronics industry, educational institutions, SMEs, private companies, and government ministries, departments, and agencies, it is evident that the majority of these studies had investigated specific industries' KM initiatives in isolation. The following sub-section discusses the importance of managing knowledge in the Malaysian organisations' context.

3.2.1 The importance of KM to Malaysian organisations

With respect to the Malaysian businesses, research has shown that 'knowledge is a necessity and can be used as a strategic tool against competitors' (Naquiyuddin, Teong, and Heong 1992, p. 72). Since then, numerous studies exploring the Malaysian KM practices have highlighted the importance and benefits of KM to the local organisations (Bontis, Keow, and Richardson 2000; Hegde and Shapira 2007; Helmi 2002; Rahman 2004). These studies have identified that it is very important for Malaysian organisations to manage knowledge effectively for a number of reasons. For example, through proper management, knowledge could be used to maximise the performance and accelerate the growth of an organisation. Further, KM, which was identified as a valuable strategic tool in Malaysia, is particularly useful in helping these organisations to make more informed decisions mainly for the formulation of new business strategies (Salleh, Richardson, and Narayanan 2003).

Nevertheless, perhaps the most important reason to manage knowledge in Malaysian organisations is the need to develop new areas of growth in the knowledge-intensive areas in line with the nation's shift to a knowledge-based economy (Gan, Ryan, and Gururajan 2006; Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004). Malaysia needs to develop new areas of growth in the knowledge-intensive service sector as the reliance on manufactured goods and the export of traditional commodities will not be adequate to generate future growth for the Malaysian economy (Gan, Ryan, and Gururajan 2006; Wee 2001b). It is projected that through a knowledge-based economy, the level of the country's Gross Domestic Product (GDP) can increase fourfold within 20 to 25 years (Mustapha and Abdullah 2004).

The Knowledge-based Economy Master Plan (KEMP) introduced at the end of the year 2002, proved that the Malaysian government is very serious about transforming Malaysia from a production-based economy, a P-economy, to a knowledge-based economy, a K-economy (Syed-Ikhsan and Rowland 2004). The KEMP defines K-economy as 'an economy in which knowledge, creativity and innovation play an ever-increasing and important role in generating and sustaining growth' (ISIS 2002, p. 1). The K-based Economy Development Fund initially amounted to RM2 billion (approximately USD0.64 billion). The fund was operated through the relevant channels for financing up to RM300 million (approximately USD96.5 million) of grants for commercialisation of R&D, technology adoption grant, human resource and entrepreneurship development, and for the accessing of concessional loans of up to RM1.7 billion (approximately USD0.6 billion) (ISIS 2002).

In line with the KEMP, the Malaysian private sector was called to create new value by developing capacity to undertake R&D, product development and innovation, as well as package, market, and distribute their products and services efficiently. To succeed, these organisations were urged to adopt best practices and benchmark themselves at a higher level within their respective industries (Wee 2001b). Thus, in order to respond to this call by the government, research has suggested that effective KM can help the Malaysian organisations to deal with the lag of product development and innovation across the nation (Hegde and Shapira 2007; Shapira et al. 2006).

Additionally, managing knowledge is important for these organisations, as a smooth transition from labour to technology intensive, and to a knowledge-based economy, would enable the nation to compete effectively in the East Asia region for foreign direct investment or FDI (Yu 2004). Failure to manage knowledge effectively in Malaysian organisations would result in the undermining of efforts to increase the competitiveness of Malaysian industries in attracting FDI for the knowledge-based economy that is being aggressively pursued by the country (Kumar 2003). In order to compete in a knowledge-based economy, an organisation must be able to innovate more quickly than its competitors, as products consisting of a high knowledge element would have a greater growth potential and thus generate higher returns than other products (Salleh, Richardson, and Narayanan 2003).

In brief, the preceding discussion in this section suggests that managing knowledge effectively is very important for Malaysian businesses to attain sustainable competitiveness, by means of a higher level of innovation, to achieve a knowledge-based economy. The next section discusses the current KM practices in Malaysian organisations.

3.2.2 KM practices in Malaysian organisations

Numerous studies, as listed in Table 3-1, have attempted to understand the nature of KM practices in Malaysian organisations by investigating the KM initiatives implemented in these organisations. For example, an investigation into the electrical and electronics-based organisations in Malaysia revealed that there was a lack of defined and explicitly identified KM strategy in place (Kumar 2003). Similar findings have also been reported by Syed-Ikhsan and Rowland (2004) in their investigation in a public organisation, in which it was revealed that the organisation did not have any specific formal KM strategy. Despite the absence of a formal KM strategy, it was learned in the study that knowledge in the organisation was extracted and made available in the form of the organisation's procedures and policies, job manual procedures, ISO 9002 documents, desk files, work flows and databases.

Although findings from the above studies reported a general inadequacy of explicit KM strategy, an exploratory study on KM initiatives in various Malaysian industries—comprised of the electronics industry, educational institutions, small and medium enterprises (SMEs), private companies, and government ministries, departments, and agencies—indicated that out of 303 organisations investigated in its survey, nearly half of them reported that they had already established formal KM initiatives in their respective organisations (Rahman 2004). This finding illustrates that KM is prevalent in Malaysian businesses, and may have been driven by a greater awareness of the need for and importance of KM in Malaysian organisations as discussed earlier.

In addition, several relatively recent studies have shown that the awareness and understanding of the importance of KM in Malaysian organisations have improved in recent years (Chong, Chong, and Wong 2007; Wei, Choy, and Yeow 2006; Zoo and Aziz 2006). For example, an exploratory study into four Malaysian oil and gas contractors by Zoo and Aziz (2006) reported that all companies investigated in the study were seen to be actively managing their knowledge. Moreover, the study indicated that apart from organisational culture and structure, which appear to be the main impetus for the success in KM, the high levels of interaction with and application of IT to support knowledge transfer activities were also a part of the common features of these companies.

Similar findings were also reported by two studies of KM in the telecommunication industry in Malaysia (Chong, Chong, and Wong 2007; Wei, Choy, and Yeow 2006). A high level of awareness of the importance of the preliminary KM success factors, such as leadership, organisational culture and structure, technology, knowledge team, knowledge audit, and knowledge map was reported in both studies. Emphasis on linking KM strategy with business objectives and forming a more flexible organisational structure to allow knowledge flow within the organisation were already observed in these organisations. However, both studies have reported that although the KM success factors are perceived as important for their KM, most of them were only moderately or minimally implemented.

Based on the preceding discussion, it seems that although the awareness of the importance of having an adequate KM strategy to address the various success factors in KM implementation is increasing in Malaysian organisations, they all fall short in their actual implementation. Strategies such as technology, culture and leadership are still moderately implemented, with KM performance measurement being the least implemented factor (Chong, Chong, and Wong 2007; Wei, Choy, and Yeow 2006). The section below discusses IT, which is the technological success factor for KM as identified by the above studies, in order to facilitate this study's investigation of the use of IT for KM in Malaysian organisations.

3.3 THE USE OF IT IN MALAYSIAN KM

Prior research has shown that Malaysian organisations generally perceive IT as an important element in their organisations (Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004; Tan 2004; Zailani, Ong, and Shahnon 2006). For example, Syed-Ikhsan and Rowland (2004) reported that the majority of respondents from a public organisation in Malaysia believed that developing an organisational database of information and knowledge was vital in developing a successful knowledge management system (KMS) in their organisation. Similarly, it was indicated by Tan (2004), that managers in Malaysian Enterprise 25 award winners perceived the effective management of IT as critical towards their organisations' KM success. This perception is confirmed by the utilisation of some form of KM system in these organisations. Research in the Malaysian SMEs has also provided some empirical evidence on the relationship between companies with more favourable attitude toward adopting IT with having more effective KM (Zailani, Ong, and Shahnon 2006). The role of IT in Malaysian KM is discussed in more detail in the following sub-section.

3.3.1 The role of IT in Malaysian KM

Tan (2004) describes that in the Malaysian Top 25 enterprises, IT is mainly utilised for the purpose of documenting; designing; communication; internal and external knowledge searching; knowledge capturing, storage, and sharing; and research and development. In his study, the Internet emerged as the most commonly used IT-based system to support knowledge searching and transferring activities in these companies. Next to the Internet, other IT-based systems to support KM that were commonly used by these companies were document management systems and work flow systems, while KM systems such as groupware and decision support systems were found to be less common in these companies. The study also indicated that a number of the organisations studied had relied on setting up business systems, such as Supply Chain Management (SCM), Customer Relationship Management (CRM), and Enterprise Resource Planning (ERP) in order to determine the type of knowledge that their organisation would need in realigning the organisation's strategy.

In relation to the role of IT in Malaysian KM, a study on KM in various industries in Malaysia indicates that IT plays the basic and pivotal role in providing the physical support in terms of the infrastructure for KM (Rahman 2004). The technical role of IT came into play especially in addressing the aspects of individuals' communication within, as well as across, the organisations, involving technologies such as the Internet, intranet, and extranet. Additionally, these technologies also provide the required platform for online knowledge repositories that enable knowledge access and transfer between individuals.

In addition to providing the physical support and infrastructure, IT is also perceived as an important element for developing and gaining knowledge in Malaysian KM. For example, email emerges as the most important IT-based system to develop and gain knowledge as indicated by numerous studies (Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004). Apart from that, email is also reported as an important tool to disseminate knowledge within an organisation (Salleh, Richardson, and Narayanan 2003).

Table 3-2 provides a summary of IT-based systems that are utilised by Malaysian organisations to support their KM activities as identified by several studies.

Table 3-2 IT-based systems used to support Malaysian KM

Author	IT-based systems used for KM
Salleh, Richardson and Narayanan (2003)	Email, technical libraries, intranet, electronic storage of processes and manuals
Syed-Ikhsan and Rowland (2004)	E-mail, online knowledge repositories and Internet
Rahman (2004)	Internet, intranet, groupware, data warehousing and mining, extranet and unifying messaging system
Tan (2004)	Internet, document management system (purchasing and accounts system, production planning, quality procedures), groupware, decision support system
Salleh and Ahmad (2006)	Intranet, Internet, groupware
Zailani, Ong, and Shahnon (2006)	Internet, online knowledge resources, knowledge databases, document management systems

This section described the role of IT in Malaysian organisations' KM. The following section discusses how IT can address several issues in Malaysian organisations' KM.

3.3.2 Issues in Malaysian KM that can be addressed by IT adoption

A number of challenges have been identified by prior studies of Malaysian KM that may possibly be addressed by enhancing the use of IT in Malaysian organisations. The first challenge identified is the difficulty in retaining talented employees, which has led to knowledge loss in Malaysian organisations (Salleh, Richardson, and Narayanan 2003). The study indicated that this problem commonly occurred when an organisation was going through downsizing exercises, an unfortunate phenomenon that was quite common during the recent Asian economic crisis, where many businesses were closed, merged or taken over. In this situation, senior, and incidentally more experienced employees, would normally become the priority target of headcount reduction programmes, which results in the loss of those people with the most valuable experience (Coulson-Thomas 1997). Moreover, in times of uncertainty, many people with specific expertise would choose to leave their organisations in view of better opportunities elsewhere. In this instance, the study pointed out that loss of valuable knowledge could have been avoided if knowledge of such experts and skilled workers were preserved, documented, and made available for others to use (Salleh, Richardson, and Narayanan 2003).

In relation to the above issue, another challenge identified by a number of studies, is the need to preserve tacit and/or implicit knowledge in explicit form (Kumar 2003; Tan 2004). These studies reveal that the majority of Malaysian organisations, which have taken steps to incorporate KM concepts within their organisations, tend to take on a more 'human-oriented' approach that focuses on the direct sharing and exchanging of tacit knowledge between individuals. The studies suggest that in order to derive sustainable competitive advantage in a volatile business environment, KM should be undertaken more explicitly to develop better business strategy. Thus, if the human-oriented KM strategy is not backed up with the codification of tacit knowledge into an explicit form, this KM strategy may prove to be unsustainable in the long term (Kumar 2003; Tan 2004).

In addition, in order to enhance the cross and inter-functional integrations within these organisations, research has also stressed the need for Malaysian organisations to adopt a technologically-oriented approach to KM, by intensifying the codification of tacit knowledge (Kumar 2003). Moreover, a technologically-oriented KM approach would facilitate a more effective flow of organisational knowledge between different parts of an organisation and assist in the identification of new prospects or threats across markets and geographical regions. These organisational capabilities are considered to be extremely important for Malaysian organisations' sustainable competitiveness in the East Asia region (Yu 2004).

The enhancement of the level of IT use to support KM in Malaysian organisations is further justified by the economic growth through a transition from a P-economy to a K-economy. The K-economy, which is currently pursued by the Malaysian government, has brought new challenges for organisations to attain the technological levels required for the development of their human resources into skilled knowledge workers (Ahmed 2006). This requires the ability of the organisations to diffuse knowledge among their workers in the best possible ways. Thus, regardless of the business they are in, the challenge for Malaysian organisations is to use IT to improve their economic models by strengthening their business using various enabling tools, such as the Internet, to support the diffusion of knowledge (Wee 2001a).

In brief, the discussions in this section identify several issues that can be addressed by the augmentation of the adoption or use of IT in the Malaysian organisations' KM strategy. Given this understanding, the next section specifies the research problem identified in this study.

3.4 RESEARCH PROBLEM AND QUESTION

Even though the availability of IT-based systems is rather common in most Malaysian organisations, several studies have shown that these applications and tools may not be optimally utilised (Chong 2006; Chong, Chong, and Wong 2007; Salleh and Ahmad 2006). For example, Salleh and Ahmad (2006) indicated that the high level of perceived importance of IT-based systems for KM in the local authorities' organisations in Malaysia did not reflect the actual utilisation of these systems to support knowledge sharing activities in the organisations. Although these organisations expressed the same level of agreement on the importance of electronic modes of communication channels, such as intranets, the Internet, and groupware for sharing knowledge, focus in these organisations was still on using the traditional modes or non-electronic types of communication channels. For example, face-to-face meetings and paper documentation, such as circulars, letters, and internal memos, were mainly utilised for the purpose of sharing and dispersing knowledge within and between the departments in these organisations (Salleh and Ahmad 2006).

A similar phenomenon was also reported in the ICT organisations in Malaysia, in which IT infrastructure was found to be only moderately implemented to achieve KM goals (Chong 2006). The study indicated that the low uptake of IT to support KM could be attributed to the fact that many organisations were still evaluating the relevant technologies to be used for their KM programmes, and hence the perceptions that the current IT infrastructure was sufficiently supporting their KM initiatives. Moreover, a study by Chong, Chong, and Wong (2007) has provided some empirical evidence showing that although IT is rated as the most important factor for KM strategy in the telecommunication industry in Malaysia, a significant gap is identified between the degree of importance and the actual implementation of IT in their KM initiatives.

As depicted in Figure 3-2, the challenges in Malaysian KM that were discussed above suggest that Malaysian organisations should focus on efforts to enhance the adoption of IT for KM with the purpose of bridging the gap between the perceived importance and the actual use of IT to support their KM initiatives.

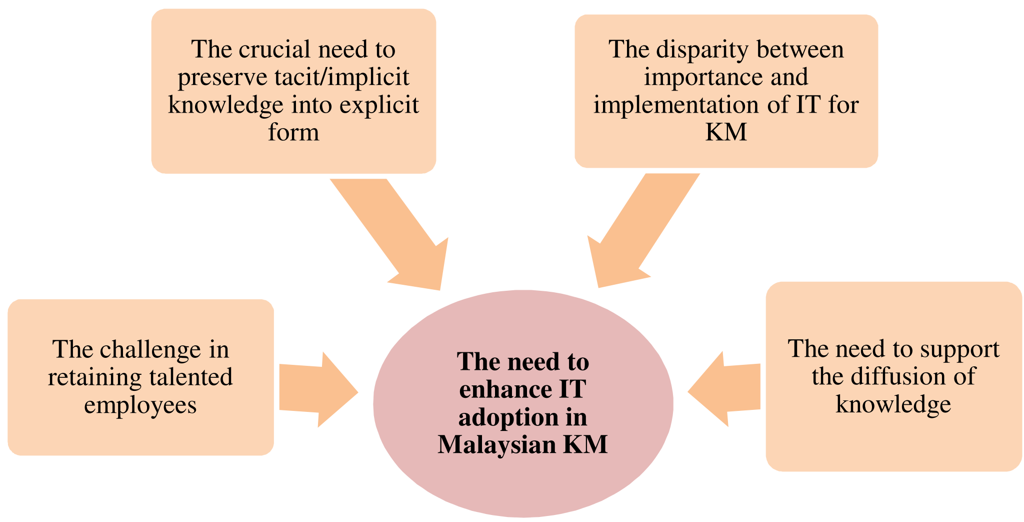


Figure 3-2 Issues in Malaysian KM that call for IT adoption for KM

Thus, based on the preceding discussions the following research problem was identified in this study:

Research Problem: 'The low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations'

Motivated by this problem, this study aimed to identify the factors that could enhance the level of IT use for KM in Malaysian organisations. The next sub-section presents the research question formulated in order to address the research problem identified.

3.4.1 Research question

Despite there being some research on Malaysian KM in the past few years, none has specifically looked at the use of IT-based systems to support KM in Malaysian organisations. Based on a review of extant literature on KM practices in Malaysia as discussed in the previous section, it is recognised that there is a need to understand the critical factors that could enhance the use of IT to support KM in Malaysian organisations. This need is especially crucial when research has shown that IT is being perceived as an important enabler to Malaysian KM initiatives.

Section 2.6 of Chapter 2 (Literature Review) highlighted that the high number of failures in deploying IT-based systems to support KM can be explained by a lack of attention to human and organisational factors (McDermott 2000). Similarly, research has also suggested that organisations should look beyond the deployment of IT and take into account other factors, such as structures, processes and culture within the organisation, which could work together in shaping and encouraging the use of IT for KM success (Kulkarni, Ravindran, and Freeze 2007). Thus, this study attempts to investigate the organisational factors that could enhance the level of IT use for KM in Malaysian organisations.

The review of the literature on Malaysian KM also revealed that the majority of prior research has targeted specific industries in isolation (Chong 2006; Chong, Chong, and Wong 2007; Gan, Ryan, and Gururajan 2006; Kumar 2003; Salleh, Richardson, and Narayanan 2003; Syed-Ikhsan and Rowland 2004; Tat and Hase 2007; Wei, Choy, and Yeow 2006; Wong and Elaine 2005; Zoo and Aziz 2006). Due to the fragmented and scant amount of literature on KM in Malaysia, it is urgent that studies on Malaysian KM in a more general context be conducted. Thus, in selecting the target organisations for this study's investigation, it is useful that the organisations meet certain criteria as follows:

(i) they should cover a range of industries that can represent a broader context of Malaysian organisations;

(ii) they should contribute to a significant percentage of the nation's economy; and

(iii) they should generally be medium to large size companies that have invested in IT infrastructure and systems to support their operations.

After a scrutiny of the available databases of Malaysian organisations, it was decided that the Malaysian publicly listed organisations would be the most appropriate sample to represent the target population of this study. For example, this type of organisation meets the required criteria as these organisations are generally medium to large size companies within various industries in Malaysia.

In addition, the economic planning unit of Malaysia (Economic Planning Unit 2010a) reports that RM25 billion (approximately USD8 billion) worth of turnover was generated across the listed organisations in 2009, which indicates that a significant portion of the Malaysian economy stems from the earnings of these organisations. Thus, these organisations play a significant role in the nation's capability of attaining a knowledge-based economy. A list of all Malaysian publicly listed organisations can be found on the Kuala Lumpur Stock Exchange company database at the Bursa Malaysia website (Bursa 2008). Table 3-3 indicates the profiles of Malaysian listed organisations based on their types of industry as listed on the Bursa Malaysia website, as at March, 2008.

Table 3-3 Profiles of Malaysian listed organisations: types of industry

Main Industry	Sub-industry	No. of Companies
Manufacturing		
	Consumer products	108
	Industrial	177
	Machinery	50
	Motor vehicles & Transport equipment	21
	Electrical /Electronics/Computer/ Telecommunication equipment	45
Agriculture & Logging		74
Oil & gas and Mining		27
Construction		84
Property development & Real estate		108
Financial services		53
IT services		74
Management services & consultancy		26
Telecommunication services		13
Services		71
Transportation & Logistics		32
Infrastructure & Utility		15
Others		16
		Total: 994

Source: (Bursa 2008)

Based on the need to understand the organisational factors that could enhance the use of IT for KM in Malaysian organisations as acknowledged in the preceding discussions, the major research question formulated for this study is as follows:

Research Question: 'What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?'

Further, the major research question is broken up into two minor questions to provide a focus for this study's investigation:

- Research minor question 1: what are the organisational factors that enhance the use of IT to support KM?
- Research minor question 2: how do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?

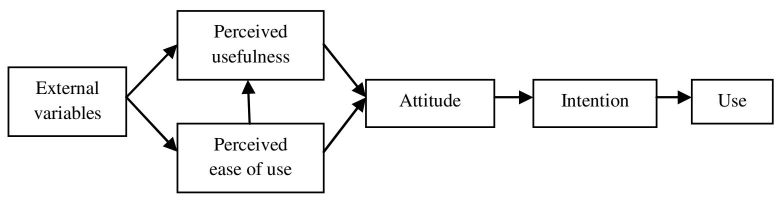
Having presented the research question, the next section discusses the theoretical background used as the basic framework for this research.

3.5 THEORETICAL BACKGROUND

It is important to note that as the main focus of this research is on IT adoption for KM, the focus of the study's investigation remained on the organisational factors that could enhance IT adoption for KM in the targeted organisations, and not on organisational factors that could enhance KM or KMS success. Additionally, the aforementioned general aim of studying the organisational factors that could enhance the level of IT adoption for KM can be translated into the objective of studying the organisational factors for the acceptance and use of IT to support KM.

Among the different research models developed in the attempt to understand technology usage or acceptance, the most well known is the technology acceptance model or TAM (Davis 1989), which has been successful in explaining the usage of information systems (Venkatesh and Davis 2000). TAM was originally conceived by Fred Davis in 1986, based on Fishbein and Ajzen's (1975) theory of reasoned action (TRA), and has received extensive empirical support through validations, applications, and replications. For example, the TAM has been widely adopted in a variety of field settings and across a broad range of IS applications such as email (Venkatesh and Davis 1996), spreadsheets (Adams, Nelson, and Todd 1992), microcomputer usage (Igbaria, Guimaraes, and Davis 1995), group support systems (Chin and Gopal 1995), and expert systems (Keil, Beranek, and Konsynski 1995). In addition to being proven effective in a number of different organisational contexts and for studying different types of computer based systems (Legris, Ingham, and Collerette 2003), TAM has also been adopted by some research specifically investigating KM systems (Kuo and Lee 2009; Money and Turner 2005; Quaddus and Xu 2005; Vitari et al. 2007; Wu and Li 2007; Xu and Quaddus 2007).

TAM in its original form, shown in Figure 3-3, aims at minimising the number of factors used to explain the determinants of technology acceptance while preserving the generality of the model. TAM was theoretically justified using the theories of the adoption of innovations, the cost-benefit paradigm, expectancy theory, and self-efficacy theory to explain user behaviour in information systems (IS) usage across a broad range of computing technologies (Davis 1989). TAM suggests that perceived usefulness of a system and perceived ease of use are the major determinants that affect an individual's attitude and intention to use the system. Perceived usefulness is defined as 'the degree to which a person believes that using a particular system would enhance his or her job performance' (Davis 1989, p. 320), whereas perceived ease of use is defined as 'the degree to which a person believes that using a particular technology would be free of effort' (Davis 1989, p. 320). Perceived ease of use is also suggested to have a positive impact on perceived usefulness.



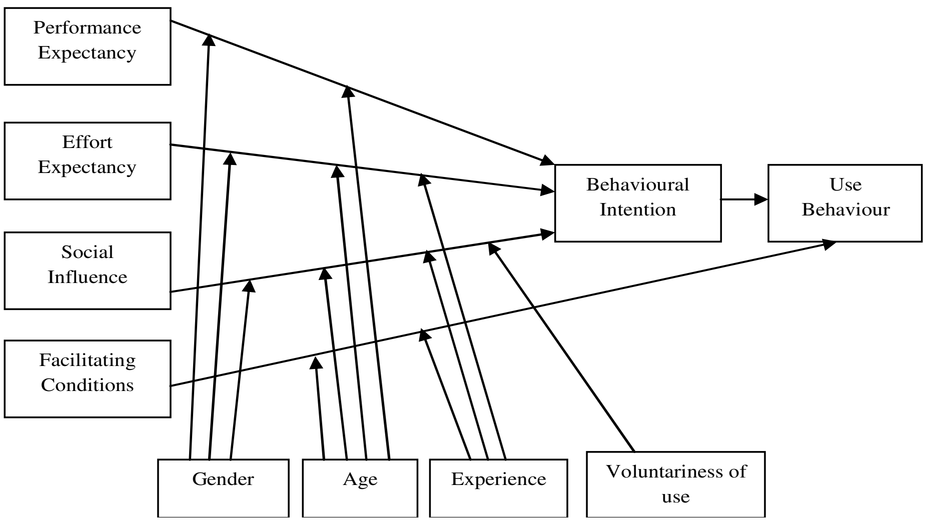
Source: (Davis, Bagozzi, and Warshaw 1989, p. 985)

Figure 3-3 The technology acceptance model (TAM) in its original form

Research efforts have been devoted to extending TAM in the investigations of various types of technology acceptances, within various contexts. For example, research has extended TAM in a number of ways, which include by introducing factors from related models; by introducing additional or alternative belief factors;

and by examining external variables that are antecedents and moderators of perceived usefulness and perceived ease of use (Wixom and Todd 2005).

In 2003, a group of leading technology acceptance researchers identified the need to formulate a unified view of user acceptance (Venkatesh et al. 2003). Accordingly, the Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated based on conceptual and empirical similarities across eight competing technology acceptance models. Venkatesh et al. (2003) indicate that UTAUT represents the more comprehensive model of technology acceptance and outperforms all eight individual models in their review, by explaining 70% of technology acceptance behaviour. As shown in Figure 3-4, UTAUT contains four core determinants of intention and usage, which include performance expectancy, effort expectancy, social influence and facilitating conditions. Additionally, the variables of gender, age, experience and voluntariness of use moderate the key relationships in the model.



Source: (Venkatesh et al. 2003, p. 447)

Figure 3-4 The UTAUT model

3.5.1 Why not UTAUT

It appears that UTAUT has been applied to a number of different systems, such as mobile application software (Han et al. 2006; Lu, Yu, and Liu 2009; Yang 2010) , e-government services (AlAwadhi and Morris 2008), and information technology in general (Al-Gahtani, Hubona, and Wang 2007; Bandyopadhyay and Fraccastoro 2007; Neufeld, Dong, and Higgins 2007). A number of studies have also extended UTAUT to incorporate other antecedent factors of user acceptance, as well as other moderating variables, in order to cater for different contexts such as technology acceptance in telecentre projects (Abdulwahab and Dahalin 2010) and by occupational therapists (Schaper and Pervan 2007). Further, a study by Sun and Zhang (2006) has extended UTAUT to incorporate the cultural background of a country as a factor that moderates the effects of 'perceived usefulness' and 'subjective norm' on 'behavioural intention' to use a technology. However this study was still at a preliminary analysis. Thus, UTAUT has been applied to a number of different types of systems and extended to suit several contexts. However, at this stage there is still limited application of this model by other researchers, especially to specific KM systems. Moreover, UTAUT's authors acknowledged that the items and scales used to measure the core constructs need to be further developed and validated (Venkatesh et al. 2003). This indicates that recurrent testing and application of this model to various technologies, within various contexts by different groups of users is needed.

Apart from the limited application of UTAUT, particularly in the KM systems' context, a major determining factor in choosing a suitable technology acceptance model in this current study was its main research objective. The research objective of the current study was to investigate the organisational factors influencing the use of IT for KM in Malaysian listed organisations. Thus, specific contextual factors pertaining to the organisations should be taken into account (Sun and Zhang 2006). Accordingly, it was decided that the augmentation of a number of organisational factors into TAM should provide the basic and sufficient framework as a foundation for this research investigation.

In addition, it seems that the identified organisational factors that could enhance the adoption of IT for KM that were garnered in section 3.5.2, such as knowledge sharing culture, policies and procedures, and management support and commitment, could actually encompass the 'social influence' and 'facilitating conditions' dimensions in UTAUT. Further, the 'performance expectancy' and 'effort expectancy' dimensions of UTAUT were also already considered in this study, and were operationalised by the 'perceived benefits of using IT for KM' and 'perceived ease of use of using IT for KM' constructs, as further described in the next section, section 3.5.1.

Finally, the moderating effects of gender, age, experience, and voluntariness of use in the UTAUT model were not considered to be as relevant as the effects of organisational factors in the current study, as the level of investigation of this study remained on the adoption of IT for KM by Malaysian listed organisations instead of the adoption of an individual user. In brief, the preceding discussion provides the justifications for not choosing UTAUT in this study and instead, despite its parsimony and simplicity, TAM was considered to be a sufficient and comprehensive model that could serve the purpose of providing the basic framework for the current study's investigation. The next sub-section discusses the application of TAM in this study.

3.5.2 The application of TAM in this study

A number of studies of TAM in the KM systems' context were reviewed in order to further understand the application of TAM in IT-based systems for KM context (Kuo and Lee 2009; Money and Turner 2005; Ong et al. 2005; Vitari et al. 2007). These studies have provided evidence for the effects of the perceived usefulness and perceived ease of use constructs on intention to use KM systems (Money and Turner 2005; Ong et al. 2005). Further, the effects of the perceived ease of use construct on intention to use were also found to be either directly or indirectly through its effects on perceived usefulness.

Money and Turner (2005) suggested that attitude could be eliminated from TAM in order to create a more parsimonious model by reflecting a direct influence of usefulness and ease of use perceptions on intention to use KM systems. The justification of this direct effect was provided by Davis, Bagozzi, and Warshaw (1989) who stated that if users had a sufficiently strong perception that using technology would enhance their job tasks, then users may decide to accept and use technology, regardless of their attitude towards it (Money and Turner 2005). Further, the elimination of both attitude and intention constructs from the TAM model was also supported by Vitari et al (2007), whose study's findings indicated that both constructs could explain the use of a KM system only to a little extent.

In addition, the applications of TAM in KM systems' user acceptance have revealed that the relationship between an individual's intention to use a system and the system's usage was low when the individual has been introduced to the system for an extended period of time (Money and Turner 2005). Moreover, research by Davis, Bagozzi, and Warshaw (1989) suggested that the link between intention and system usage was negatively correlated with the elapsed time between the measurements of intention and use. This suggested that users who had been using a technology for an extended period of time would have already formed their beliefs regarding the usefulness and ease of use of the technology, therefore reducing the effects of intention to use with their actual use of the technology (Money and Turner 2005).

Similarly, research by Straub, Limayem, and Karahanna-Evaristo (1995) also indicated that the TAM intention to use construct was only critical in a research stage where users were associated with a brief introduction to the technology. Thus, as this study investigates the use of IT-based systems that have already been implemented in the targeted organisations, the TAM constructs that are considered relevant to this study are perceived usefulness, or benefits, of using IT for KM and perceived ease of use of IT for KM. More specifically, these constructs are proposed to influence the extent of adoption, or use of IT, to support KM in Malaysian organisations. Further, past research has provided evidence that perceived ease of use has a significant effect on intention to use technology either directly or indirectly, through its effects on perceived usefulness (Kuo and Lee 2009; Money and Turner 2005; Ong et al. 2005). Thus, with the Malaysian listed organisations identified as the target population of this study, as indicated in section 1.8 of Chapter 1 of this thesis, the following hypotheses are proposed to reflect the relationships between these constructs and the extent of IT use for KM in Malaysian listed organisations:

Hypothesis 1: *Perceived benefits of using IT for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

Hypothesis 2a: *Perceived ease of use of IT to support KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

Hypothesis 2b: Perceived ease of use of IT to support KM has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations.

As discussed in section 2.6 of Chapter 2, IT support for KM adopted by an organisation must be complemented by a set of organisational mechanisms that encourage and promote the sharing or reuse of organisational knowledge (Kulkarni, Ravindran, and Freeze 2007). This suggests that the acceptance and usage of IT-based systems for KM represent a more complex phenomenon than the acceptance of general systems and should involve other factors, such as structures, processes, and culture within an organisation.

In addition, as cautioned by Money and Turner (2005), although previous TAM-based user acceptance research can serve as a basis for investigation of KM systems' user acceptance, other factors related to the KM systems' complex social and cultural organisational implications must also be explored. Thus, it is necessary to explicate the set of factors that fall under the name *external variables* in TAM, which in this study are identified by a set of organisational factors that influence the level of IT adoption or use for KM. The principle of TAM proposes that the effects of organisational factors as external variables in TAM, on a system usage, are mediated by the individual's perceived usefulness and perceived ease of use constructs (Davis 1989).

While beliefs are internal constructs, organisational factors are external constructs that may be controlled by means of appropriate managerial intervention (Lewis, Agarwal, and Sambamurthy 2003). Although the concept of technology usage is widely accepted, through TAM, as a condition for systems' acceptance, identifying the organisational factors that determine such acceptance is a more challenging task.

This section described the application of TAM in the study. The following section attempts to identify the organisational factors that could enhance IT use for KM based on a review of the relevant literature.

3.5.3 Organisational factors for the use of IT for KM

Among the multidisciplinary concepts that KM draws upon are organisational learning, organisational behaviour, organisational strategy, and sociology (Argote, McEvily, and Reagans 2003). The multi-faceted nature of KM suggests that merely providing IT-based systems to support the management of knowledge in an organisation does not guarantee that users will use the systems to support their activities of managing knowledge. Hence, careful attention must be paid to other socio-cultural and organisational factors that can influence the use of these IT-based systems to support KM in an organisation.

Xu and Quaddus (2007), in their study, identified four variable categories that could influence KM systems adoption. These categories include individual factors, task complexity, organisational factors, and organic growth. Among these four categories, the focus of this study remains specifically on the organisational factors influencing the extent of IT use for KM. In this study's context, the organisational factors are treated as those internal factors that may be controlled by means of appropriate managerial intervention (Lewis, Agarwal, and Sambamurthy 2003). On the other hand, external factors, such as environmental influences, are not taken into account in this study as an organisation would have little control over them.

In order to identify a list of organisational factors that could enhance IT use for KM, a review of the literature related to the use of IT for KM and the adoption of KM systems was conducted. The reviewed studies of adoption or use of KM systems were of studies of general KM systems and not of specific KM systems, such as group support systems or expert systems, as the focus of this study was on the general IT-based systems to support KM.

A narrative synthesis approach was used to compile the organisational factors investigated and/or mentioned in the individual studies and building them into a table (Hammersley 2001). The synthesis approach is a process by which the results are brought together in order to answer the question posed by the review (Gough 2004). The narrative synthesis approach is particularly suitable for this review, as the sample of the studies reviewed includes both quantitative and qualitative contributions.

The review has revealed 16 related works of the investigation of KM systems, which have provided a list of organisational factors impacting the extent of IT-based systems for KM that are based on theoretical and empirical support. In particular, some of them have derived their sets of factors from both qualitative and quantitative methods (Jennex and Olfman 2004; Kulkarni, Ravindran, and Freeze 2007; Vitari et al. 2007), others have developed their sets from quantitative surveys (Halawi, McCarthy, and Aronson 2008; Kankanhalli, Tan, and Wei 2005; Lai 2009; Purvis, Sambamurthy, and Zmud 2001; Subramaniam and Soh 2009), and the rest have suggested their sets based on qualitative investigations (Benbya and Belbaly 2005; Butler, Heavin, and O'Donovan 2007; Damodaran and Olphert 2000; Desouza 2003; Hendriks 2001; Huysman and Wit 2004; Moffett, McAdam, and Parkinson 2004; Nevo and Chan 2007). By incorporating all of these previous works, 12 organisational factors resulting from IT use for KM initiatives were identified.

It is also worthy to note here that certain factors, for example organisational structure, although being investigated in the reviewed literature (Vitari et al. 2007), are not included in this study due to a number of reasons. Firstly, findings from the literature have shown a weak support for the organisational structure factor. Secondly, it would be difficult to operationalise organisational structure and develop a measurement that can be applied across all Malaysian listed organisations as these organisations cover a broad range of industries. Consequently, organisations from different types of industries may require different types of organisational structure, which are typically based on the core functions or processes that reflect their logical functions and key processes, in order to effectively facilitate their operations (Butler, Heavin, and O'Donovan 2007). Notwithstanding this omission, Table 3-4 lists the organisational factors gathered from the synthesised literature, according to their rank, which is based on the number of sources citing them. As can be seen in the table, some of the factors were found to have similar meaning, and hence were grouped under the same theme.

Table 3-4 Organisational factors for IT use for KM

Organisational Factors	**Management Support & Commitment** —Dedicated roles and skills for managing knowledge —Perception of IT value in KM —Having an adequate KM budget	**Rewards and Incentives**	**Knowledge Sharing Culture** —Enjoy helping others	**Knowledge Classification** —Value and quality of knowledge	**Institutionalisation of IT Use into Normal Work Practice** —IT Integration —Having policies, procedures, and guidelines for using IT for KM
Damodaran and Olphert (2000)	X		X	X	X
Hendriks (2001)				X	
Purvis, Sambamurthy, and Zmud (2001)	X				
Desouza (2003)			X		
Moffett, McAdam, and Parkinson (2004)	X	X			
Huysman and Wit (2004)					X
Jennex and Olfman (2004)	X	X	X	X	X
Benbya and Belbaly (2005)	X	X	X		X
Kankanhalli,Tan , Wei (2005)		X	X		
Nevo and Chan (2007)	X	X		X	X
Kulkarni, Ravindran, Freeze (2007)	X	X	X	X	
Butler, Heavin, and O'Donovan (2007)	X	X	X	X	
Vitari et al. (2007)	X	X	X		
Halawi, McCarthy, and Aronson (2008)				X	
Lai (2009)		X			
Subramaniam and Soh (2009)	X	X	X		
Frequency	**10**	**10**	**9**	**7**	**5**

During the identification, all factors under the same theme—such as dedicated roles and skills for managing knowledge; management's perception of IT value; and having an adequate KM budget—were grouped together under the heading of management support and commitment. Similarly, IT integration and policies, procedures, and guidelines for IT use were grouped under the heading of institutionalisation of IT use into work practice.

Based on the analysis in Table 3-4, the items that appeared the most number of times were management support and commitment, and rewards and incentives. These two factors are cited ten times by the studies reviewed. The next most cited organisational factor, in the analysis, is knowledge sharing culture, which is cited nine times by the studies. Thus, this indicates that the main focus of prior research was targeted on the managerial, culture, and human factors for a successful implementation of KM systems in the organisations. These organisational factors are followed by knowledge classification, cited seven times out of sixteen, indicating that IT should be used by organisations to leverage the right and relevant knowledge needed in achieving their business objectives. The last organisational factor appears to be institutionalisation of IT use into normal work practice. Although this factor appeared the least in the reviewed literature, it was still given moderate attention indicating that it is worthwhile for its impact on the level of IT use for KM to be investigated and confirmed. It should be noted that the difference in the level of emphasis given upon these organisational factors could be due to the diversity of the researchers' background and focus.

In general, the organisational factors can be grouped into five dimensions:

i. management support and commitment;

ii. rewards and incentives;

iii. knowledge sharing culture;

iv. knowledge classification; and

v. institutionalisation of IT use into normal work practice

The following sub-sections discuss each of the dimensions in more detail.

3.5.3.1 Management's support and commitment

Research has indicated that management's support of the use of IT to support KM in an organisation can be seen in the amount of funds that are allocated for IT resources, training, and infrastructure to support KM initiatives (Davenport, De Long, and Beers 1998; Jennex and Olfman 2004; Moffett, McAdam, and Parkinson

2004). Management's commitment to IT use for KM, on the other hand, can be demonstrated by having managers lead and support the technology use, and not just by promoting the technology itself (Damodaran and Olphert 2000; Purvis, Sambamurthy, and Zmud 2001). This commitment can also be demonstrated through their expressed mandates and communications, to indicate their commitment to use of the technology (Purvis, Sambamurthy, and Zmud 2001). Thus, actions by management or technology champions, through their demonstrations, promotions, and communications may reinforce the norms that value the use of IT and are likely to encourage the use of IT for KM (Purvis, Sambamurthy, and Zmud 2001).

To further substantiate the importance of management support and commitment in this research context, it is noted that Butler, Heavin, and O'Donovan (2007), in their study to develop a framework for KM systems implementation, indicated that among the identified critical success factors for KM systems' implementation are management's support and commitment, as well as the establishment of new roles and responsibilities to support the implementation. These findings were also supported by Vitari et al. (2007) in their study to understand the determinants of contributions to a KM system in an organisation. In addition to establishing new roles to support KM, it was observed that, rather than improving the usability aspects of a KM system, management's commitment in promoting the results achieved by sharing knowledge through the KM system was even more effective in increasing knowledge contributions made to the KM system. Thus, this suggests that management support and commitment in promoting the benefits of sharing knowledge is important to encourage individuals' use of IT for KM in an organisation.

Several researchers have used the term 'leadership', rather than 'management support and commitment', in their studies of KM systems' implementation and success (Aurum, Daneshgar, and Ward 2007; Kulkarni, Ravindran, and Freeze 2007). Leadership for KM is described as the understanding about KM by management levels, their participation in setting direction for KM, and their demonstration of commitment towards KM (Kulkarni, Ravindran, and Freeze 2007). In Kulkarni, Ravindran, and Freeze's (2007) KM success model, which was developed based on a transition from the IS success model originally developed by DeLone and McLean (1992), leadership's commitment on KM was identified in the model as an organisational support factor that had both direct and indirect influences on the extent of KM system use. The importance of leadership for KM was also supported by Moffett, McAdam, and Parkinson (2004), in their study on successful technological adoption and application within an organisation's KM, where they emphasised the need to establish dedicated roles, such as KM leaders, in order to promote the use of IT for KM in an organisation.

In addition to contributing to the extent of IT adoption or use for KM in an organisation, management's support and commitment is also recognised as an important factor that determines a successful promotion of a knowledge sharing culture in an organisation. Benbya and Belbaly (2005), in their exploratory study of the mechanisms for KM systems effectiveness, describe how an employee's perception on management's commitment can influence the knowledge sharing culture. They describe that an organisation in which the employees perceive the management as not very committed to the implementation of a KM technology will not likely to be successful in promoting a strong knowledge sharing culture in that organisation.

Similarly, Damodaran and Olphert (2000), in their report of a post-implementation of a KM system, suggest that employees' attitude towards sharing of knowledge appear to be influenced by the level of resentment they have towards the employer. They argue that if employees feel that they are not treated with trust, such as in the case where promises and commitments are not kept by their employer, they will be less likely to be willing to share their knowledge at work. Numerous KM practitioners have also attested to this argument by suggesting that management were the ones responsible to drive the required cultural and systems changes to increase KM system usage (Butler, Heavin, and O'Donovan 2007; Subramaniam and Soh 2009). Thus, it is clear that management support and commitment is important to drive the knowledge sharing culture in an organisation.

In addition to influencing the level of IT use for KM and the knowledge sharing culture, a study by Kulkarni, Ravindran, and Freeze (2007) has reported that management support and commitment is an influencing factor on the level of knowledge content quality in their study. The results of their study clearly indicated that the commitment exhibited by the senior leadership affects the quality of shared knowledge, by leading the task of developing an organisational-wide taxonomy of knowledge, which can be fed into a KM system. Moreover, the study indicates that organisational work involving champions and facilitators is needed to ensure that knowledge contributed and shared by the use of IT is of high quality and can be adapted by the organisational context required. For example, the processes of cleansing and categorising of captured knowledge are usually assigned to the knowledge champions or managers in an organisation (Butler, Heavin, and O'Donovan 2007). In brief, management support and commitment determines the organisational strategies of defining and classifying knowledge (Aurum, Daneshgar, and Ward 2007) and thus could be an important factor that enhances the extent of knowledge classification in an organisation.

Management support and commitment is defined, in the context of this study, as 'the support and commitment to KM by management, exhibited by the allocation of funds, resources, training, dedicated personnel for the use of IT for KM, and the communication of the importance of using IT for KM'. It can be summarised based on the preceding discussions that, management's support and commitment on the use of IT for KM has been found to have both direct and indirect influences on the extent of IT use for KM. Thus, the following hypotheses are advanced to investigate the influence of this organisational factor on the use of IT for KM in Malaysian listed organisations:

Hypothesis 3a: Management support and commitment has a positive influence on the level of IT use for KM in Malaysian listed organisations.

Hypothesis 3b: Management support and commitment has a positive influence on the knowledge sharing culture in Malaysian listed organisations.

Hypothesis 3c: Management support and commitment has a positive influence on the extent of knowledge classification in Malaysian listed organisations.

3.5.3.2 Rewards and incentives

KM researchers have long been advocating rewards and incentives as an effective mechanism to motivate knowledge sharing (Alavi and Leidner 1999a; Davenport, De Long, and Beers 1998). Davenport, De Long, and Beers (1998) indicated that rewards and incentives introduced by organisation should be able to sufficiently motivate knowledge sharing in the long-run. They further described that longer-term motivational aids, such as salary increments and promotion, bonus incentives, and job security, have proven to sustain ongoing knowledge sharing activities.

Similarly, in the context of IT use to support KM, many KM researchers believe in the importance of rewards and incentives as an effective way to motivate knowledge sharing, as well as the use of IT to support knowledge sharing (Benbya and Belbaly 2005; Kankanhalli et al. 2003; Moffett, McAdam, and Parkinson 2004). Recent studies have also provided empirical evidence on the positive effects of rewards and incentives on the intention to use KM systems (Lai 2009), as well as an inducement to use the systems (Subramaniam and Soh 2009). An example of such rewards and incentives mechanisms could be by means of incorporating KM systems utilisations into the employees' evaluation process so that a standardised reward system can be achieved (Jennex and Olfman 2001; Kulkarni, Ravindran, and Freeze 2007). Further, KM systems can also be designed with built-in features to monitor and evaluate their use, such as knowledge contributions to the systems, to assist in the implementation of rewards and incentives mechanisms for using the system (Vitari et al. 2007).

The rewards offered to motivate the use of IT to support KM can be extrinsic or intrinsic types of rewards (Benbya and Belbaly 2005). Extrinsic rewards can be in the form of financial rewards such as monetary incentives or gifts. On the other hand, intrinsic rewards are non-monetary, such as attention and recognition, given by peers and management to the subject matter experts who had shared their knowledge with others. These attentions and recognitions provide intrinsic motivations in the form of credit, status, and personal pride to the knowledge contributors (Benbya and Belbaly 2005).

In view of the types of rewards and incentives, Davenport, De Long, and Beers (1998) suggested that organisations should find the right balance between offering extrinsic and intrinsic rewards to motivate contributions to their knowledge databases. They further elaborated that the types of rewards and incentives mechanisms vary from one organisation to another and are mostly dependant on the cultural norms in that organisation. To date, research has indicated that most organisations implementing KM systems are using some type of reward system to induce the use of their KM systems (Aurum, Daneshgar, and Ward 2007; Butler, Heavin, and O'Donovan 2007). For example, Aurum, Daneshgar, and Ward (2007) indicated that a number of organisations investigated in their study believe that financial rewards are effective motivators for sharing knowledge.

In contrast, other organisations may rely on implicit rewards to encourage knowledge contributions to their knowledge repositories. For example, Butler, Heavin, and O’Donovan (2007) in their qualitative study on KM system implementations, revealed that all 12 investigated organisations were offering either monetary or non-monetary rewards to help induce knowledge sharing activities. Thus, regardless of whether they were extrinsic or intrinsic, rewards and incentives appears to be an important organisational support factor that was found to be directly influencing the extent of IT use for KM in an organisation (Kulkarni, Ravindran, and Freeze 2007).

In the context of this study, the organisational factor of rewards and incentives is defined as ‘the extent to which an organisation has a standardised rewards and incentives system to encourage KM activities and also the use of IT to support these activities’. To further ascertain the effect of rewards and incentives on the extent of IT adoption or use for KM in Malaysian listed organisations, the following hypothesis is also proposed:

> *Hypothesis 4:* *Rewards and incentives has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

3.5.3.3 Knowledge sharing culture

From the analysis of the literature, the knowledge sharing culture is the next item that was stated the most by KM systems researchers. To understand what constitutes a knowledge sharing culture, this study looks at the description of organisational culture. Organisational culture can be described as the shared meanings, norms, values and beliefs that are upheld by employees in an organisation (Denison 1996) and are typically shaped by the senior management (Kulkarni, Ravindran, and Freeze 2007).

In the context of KM, Janz and Prasarnphanich (2003, p. 353) state that, 'Organisational culture is believed to be the most significant input to effective KM and organisational learning in that corporate culture determines values, beliefs, and work systems that could encourage or impede knowledge creation and sharing'. Further, a knowledge sharing culture can be described as an organisational culture that is in favour of knowledge sharing (Alavi and Leidner 1999a) and is said to exist in an organisation in which the employees are intellectually inquisitive, enthusiastic about sharing knowledge with others, as well as enjoy helping others in the organisation (Davenport, De Long, and Beers 1998).

Research has proposed that the importance of a knowledge sharing culture in many organisations can be seen in its ability to transform their employees' attitudes and behaviour so that they are inclined to share their knowledge (Alavi and Leidner 1999a; Damodaran and Olphert 2000). Moreover, a knowledge sharing culture is identified as a very important element for effective KM as revealed by a study of 12 organisations, which had successfully implemented KM systems (Butler, Heavin, and O'Donovan 2007). In the study, it was reported that the KM practitioners in these organisations perceive that a knowledge sharing culture, represented by the high trust and team-oriented culture, is a fundamental cultural change that is required prior to the introduction of the KM systems in the organisations.

In addition, another study has made a similar observation stating that the 'promotion of a spirit built on friendship and a genuine desire to help each other and sharing a sense of pride' had supported effective knowledge sharing (Benbya and Belbaly 2005, p. 213) in an organisation. Further, the importance of a knowledge sharing culture in KM is evidenced by the findings of Lee and Choi's (2003) study on the various enablers of knowledge creation, which indicated that shaping an organisation's cultural factors by promoting teamwork, trust, and learning, is key to an organisation's ability to manage knowledge effectively.

In the context of IT use for KM, Desouza (2003), in his study on the use of a KM system in a software engineering organisation, suggests that the establishment of a knowledge sharing culture can help to overcome engineers' resistance to use and contribute knowledge to the KM system and thus lead to an increased usage of the system. This role of knowledge sharing culture in the use of IT for KM is further confirmed by Alavi, Kayworth, and Leidner (2006), whose study indicates that not only does a knowledge sharing culture influence KM activities, such as knowledge sharing and seeking, it also influences technology selection and use. The authors further elucidated that individuals' perceptions of the technology for KM are shaped by the values upheld in their organisations, which, in turn, leads to their different patterns of technology use. For example, the study indicates that within an organisational culture that values the benefits of teamwork and collaboration, individuals will demonstrate a greater tendency to use groupware or online collaboration software.

The same study by Alavi, Kayworth, and Leidner (2006) also indicates that apart from IT use to support knowledge sharing between teams, a knowledge sharing culture also influences the use of IT in solving explicit problems, as IT enables the capturing and disseminating of subject matter experts' knowledge that is required to solve the problems. The inclination of sharing knowledge in a knowledge sharing culture motivates users to contribute to, for example, an electronic knowledge repository, which in turn encourages the system's use by others to facilitate their knowledge searching for solving problems (Alavi, Kayworth, and Leidner 2006). Thus, the development of a knowledge sharing culture that promotes social ties between users in an organisation is required before the users will effectively use the KM system to disperse their knowledge to others.

Similarly, Kulkarni, Ravindran, and Freeze (2007) indicate that organisations with a prevalent knowledge sharing culture, in which management and peers provide the encouragement for contributing to, as well as, using the knowledge in a KM system, would observe a higher level of user uptake of the KM system. Thus, these discussions highlight the particular importance of the development of a proper knowledge sharing culture to facilitate effective knowledge-related behaviour to achieve the desired level of IT use for KM in an organisation.

Alternatively, Jennex and Olfman (2004), in their proposal of a framework to assess KM success, stress the need to identify negative organisational culture that can inhibit the usage of KM systems in an organisation. This negative organisational culture can be attributed to the feeling of dissatisfaction of employees towards their organisations and hence contributes to their reluctance of sharing knowledge and helping others (Damodaran and Olphert 2000; Davenport and Prusak 1998). For example, employees who feel that their management has treated them unfairly, such as by failing to honour their promises and commitments, are less likely to feel disposed to share their knowledge with others. This indicates that attitudes towards sharing of knowledge appear to also relate to the negative organisational culture within an organisation. Thus, it is important to identify and possibly eradicate the negative organisational culture that may inhibit an organisation's cultural change efforts towards a knowledge sharing culture that could, in turn, encourages employees' use of IT for KM.

The impact of a knowledge sharing culture on the extent of KM systems usage in an organisation has been a recurrent theme in relatively recent literature about KM systems (Aurum, Daneshgar, and Ward 2007; Butler, Heavin, and O'Donovan 2007; Subramaniam and Soh 2009; Vitari et al. 2007). Nevertheless, research has also advised that development and introduction of an organisational culture to encourage the use of KM systems should be introduced with caution. For example, a study on KM practices in a software development organisation indicates that an organisational culture that attempts to make the use of a KM system mandatory will only be seen by the employees as forcing them to disposed of their knowledge and thus will not succeed in creating the desired culture of sharing knowledge (Aurum, Daneshgar, and Ward 2007).

Based on the preceding discussions, knowledge sharing culture is defined, in this study's context, as 'a culture existing within an organisation that believes in the importance of knowledge for an organisation's success, values employees' experiences, and fosters the use of IT to support knowledge sharing'. In the context of Malaysian organisations, a study in the manufacturing sector of Malaysia has found that knowledge sharing activities were done at a moderate level and that there was a significant relationship between a knowledge sharing culture and knowledge sharing activities (Hishamuddin Md Som 2004). In order to further our understanding of the impact of a knowledge sharing culture on the extent of IT use for KM in Malaysian listed organisations, the following hypothesis is advanced:

> *Hypothesis 5:* *Knowledge sharing culture has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

3.5.3.4 Knowledge classification

Numerous studies on KM indicate that to have a successful KM, organisations should use IT to manage knowledge and not just information (Alavi and Leidner 1999a; Davenport, De Long, and Beers 1998; Flanagin 2002). Nevertheless, distinguishing knowledge from information may not be an easy task. For example, Ruggles (1997), in his survey of 431 US and European companies, reports that 40% of the respondents found it difficult to decide what actually represented knowledge in KM implementations.

In view of the above issue, Davenport, De Long, and Beers (1998) emphasise the need for organisations to establish a clear definition of what constitutes 'knowledge' in their KM project as it is easier to manage knowledge, when an organisation knows what it is and how it differs from data or information. The authors further clarified that organisations may end up having KM systems that are managing information, as opposed to managing knowledge, when they do not distinguish the terms clearly. Thus, the distinction between knowledge, information, and data is especially crucial to allow the conception of suitable strategies to manage the actual knowledge instead of just information or data.

In relation to the distinction between knowledge and information, research has revealed that the reason the relationship between IT-based systems and knowledge is problematic is mainly due to the fact that, instead of addressing knowledge, these systems were actually used to address data and information (Hendriks 2001). Acknowledging this issue, Alavi and Leidner (2001) report that KM systems in an organisation are often overloaded with knowledge that has no specific performance or economic significance to the organisation. As a result, the authors emphasise the need for knowledge databases to only contain knowledge, and not information or data itself. This indicates that it is important for an organisation to identify relevant knowledge for its competitive needs, and for this to be fed into the organisation's KM systems.

In line with this view, a study has demonstrated how an automobile manufacturing company had achieved a successful KM system by interpreting knowledge clearly in the organisation (Davenport, De Long, and Beers 1998). The authors describe how the company's knowledge repository of chassis design filters out crash test reports and only accepts content that is considered knowledge on chassis design, such as documents on the historical context, implications of findings from crash tests, comparisons to other automobiles from competitors, and lessons learned from the crash test process.

The above example is in accordance with the findings of relatively recent KM research, which indicates that raw data and information should be interpreted and transformed into knowledge before it is deposited into a KM system (Zailani, Ong, and Shahnon 2006). Further, research has also indicated that the ability of KM systems to process knowledge that is relevant to specific business needs and adds value to individuals and teams, is identified as one of the underlying success factors of any KM system implementation that determines its continued usage (Damodaran and Olphert 2000; Halawi, McCarthy, and Aronson 2008; Mohamed, Stankosky, and Murray 2006).

In order to assist with the identification of knowledge that can be managed by the use of IT, numerous KM researchers suggest the use of a suitable enterprise wide taxonomy of knowledge that contains a clear definition of knowledge to avoid ambiguity about what constitutes knowledge within an organisation, as well as to help produce high quality content of knowledge (Butler, Heavin, and O'Donovan 2007; Jennex and Olfman 2004). Further, the use of appropriate knowledge taxonomies has been identified as the key to the success of a KM system by many KM practitioners (Butler, Heavin, and O'Donovan 2007), indicating the importance of adopting a knowledge taxonomy or classification by organisations implementing KM systems. Research has exemplified that some organisations classify their knowledge according to their business functions, while others, with the use of a detailed level of classification for project management's related knowledge, classify knowledge according to the different time phases and processes in the project

(Butler, Heavin, and O'Donovan 2007). An example of a knowledge taxonomy designed to organise the knowledge residing within a management consultant organisation is as shown in Figure 3-5 (Cheuk 2002). An effective knowledge taxonomy in an organisation should be able to make sense to the employees in ways that the taxonomy is organised according to categories that enable intuitive searching for knowledge, use language that employees used naturally at work, and changes over time to reflect evolving business needs and changing communication trends within the organisation. .

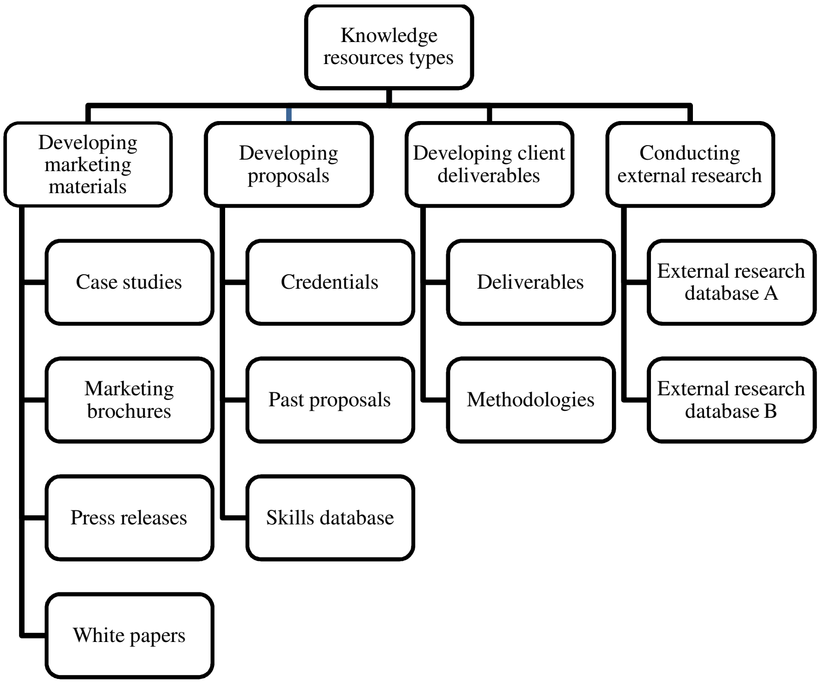


Figure 3-5 An example of a knowledge taxonomy

Based on the preceding discussion, it is clear that having a knowledge classification system could lead to higher quality of knowledge to be deposited and managed by KM systems, which, in turn, enhances the use of the systems.

To further understand how having a knowledge classification system influences the use of IT to support KM in an organisation, research has noted that the ability of IT-based systems to process relevant and useful knowledge would help to increase employees' performance and productivity (Wang 2002). For example, among the common benefits observed are reduction in the time needed to make decisions and ease of finding needed knowledge.

Further, the use of a knowledge taxonomy or classification also facilitates individuals to navigate the knowledge stored in a KM system and helps them find an appropriate knowledge source (Butler, Heavin, and O'Donovan 2007; Davenport, De Long, and Beers 1998). Accordingly, research has observed that users' perception on the benefits of using a KM system is more likely to improve if knowledge that is stored in the KM system is relevant, of high quality, and helps improve their work efficiency (Halawi, McCarthy, and Aronson 2008; Jennex and Olfman 2004; Kulkarni, Ravindran, and Freeze 2007). Thus, relevant and high quality knowledge content that is available and accessible throughout an organisation is regarded as an important factor that enhances the perceived benefits of IT for KM, which in turn leads to a higher level of its use. In brief, this discussion highlights the positive influence of a knowledge classification system on users' perceived benefits of using IT for KM in an organisation.

The preceding discussions suggest that having a knowledge classification system is a factor that enhances both perceived benefits of using IT for KM and the extent of IT use for KM. In the Malaysian KM context, the ability to distinguish knowledge from information was also identified as the key to effective KM (Helmi 2002). Further, research has also identified the need for Malaysian organisations to fully understand the knowledge that needs to be captured, processed and utilised by the use of IT in order to meet the emerging challenge of the knowledge-based economy (Zailani, Ong, and Shahnon 2006).

In the context of this study, knowledge classification is defined as 'an enterprise-wide classification system or taxonomy for knowledge'. Thus, to further the understanding of the impact that having a knowledge classification system has on the level of IT use for KM in Malaysian listed organisations, the following hypotheses are proposed:

Hypothesis 6a: *Having a knowledge classification system has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

Hypothesis 6b: Having a knowledge classification system has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations.

3.5.3.5 Institutionalisation of IT use for KM

The final organisational factor identified through the synthesis of previous studies is the institutionalisation of the use of IT for KM into normal work practices. A post-implementation review of the usage of a KM system, has reported that the institutionalisation of the use of a KM system into normal work practice could lead to a higher level of the system's use (Damodaran and Olphert 2000). In the review, institutionalisation refers to the extent to which the KM system is used to support routine work processes, as well as projects across an organisation. It was further indicated in the review, that the failure to institutionalise a KM system is one of the main causes of the under-utilisation of the system.

The importance of the institutionalisation of IT use to support KM has also gained support from other studies such as Huysman and Wit (2004), Jennex and Olfman (2004), Nevo and Chan (2007), and Purvis, Samabamurhty, and Zmud (2001). For example, in a synthesis of the literature on KM system success factors, Jennex and Olfman (2004) identify the incorporation of a KM system's use in the organisational work processes to be one of the factors responsible for the KM system's success.

Similar observations were also made in a case study of ten large companies' knowledge sharing practices that were supported by the use of IT (Huysman and Wit 2004). The study emphasised the importance of making the use of IT to support knowledge sharing activities as part of users' daily routine. Additionally, a study of 12 organisations in a large North American city also indicated similar importance, in which the results of the study showed that a KM system that failed to be integrated into users' daily function in completing their tasks, to the point that the system was indispensable, would not be accepted and thus would not be used (Nevo and Chan 2007). In sum, this discussion highlights the important contribution of the institutionalisation of IT use for KM towards the extent of its use in an organisation.

In this study, the perspectives from the institutional theory were observed in order to operationalise the concept of institutionalisation of IT use for KM. The institutional theory suggests that the individuals' behaviour within an organisation is influenced by the norms, values, culture, and history that are prevalent in the organisation (Orlikowski 1992). Further, the theory suggests that individuals' behaviour in an organisation is guided by the institutional structures, such as organisational routines, rules, guidelines, and procedures. The ways in which the institutional structures influence individual behaviour, such as the use of technology in an organisation, are described in the study of Orlikowski (1992). Based on the perspectives from the institutional theory, this study proposes that the institutionalisation of IT use for KM in an organisation can be achieved by the establishment of organisational policies and procedures for IT use for KM, which will have an impact on the extent of IT use for KM in an organisation.

From the preceding discussions and the institutional theory, the institutionalisation of IT use for KM, in this study, is represented by the establishment of 'policies and procedures that formalise, as well as facilitate, the use of IT to support KM activities in an organisation'. To investigate the effect of this proposed organisational factor on IT use for KM in the Malaysian context, the following hypothesis is proposed:

Hypothesis 7a: *The policies and procedures for IT use for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

In addition, the study also proposes that the establishment of the policies and procedures to facilitate the use of IT for KM will lead to an enhanced perception of the ease of using IT for KM. Thus, to ascertain this association, the hypothesis below is advanced:

Hypothesis 7b: *The policies and procedures for IT use for KM has a positive influence on the perceived ease of using IT for KM in Malaysian listed organisations.*

The next section discusses the two control variables identified in this study.

3.5.3.6 Control variables

Several factors were identified as control variables in this study. As this study focuses on the level of the organisation rather than the individual, the organisation's size and its type of industry were thus identified as the control variables in this study.

Past research has suggested that organisation size may have an association with the extent of innovation in an organisation (Damanpour 1992). Moreover, as the organisations participating in this study come from a variety of industries, it was necessary to control, to some degree, the different industry conditions under which the organisations were operating as this variable has been shown to influence the degree to which organisations emphasise innovation (Johansson and Loof 2008). The approach adopted in this study was to first separate manufacturing from service industries and then to consider the innovation intensity within the industries when sorting them into different groups of industrial sectors.

The primary aspect of the control measures is that in the assessment of each organisation's use of IT to support KM activities, the data analysis should have control of the effects of the organisation's size and the type of industry.

Having developed the hypotheses on the effects of the identified organisational factors on the extent of IT use for KM, the next section presents the proposed research model for this study that was developed based on the hypotheses formulated in this section.

3.6 THE PROPOSED RESEARCH MODEL

A research model was developed to illustrate the potential relationships, based on the hypotheses presented in the previous section, between all constructs identified in the study. In accordance with the findings of Davis, Bagozzi, and Warshaw (1989) and Money and Turner (2005) with regards to the application of TAM in the post-implementation stage and in the KM systems' context as discussed in section 3.5.1 of this chapter, the attitude and intention constructs were not included. The hypotheses that were going to be tested in this study were also incorporated in the research model as shown in Figure 3-6.

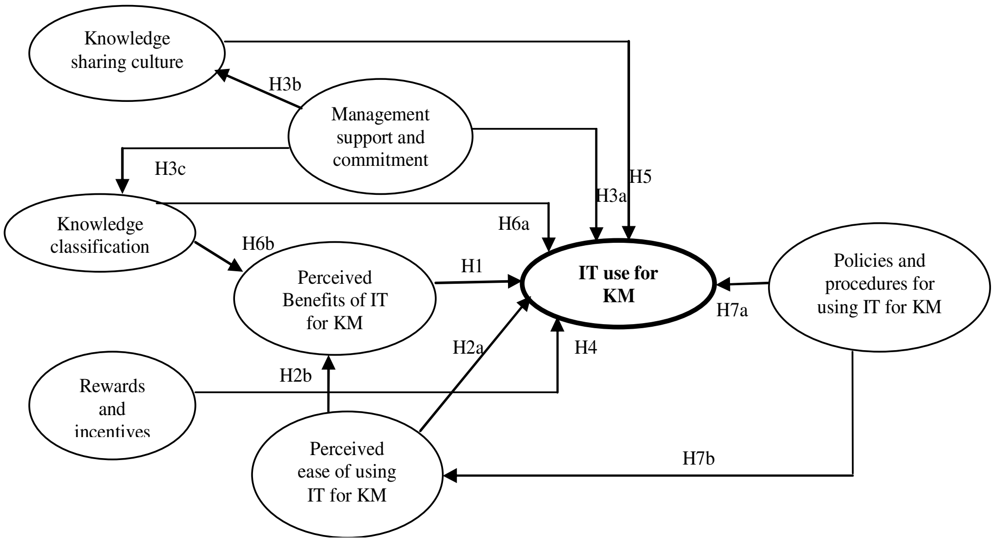


Figure 3-6 The proposed research model

The focus on the use of IT to support KM activities in this study led to changing the research model from using the construct of perceived usefulness to that of the perceived benefits of using IT for KM. Similarly, the perceived ease of use construct was changed to the perceived ease of using IT to support KM to represent the adaptation of the construct to the context under the analysis of this study. Thus, TAM was used as a guiding framework for this study in that TAM was used to justify some of the factors in the proposed research model. Other theoretical bases from the review of the relevant literature were also used to justify some of the other (organisational) factors included in the model. Thus, this study built the justification and support for the proposed research model.

From the discussion in the above sections and based on the proposed research model developed, eight constructs were identified for further investigation to answer the stated research question. As can be seen in Figure 3-6, the focus of this study, which is the use of IT for KM in Malaysian listed organisation, is the main dependent construct in the research model. As expressed in section 2.5 of Chapter 2 earlier, IT use for KM is conceptualised as the use of IT to support the four main KM processes of creating, storing, transferring, and applying organisational knowledge. Thus, based on this conceptualisation, the dimension of IT use for KM in the research model is operationalised by the four sub-dimensions of IT use for knowledge creation, IT use for knowledge storage, IT use for knowledge transfer, and IT use for knowledge application. It is noted here that IT is used to manage explicit as well as tacit knowledge in an organisation, in particular for knowledge transfer process, as certain IT-based systems such as electronic meeting and videoconferencing software have the capabilities of supporting the exchange of both classifications of knowledge.

IT use for KM is thus defined, in the context of this study, as 'the extent of IT-based systems' use to support the creation, storage, transfer and application of knowledge in an organisation'. A summary of the constructs appearing in the research model and their definitions are provided in Table 3-5.

Table 3-5 Definition of constructs

Construct	Definition
IT Use for KM	
• IT use for knowledge creation	The extent of IT-based systems' use in an organisation to support the knowledge creation process—acquire new knowledge or combine existing knowledge into new knowledge
• IT use for knowledge storage	The extent of IT-based systems' use in an organisation to support the knowledge storage process—extract individual's tacit knowledge, codify it to an explicit form, and make this knowledge available and accessible to others
• IT use for knowledge transfer	The extent of IT-based systems' use in an organisation to support the knowledge transfer process—facilitate the dissemination and exchange of knowledge within an organisation
• IT use for knowledge application	The extent of IT-based systems' use in an organisation to support the knowledge application process—use and apply knowledge for adjusting strategic direction, solving new problems, and improving efficiency and productivity
Management support and commitment	The extent of management's support and commitment towards the use of IT to support KM activities in an organisation
Knowledge sharing culture	The extent to which a culture that believes in the importance of knowledge for an organisation's success, values employees' experiences, and fosters the use of IT to support knowledge sharing, exists in an organisation
Rewards and incentives	The extent to which an organisation has standardised rewards and incentives systems to induce KM activities and encourage the use of IT to support these activities in an organisation
Knowledge classification	The extent to which an organisation has an enterprise-wide classification system or a taxonomy for knowledge
Institutionalisation of IT for KM	The extent to which policies and procedures are established in an organisation to facilitate the use of

Construct	Definition
	IT to support KM activities
Perceived benefits of using IT for KM	The extent to which an employee believes that using IT for KM in an organisation improves his or her job performance, productivity, effectiveness, and ease of doing the job
Perceived ease of using IT for KM	The extent to which an employee believes that using IT to support their KM activities would be free of effort

3.7 SUMMARY

This chapter reviewed extant literature related to KM, and the use of IT for KM in the Malaysian context. An examination of the use of IT in Malaysian KM revealed that the level of perceived importance of IT for Malaysian KM strategy did not reflect the level of its actual implementation in these organisations. This led to the identification of this study's research problem: **'**the low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations'. Consequently, the need to understand the factors that could enhance the use of IT in these organisation led to the formulation of a specific research question to be answered by this study, 'What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?' Next, a research model developed based on the review of i) literature on the adaptation of TAM in the KM systems' context, and ii) previous studies of the investigation of IT use in KM, was proposed in order to answer the research question. The research model incorporated hypotheses corresponding to the potential relationships between selected TAM and organisational factor constructs, and the extent of IT use for KM in the organisations investigated. The next chapter discusses the research methodology, design, and implementation used to collect data required in this study.

CHAPTER 4: RESEARCH METHODOLOGY AND DESIGN

4.1 INTRODUCTION

Following the development of the research model and hypotheses in the previous chapter (Chapter 3), the research approach taken to answer the research questions, test the hypotheses, and validate the research model is presented in this chapter. The first section introduces the chapter and is followed by a section that provides an overview of the research problem and questions as identified in the previous chapter. An appropriate research approach is sought, which involves clarifying the approach, strategy, and methods for collecting and analysing data related to the research questions. This is presented in the third section of this chapter, in which the appropriateness of a range of approaches, strategies and methods that are available to help answer the research questions and meet the research objectives are assessed. Further, the choice of the research approach employed in this study is described and justified in this section.

Subsequently, an overview of the research process undertaken in this study is presented in the fourth section of this chapter. This is followed by a section on the design of the research, which involves the basic aspects that make up the research design. The sixth section presents the preliminary data collection phase of the research, in which the investigation of the relevancy and appropriateness of the five identified dimensions of organisational factors, presented in Chapter 3 of this thesis, in the Malaysian context is conducted. Once the relevancy of the organisational factors is verified, the following section describes the development of the survey instrument to collect the quantitative data needed in this study. The subsequent sections describe the appropriate measures taken to ensure the quality of the data collected from the survey, as well as the ethical considerations that were taken into account in the research approach. This is followed by a section presenting the administration and analysis of a pilot study of the survey, with the objective being to test the validity and reliability of the instrument. Finally, the last section describes the administration of the actual survey for the main data collection and briefly discusses the data analysis techniques chosen to analyse and interpret the collected data.

Figure 4-1 provides an overview of the sections presented in this chapter.

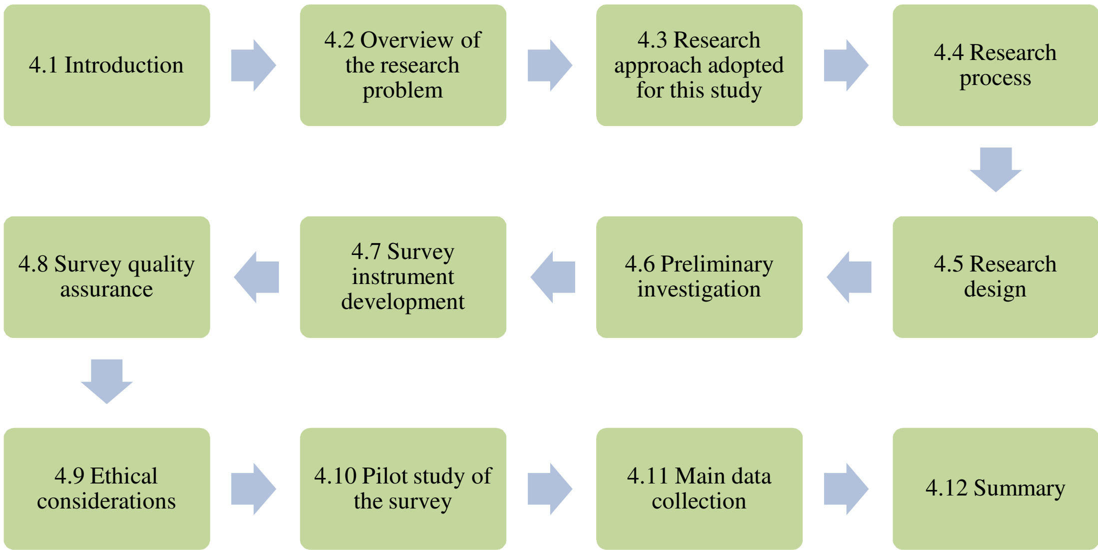


Figure 4-1 Overview of the sections in Chapter 4

The following section provides an overview of the research problem, questions and hypotheses that were identified and developed in Chapter 3 of this thesis.

4.2 OVERVIEW OF THE RESEARCH PROBLEM

Based on the need to understand the underlying organisational factors influencing the extent of IT adoption or use for KM in Malaysian listed organisations as identified in the previous chapter, the following research problem was identified in this study:

Research Problem: 'The low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations'

A main and two minor research questions were then formulated to address the research problem specified above, which are:

Research Question: 'What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?'

- Research minor question 1: what are the organisational factors that enhance the use of IT to support KM?

- Research minor question 2: how do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?

A review of the relevant literature in the area of KM systems' use led to the development of a number of hypotheses to be tested by collecting relevant data in the targeted organisations. A summary of these hypotheses is provided in Table 4-1.

Table 4-1 Hypotheses developed in this study

Hypotheses
Hypothesis 1: Perceived benefits of using IT for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 2a: Perceived ease of use of IT to support KM has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 2b: Perceived ease of use of IT to support KM has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations
Hypothesis 3a: Management support and commitment has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 3b: Management support and commitment has a positive influence on the knowledge sharing culture in Malaysian listed organisations
Hypothesis 3c: Management support and commitment has a positive influence on the extent of knowledge classification in Malaysian listed organisations
Hypothesis 4: Rewards and incentives has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 5: Knowledge sharing culture has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 6a: Having a knowledge classification system has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 6b: Having a knowledge classification system has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations
Hypothesis 7a: The policies and procedures for IT use for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations
Hypothesis 7b: The policies and procedures for IT use for KM has a positive influence on the perceived ease of using IT for KM in Malaysian listed organisations

The next section presents a review of the available research approaches and their components, as different research problems require different research approaches to answer them (Singleton, Straits, and Straits 1999).

4.3 RESEARCH APPROACH ADOPTED FOR THIS STUDY

Research approaches are 'plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis' (Creswell 2008, p. 3). The two main categories of research approaches for social sciences are the quantitative and qualitative approaches.

The qualitative research approach, which is also referred to as the interpretive or constructivist approach, is typically used to answer questions about the complex nature of social phenomena by exploring and understanding the phenomena from the perspectives of the research subjects (Leedy and Ormrod 2005). The approach generally involves collecting large amount of verbal data from a small number of participants, organising data into general themes, and making interpretations of the meaning of the data to produce tentative answers to the research questions.

On the other hand, the quantitative research approach, which also referred to as the experimental or positivist approach, is typically used to answer questions about the relationships among measurable variables by means of testing objective theories in order to explain, predict or control a phenomenon (Leedy and Ormrod 2005). Quantitative research generally involves developing specific hypotheses to be tested and designing a research strategy to test the hypotheses, which includes developing an instrument to measure the variables investigated, in order to produce numeric data that can be analysed using statistical procedures to confirm or reject the hypotheses proposed (Creswell 2008). In addition, findings from a quantitative research approach are usually able to be generalised and replicated.

Table 4-2 below lists the different characteristics of the quantitative and qualitative research approaches that can be used to guide the decision in adopting a research approach.

Table 4-2 Quantitative and qualitative research approaches

Characteristic	Quantitative	Qualitative
The purpose of the research	To explain and predict To confirm and validate	To describe and explain To explore and interpret
The theory orientation	Deductive; testing of theory	Inductive; generation of theory
The research questions	Who (how many)? What (how much)?	How? Why?
The nature of the literature review	Explanatory—what are the relationships between the variables which have been previously identified and measured?	Exploratory—what are the variables involved?
The nature of the research process	Focused Known variables Established guidelines Predetermined methods Detached view	Holistic Unknown variables Flexible guidelines Emergent methods Personal view

Source: Adapted from Leedy and Ormrod (2005)

From the table, it can be seen that the decision about the choice of a research approach is largely determined by the research purpose, theory orientation, research questions, nature of literature and nature of research process. Based on the research questions of this study, the purpose of this study is to confirm and validate the hypotheses formulated on the organisational factors influencing the level of IT use for KM in Malaysian listed organisations. This study also adopts a deductive approach whereby the study begins with developing theoretical hypotheses, and uses empirical data to test the hypotheses in order to prove or disprove them (Cavana, Delahaye, and Sekeran 2001).

Further, the research questions of this study focus on the 'what' and 'how' questions as indicated in the previous section. The nature of the literature review of this study is also explanatory, in which the variables have been previously identified and the study sets out to investigate the relationships between them. The nature of the research process of this study can be described as focused, as it is limited to the investigation of known variables, using some established instruments to measure a number of them, and the preservation of an objective view through out the research process. Thus, it is evident from the table that based on this study's characteristics the quantitative research approach emerges as a more suitable research approach to be adopted in this study.

There are three main components in a research approach, which include the research paradigm or the basic philosophical assumptions that researchers hold in the study;

the types of research strategies, or methodologies, employed in the study; and the specific methods used in conducting these strategies (Creswell 2008). The following sub-sections describe the three main components of the quantitative research approach that was adopted in this study in more detail.

4.3.1 Research paradigm

A research paradigm is defined as the overall conceptual framework within which a researcher may work, or the 'basic set of beliefs or worldview that guides the investigator [researcher]' (Guba and Lincoln 1994, p. 105). A research paradigm is also described as theoretical perspective, which is defined as 'the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria' Crotty (1998, p. 3). A research paradigm provides a context of the logic and principles involved in a chosen research approach (Crotty 1998). In order to determine a suitable research paradigm, in which the investigation of this study will operate in, the three major research paradigms of positivism, constructivism, and critical theory are discussed below.

The positivism research paradigm is often associated with quantitative research approaches and is the default paradigm for most scientific research (Creswell and Clark 2007). This research paradigm assumes that there is one true reality that can be discovered by means of rigorous empirical study (Creswell 2008; Corbetta 2003; Guba and Lincoln 1994). Researchers in this paradigm are neutral observers as their values, beliefs and biases do not influence the outcomes of the research (Babbie 1990; Guba and Lincoln 1994). Thus, positivist researchers are expected to remain separate from the research subjects to ensure objectivity during data gathering and analysis.

The next research paradigm is constructivism, which is typically seen as the research paradigm for qualitative research. The philosophical assumptions of this paradigm permit the development of subjective meanings of an individual's experiences toward certain issues, in order to understand about a certain phenomenon (Creswell 2008). Thus, this allows the interactions between the researchers and the research subjects to take place, in order for the researchers to interpret the meanings that the subjects have about a phenomenon.

Lastly, the critical theory research paradigm holds philosophical assumptions that reality is shaped by social, political, cultural, economic, ethnic, and gender values (Guba and Lincoln 1994). The researchers in this paradigm work to acquire a single apprehensible reality, but believe that the reality is shaped by social values and also by influences from other forces.

Table 4-3 summarises the differences between the research approaches undertaken in the positivist and non-positivist research paradigms.

Table 4-3 Positivist, constructivist, and critical theory research paradigms

Characteristic	Research Paradigm		
	Positivism	**Constructivism**	**Critical Theory**
Nature of reality	An objective, true reality exists which is governed by unchangeable natural cause-effect laws Reality can be generalised The researcher and reality are independent	The reality is constructed, interpreted and experienced by people in their interactions with each other and with wider social systems	Reality is shaped by social, political, cultural, economic, ethnic, and gender values
Nature of knowledge	Knowledge consists of verified hypotheses that can be regarded as facts or laws	Knowledge is based not only on observable phenomena, but also on subjective beliefs, values, reasons, and understandings	Knowledge is constituted by the lived experience and the social relations that structure these experiences
Theory building/ testing	Postulates theories that can be tested in order to confirm or reject Test theories in a controlled setting, empirically supporting or falsifying hypotheses through process of experimentation	Theories are built/constructed from multiple realities—need to look at different things to understand a phenomenon Theory is shaped by social and cultural context	Theories are built from deconstructing the world, from analysing power relationships
Role of research	Uncover reality Scientifically explain, describe, and predict phenomena	Study mental, social, cultural phenomena to understand why people behave in certain ways Describe multiple realities	Political emancipation and increasing critical consciousness

Source: Adapted from Crotty (1998), Guba and Lincoln (1994), and Neuman (2003)

From the table, it appears that the choice of a research paradigm is influenced by several characteristics of the research, which include the nature of reality and knowledge to be discovered; whether the purpose of the study is to build or test theories; as well as the role of the research. Based on the table, it seems that the view on the nature of reality and knowledge in this study is in line with the positivist research paradigm, which assumes that an objective and true reality exists; the reality can be generalised; and the researcher observes the problem domain as a spectator observes the world by remaining neutral and independent throughout the study. Further, in line with positivist research, this study also involves theory testing, which includes developing theoretical hypotheses to be tested, in order to explain and predict the real world phenomenon of the use of IT for KM in the Malaysian listed organisations. Thus, based on the characteristics of the study, it is evident that the study falls within the positivist research paradigm.

The next section discusses the next component of the quantitative research approach adopted in this study, which is the research methodology.

4.3.2 Research methodology

Research methodology is defined as the 'strategy, plan of action, process, or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes' (Crotty 1998, p. 3). Further, research methodologies are also described as the types of quantitative or qualitative designs that provide specific guidance for the procedures in a research approach (Creswell 2008). In other words, a research methodology is concerned with how to answer a set of research questions and how to meet the research objectives. The selection of a methodology for carrying out a specific research project is crucial to the success of any research project as the methodology selected can guide the conduct of the research and affect the quality of the research result (Corbetta 2003; Creswell 2008).

The research methodologies for qualitative approaches include: (i) case study—a strategy of inquiry in which a particular individual, program or event is studied in depth for a defined period of time; (ii) ethnography—a strategy of inquiry in which the researcher looks in-depth at an entire group that shares a common culture; (iii) grounded theory—a strategy of inquiry that derives a theoretical framework from analysis of data using a prescribed set of procedures; and (iv) phenomenological study—a strategy of inquiry that attempts to understand people's perceptions, perspectives, and understanding of a particular phenomenon (Creswell 2008; Leedy and Ormrod 2005).

Because the research approach adopted in this study is the quantitative approach, the research methodologies for quantitative research approaches are discussed in more detail below.

4.3.2.1 Experimental research

Experimental research methodologies are used to determine if an introduction of a specific change influences an outcome (Creswell 2008). The two types of experimental research are as below:

i) Laboratory experiments—this strategy is used to determine the relationships between two or more variables in a constructed and controlled environment.

ii) Field experiments—this strategy is an extension to laboratory experiments, which are conducted in a more realistic environment than in the artificially designed environment, as in laboratory experiments. For example, field experiments are conducted in the real world of organisations or societies.

Experimental research generally consists of two groups, where one group is introduced with a specific change, while the other group serves as a control group. The impact of the change introduced on a particular outcome is then assessed by using quantitative analytical techniques.

4.3.2.2 Survey research

The survey research methodology involves providing a description about one or more groups of people's characteristics, opinions, attitudes, or practices on a certain phenomenon, by asking them questions using questionnaires or structured interviews and then tabulating and analysing their answers by using quantitative analytical techniques (Leedy and Ormrod 2005; Nissen, Klein, and Hirschheim 1991). Surveys include cross-sectional and longitudinal studies with the aim of learning about a large population by surveying a sample of that population. The findings of the surveys can then be generalised from the sample to the population.

The survey methodology is appropriate when the purpose of the research is to produce a quantitative description of the relationships between a set of investigated variables (Pinsonneault and Kraemer 1993). With careful design, surveys are a good means of investigating a larger number of variables than in experimental studies, from which a reasonably precise description of real world situations from various point of views can be provided (Nissen, Klein, and Hirschheim 1991).

4.3.2.3 Research methodology adopted—survey methodology

The conditions for determining the appropriate research methodology for a particular research is considered in order to choose between the experimental and the survey research methodology for this study. Table 4-4 tabulates the three conditions for selecting an appropriate research methodology as prescribed by Yin (1994).

Table 4-4 Selecting the appropriate research methodology

Methodology	**Type of research problem**	**Requires control of behavioural events?**	**Focuses on contemporary events?**
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes

Source: Adapted from Yin (1994)

The research problem of this study focuses on the ‘what’ and ‘how’ research questions as indicated in section 4.2 of this chapter, on the overview of the research questions identified in this study. This study also focuses on contemporary events and does not require control of behavioural events. Thus, based on the table, it appears that an investigation of the present situation pertaining to the use of IT for KM in Malaysian organisations is appropriately addressed by using survey methodology, which predominantly falls under the quantitative research approach.

In addition, the research methodologies adopted by prior studies investigating the enablers of KM, among which is the use of IT, in several organisational contexts were also reviewed in order to determine the appropriate methodology for this study. Table 4-5 lists the methodologies adopted by the reviewed studies.

Table 4-5 Research methodologies used in related studies

Study	Research Context	Methodology	Sample Size	Response Rate
Damodaran and Olphert (2000)	Stakeholders of a KM system in a multinational company	Semi-structured interviews	33	n/a
Purvis, Sambamurthy, and Zmud (2001)	KM system's users	Postal Survey	124	39%
Desouza (2003)	Software engineers in 50 organisations	Interviews	50	n/a
Hysman and Wit (2004)	Large companies	Case study	10	n/a
Kankanhalli, Tan, and Wei (2005)	Public sector organisations	Postal survey	150	37.5%
Nevo and Chan (2007)	Organisations in a large North American city	Delphi study	21	n/a
Lee and Choi (2003)	Major Korean firms	Survey	426	43%
Tanriverdi (2005)	Senior IT executives	Postal survey and Internet survey	250	28%
Wang, Klein, and Jang (2007)	Major Taiwanese manufacturing firms	Postal survey	149	30%
Sher and Lee (2004)	Major Taiwanese firms	Postal survey	142	12.7%
Moffett, McAdam, and Parkinson (2004)	1004 organisations in the engineering, retailing and technology industries	Postal survey	88	8.76%
Jennex and Olfman (2004)	Large, electric utility and holding company in the US	Survey (questionnaire) and field study	21	23.9%
Benbya and Belbaly (2005)	Multinational organisations	Case study	20	n/a
Kulkarni, Ravindran, and Freeze (2007)	150 midlevel managers enrolled in the executive MBA program at a university in the US	Survey (questionnaire)	111	74%
Butler, Heavin, and O'Donovan (2007)	Multinational organisations	Field study	12	n/a
Vitari et al. (2007)	Large French companies	Semi-structured interviews	13	n/a
Lin (2007)	Top 2000 Taiwanese companies	Postal survey	141	23.5%
Lee and Lee (2007)	Korean companies	Survey	215	Not stated

From the table, survey, case study, and field study appear to be the research methodologies adopted by these studies, with survey emerging as the methodology adopted by most of the studies. Thus, based on past relevant studies, the survey methodology also appears to be an appropriate methodology to be applied in an investigation of IT use for KM in organisations.

The next section discusses the next component of the quantitative research approach adopted in this study, which is the research method.

4.3.3 Research method

The third major component of a research approach is the specific research methods. Whilst a research methodology provides a general plan to conduct a research project, research methods, on the other hand, specify the details of data collection and analysis. Research methods are also described as the techniques or procedures used to gather and analyse data related to some research questions or hypotheses (Creswell 2008).

There are several methods that can be used to collect data in survey research. These methods include postal mail survey, telephone survey, personal interview survey, email survey, and web-based survey. Each method has its own advantages and disadvantages, and the choice of a method will mostly depend upon the type and size of the sample being studied; purpose of the study; time constraint; and available budget and resources (Cavana, Delahaye, and Sekeran 2001). Table 4-6 shows an overview of advantages and disadvantages of various methods of data collection in survey research.

Table 4-6 Various methods of data collection in survey research

	Postal	**Telephone**	**Personal interview**	**Web-based**
Coverage	High: Everyone has some kind of address—wide geographic regions can be reached	Low: Not everyone has a telephone	Low: Sample size must be low	Low-Medium: Everyone may not have access to Internet—can reach out globally
Response rate	Low: Low response in general	Medium: Generally people would participate	High: Generally every respondent will participate	Low-Medium: Generally higher with specialised samples
Speed	Low: Takes time, requires follow-up	High: Quick response possible	High: Quick response possible	High: Quick response possible—fast delivery
Labour	High: Copying, labelling, folding and stuffing into envelopes and preparing return envelopes takes considerable labour	Medium: Staff required for dialling	Low: Except preparing questionnaire and interviewing, no other labour is needed	Low: Except setting up website, labour is minimal
Expertise to construct	Low: Easy to construct	Low: Easy to construct	High: Requires social skill and quick thinking	High: Setting up web server, designing page and validating questionnaire

	Postal	Telephone	Personal interview	Web-based
Cost	High: Postage, photocopying, stationery and labour costs are involved	Low: If dialling is local and volunteers are available	High: Requires excessive time and cost	No cost or minimal cost since postage and stationery cost are eliminated
Other Issues	• Can be buried in junk mail • Difficult to have accurate mailing list • Follow-up procedures for non-responses are necessary	• Language barrier could affect the process • Caller ID and answering machines limit access • Interviews have to be kept short • Respondent can terminate the interview at any time	• Interviewers need to be trained • Researcher can make more valid interpretations • More than one interview might be necessary to check the validity of the data if third party is engaged • Respondents may be concerned about confidentiality of information given	• Can be deleted without opening/ reading email • Reminder needed • Computer literacy is essential • Respondents must have access to the facility • Respondent must be willing to complete the survey

Source: Adapted from Cavana, Delahaye, and Sekeran (2001), Cobanoglue, Warde, and Moreo (2001), and De Vaus (2002)

The data collection method for survey research includes telephone surveys, which are popular because information can be obtained quickly and can be inexpensive, provided that dialling is local and there are resources available to help making the calls (De Vaus 2002). This method is appropriate when there are a few simple questions to be asked and when only trivial information is sought from the respondents instead of in-depth responses. Since the current study aimed to collect a substantial amount of information on several factors regarding the use of IT for KM in about 830 Malaysian listed organisations, it was decided that a telephone survey would not be suitable.

In the case of interview surveys, the advantages of using this method include the ability of the interviewer to gain insights into the respondents' answers, collect sensitive data, ask complex questions, and record interview sessions (De Vaus 2002). However, data that was needed in this study were general, factual, and not sensitive. Further, in this study, data were needed in a large number due to the relatively large number of variables to be investigated. Moreover, interview surveys would place high demand on time and cost in order to gather data from a wide coverage of population. Thus, an interview survey may not have been an advantageous choice of a data collection method for this study

In a directly administered survey, information is collected by distributing a survey questionnaire to a group of the population in a meeting between the researcher and the research subjects. The procedures for developing such surveys are similar to those for a postal survey. However, as the subjects of this research were employees of Malaysian listed organisations with offices across the country, it would have been logistically difficult to gather all respondents at one place. In addition, considering the researcher's possible influence on the subjects, a directly administered survey was not considered to be suitable for this study.

Based on the preceding discussions on various research methods, it was decided that a questionnaire sent to the selected organisations in this study would be the most effective and appropriate data collection method. Subsequently, in order to choose between a postal and a web-based survey for this study, a number of factors were considered in this study, as below:

i) The target audience—representative samples of specific populations, for example, organisations in which the staff has high access to the Internet, as in the case of this study, would provide excellent samples for a web-survey.

ii) Coverage—both postal and web-based surveys provide good coverage to cater for a geographically dispersed population. However, postal survey costs and time requirements are greater than for web-based surveys.

iii) Response rate—A good response rate can be anticipated from a web-based survey when it is used in particular contexts, for example, in surveying professionals who have access to and use the Internet on regular basis.

iv) Speed—Prior studies that conducted surveys on the Internet have shown that web-based surveys can offer shorter administration time (Porter 2004; Sheehan and McMillan 1999; Yun and Trumbo 2000).

v) Expertise to construct—web-based surveys require a separate skill set for programming and designing the survey site. Fortunately these tasks can be alleviated with the use of readily available online web-based survey services.

vi) Cost—a web-based survey cost is barely affected by the geographic dispersions of the survey population. However, there is some cost incurred to subscribe to an online web-survey service for placing and hosting the questionnaire on a host server.

The discussion in this section suggests that while every mode of survey has its own advantages and disadvantages, a web-based survey appeared to be the most appropriate mode of data collection for this study. Compared to the postal survey, the web-based survey is more efficient, receives quicker responses, reduces postage and copy cost, lessens time of data entry, and reduces error of data entry (Lazar and Preece 1999). Further, the web-based survey was also considered to be more advantageous for this study, as the target respondents of this study were employees at the managerial level, which indicates that they would have had easy access to the Internet and been allocated with business email accounts, to where the survey could be directly sent.

The justification of the quantitative research approach—comprising of a research paradigm, methodology, and method—adopted in this study was elaborated in this section. The next section provides an overview of the research process undertaken in this study.

4.4 RESEARCH PROCESS

Figure 4-2 illustrates the overview of the research process in conducting this research. The process started with a review of the relevant theories to provide the theoretical background for the research. This stage explored the potential key variables in this study, through a synthesis of previous relevant studies, in order to develop the initial research model as presented in Figure 3-6 in Chapter 3 of this thesis.

In order to ensure the reliability and validity of the research findings, the survey instrument, data collection, and analysis should be carefully designed and conducted (Bryman and Bell 2007). Thus, although the main data collection for this study was of quantitative data, qualitative data was also collected through a series of interviews conducted in the preliminary phase of data collection. The main objective of the interviews was to investigate the relevancy and appropriateness of the organisational factor dimensions, obtained from the review of the literature, in the context of Malaysian listed organisations' KM. Once their relevancies were verified, the survey could then be designed to collect the quantitative data needed to test the hypotheses presented in this study. The research model was also refined according to the findings of the interview.

The next process was to develop the instrument for the survey, which included the development of measures for the constructs, designing of survey questions, and pre-testing the instrument. Then, a pilot study of the survey was conducted to test the validity and reliability of the instrument. The finalised instrument was then administered to the target population using an online web-based survey service.

The next process involves the analysis of the collected data using a structural equation model based on the partial least squares (PLS) approach (Chin 1998b). The research hypotheses are tested and the research model is evaluated based on the data analysis results. This is followed by the discussion of the results of the data analysis. Finally, the conclusions for the study are presented, along with discussions of the study's limitation, implications of the research in terms of theoretical and practical contributions, and recommendations for future work.

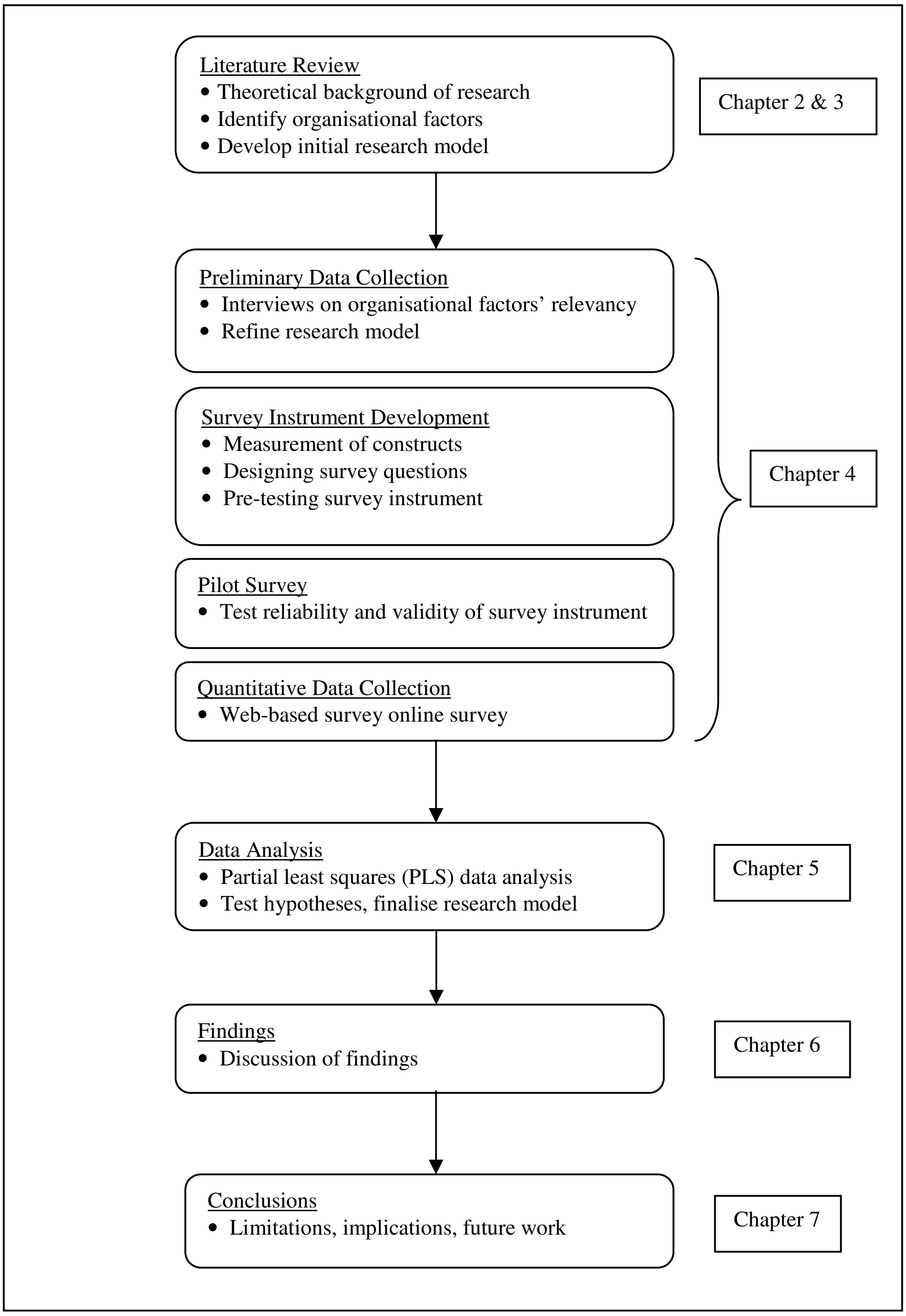


Figure 4-2 Overview of the research approach

The next section presents the design of the research approach for this study.

4.5 RESEARCH DESIGN

In section 4.3 of this chapter, it was decided that the quantitative research approach was mainly the appropriate research approach to address the research problem of this study. The emphasis now shifts to the design and implementation of the research instruments with the objective to ensure the validity and reliability of the research findings (Cooper and Schindler 2003; Robson 2002; Saunders, Lewis, and Thornhill 2009).

The research design constitutes the detailed outline for the measurement, collection, and analysis of data (Cooper and Schindler 2003). It involves processes such as specifying the details of the study, selecting sources and types of information to answer the research questions, and planning procedures to conduct the research. In addition to providing the plan and structure for the researcher to answer the research questions, a research design also helps researchers to allocate their limited resources to complete the research project within the specified time and financial constraints (Cooper and Schindler 2003; Robson 2002).

In the sub-sections below, several basic aspects of the research design are discussed.

4.5.1 Basic aspects of the research design

Table 4-7 provides a high-level view of the design of this research that covers eight basic aspects of a research design, which include the purpose of the study, the type of investigation, the unit of analysis of the study, the time horizon of the study, the sampling design, the extent of the researcher's interference, the development of measures, and the quantitative data collection. The discussions of the first six basic aspects of a research design are presented in the following sub-sections. The rest of the basic aspects of a research design will be discussed in section 4.7 (Survey instrument development) and section 4.11 (Main data collection).

Table 4-7 Research design: details of the study

	Aspect of Research Design	Details
1	Purpose of the study	Hypotheses testing
2	Types of investigation	Constructs' correlation, predictive ability of research model
3	Unit of analysis	Malaysian listed organisations
4	Time horizon	One-shot (cross-sectional)
5	Sampling design	Probability sampling
6	Extent of researcher's interference	Minimal—studying as they normally occur
7	Development of measures	Operational definition of constructs, measuring items development, questionnaire development
8	Quantitative data collection	Administration of questionnaire, web-based survey

Source: Adapted from Cavana, Delahaye, and Sekeran (2001)

4.5.1.1 The purpose of the study

In line with the quantitative research approach discussed in the previous sections, this study was designed as a hypotheses testing type of study. Hypotheses testing studies usually aim to explain the nature of certain relationships of two or more factors in a situation (Cavana, Delahaye, and Sekeran 2001). The hypotheses to be tested in this study were as presented earlier in section 4.2 (Overview of the research problem and questions).

4.5.1.2 Type of investigation

After a clear understanding of the concepts or variables involved in this study was achieved, the focus of the research turned to the relationship between the variables. A correlational relationship indicates that at least two concepts or variables change simultaneously (Cavana, Delahaye, and Sekeran 2001). A correlational study is appropriate when, for example, a study aims to identify the important factors associated with a problem. A correlational type of investigation strives to identify the most crucial factors that are associated with the problem, as usually, there will be more than a single factor that influences a particular problem.

As the purpose of this study was to identify the crucial factors that were associated with the phenomenon of IT use for KM, the correlational type of investigation was thus adopted in this study. In addition, this study also investigated the predictive capability of the proposed research model in explaining the extent of IT use for KM.

4.5.1.3 Unit of analysis

Another aspect of a research design is the unit of analysis for data collected for the research. The unit of analysis refers to the level of aggregation of data during the data analysis stage and is usually determined by the research problem statement (Cavana, Delahaye, and Sekeran 2001). The problem statement of this research was related to the use of IT for KM in Malaysian listed organisations. Hence, the unit of analysis of this study was determined as the Malaysian listed organisation.

4.5.1.4 Time horizon

The data collected in this study were pertinent to the factors influencing the use of IT for KM in Malaysian listed organisations. It was decided that data collected at a particular point in time was sufficient to represent a broad picture of the use of IT to support KM in Malaysian listed organisations. Thus, the time horizon for this study was designed as cross-sectional. In a cross-sectional designed research, data on a sample or a cross section of respondents chosen to represent a particular target population are gathered at essentially one point in time (Singleton, Straits, and Straits 1999). This means that data can be collected in as short a time as is feasible.

4.5.1.5 Sampling design

Sampling is the process of selecting units, such as individuals, groups, or organisations, from the target population of a study (De Vaus 2002). By studying the data collected from this sample, the results may be generalised back to the population from which they were chosen (Collis and Hussey 1997). Samples can be divided into two major types, which are probability sampling and non-probability sampling (Babbie 1990). The probability sampling method was considered appropriate to be used in this study since the basic principle of probability sampling involves considering that every member of the population has an equal chance of being selected in the sample (Babbie 1990; De Vaus 2002). By applying the probability sampling method, the survey should be sent to all Malaysian listed organisations so that each organisation has an equal chance to participate in the survey.

From the literature, it is understood that deciding on a sample size is a complex process. It depends on the kind of statistical analysis the study proposes (Collis and Hussey 1997), the size of the target population from which the sample is to be drawn (Dillman 2000), as well as cost and time (Newton and Rudestam 1999). Many statistical tests may not work well with a small sample size that fits a research budget. However, although a larger sample size may produce more reasonable results, such surveys may not be feasible to carry out due to the higher cost and longer time requirement.

Statistical analysis using variance-based structural equation modelling (SEM), such as partial least squares (PLS) based SEM, suggests that the sample size should be at least ten times the maximum number of items in a construct or latent variable (Chin 1998b). In the revised research model of this study, as shown in Figure 4-3 of this chapter, the construct having the highest number of items was IT use for KM, which had eight constructs of independent variables connected to the construct. Therefore, the minimum number of responses to enable data analysis using PLS-based SEM statistical techniques in this study was 80 responses. Considering the number of responses needed by this study, it was decided to survey all 994 organisations listed on the Bursa KL website (Bursa 2008).

4.5.1.6 Extent of researcher interference

This study aimed to investigate how certain factors affect, including the extent of the effects, the use of IT for KM in Malaysian listed organisations. Thus, ideally, the investigation should be conducted in as much a natural setting of the organisation as possible. In this study, although there was some disruption to the normal flow of work as the questionnaire was administered in the target organisations, the extent of the researcher's interference in the workplace was very minimal, so as to not introduce any bias in the way that respondents provided information.

In summary, the six basic aspects of a research design were discussed in this section. The next section describes the preliminary phase of data collection, which was the investigation of the organisational factor dimensions in the Malaysian context.

4.6 PRELIMINARY INVESTIGATION

As mentioned in the research process section, in addition to the quantitative data, some qualitative data was also collected in this study through a series of interviews. As the literature used to identify the organisational factors that could enhance IT use for KM was mostly Western biased, it was decided that it was crucial to determine their relevance and appropriateness in the Malaysian organisations' context. Thus, interviews were conducted in four Malaysian listed organisations with the objectives being to:

i) explore the current situation with respect to KM in Malaysian listed organisations in order to investigate the relevancy and appropriateness of the proposed organisational factor dimensions in the Malaysian context; and

ii) probe into each dimension to determine the factors or items that may constitute the dimension in order to aid in developing its measuring items.

The following sub-sections discuss the selection of the interview respondents, the interview questions and, lastly, findings from the interviews.

4.6.1 Interview respondents

The use of key organisational informants has been an effective approach in many research contexts (Huber and Power 1985). Typically, these informants or respondents are "usually chief executives, vice presidents, division managers or planners who have important information about organisational events" (Huber and Power 1995, p. 171). The key informants for the use of IT for KM in an organisation, can come from those who are well-informed on the whole range of IT-based systems that are deployed in the organisation, and the way the systems are used to support the organisation's KM activities.

For the purpose of this study, the respondents should also be able to describe the organisational elements, in addition to the KM activities or processes that exist in the organisation. Therefore, the respondent profile considered ideal for this study was a person holding a middle management position, such as sectional or departmental heads, similar to those targeted in studies of strategic management. Besides having the experience of using IT-based-systems for their tasks, these respondents could also provide commentary on the whole organisation's activities of using IT for KM.

Potential organisational respondents were profiled and organisations from different industries were selected in order to be able to generalise the findings to a number of industries. The respondents were chosen based on three criteria:

i) respondents were from listed organisations in Malaysia;

ii) respondents held at least a managerial position in an IT or KM department in the organisation; and

iii) respondents had worked for more than five years in the organisation.

Emails requesting an interview appointment were sent to selected respondents. A cover letter introducing the researcher and explaining the background as well as the significance of the study was included in the email. Respondents were advised on the objectives of the interview and the approximate duration of the interview.

Research and ethics approvals from Curtin University and the Economic Planning Unit (EPU) Department of Malaysia were also attached with the request email in order to emphasise the importance of the research towards the nation's interest, as it is fully supported by the Malaysian government. In the email, respondents were also advised that their participation was voluntary and that their responses would remain confidential. Lastly, to entice participation, respondents were offered an incentive in the form of a copy of the study's final report. The interview request email is included in Appendix A of this thesis.

In order to give an idea on what type of questions would be asked during the interview and to give ample time for the respondents to think about their answers, the interview questions were sent along with the email. An information sheet was attached to the interview questions, which provided the definitions of some key terms, such as 'knowledge', 'knowledge management', 'knowledge management activities', 'knowledge creation', 'knowledge storage', 'knowledge transfer', and ‘knowledge application’. Some examples of knowledge and information in an organisation were also provided.

Appointments with four managers from four listed organisations in Malaysia were made following the responses received from them. Interviews were then conducted from the period of 15 January 2009 until 6 February 2009. The next section describes the semi-structured interview questions that were asked during the interviews.

4.6.2 Semi-structured interviews

A semi-structured interview approach was used for the interviews. Whilst having an overall structure and direction, a semi-structured interview allows the flexibility for the interviewer to include relevant unstructured questioning (Hair et al. 2003). In this approach, the interviewer has a list of pre-determined questions to cover during the interview. However, during the interview, the interviewers are free to decide on whether or not to probe further into the respondent’s answers by asking additional related questions that were not originally included. This approach may result in unexpected and insightful information to further enhance the interview findings.

The interview protocol included in Appendix B was developed to facilitate the interview process and enable the researcher to gather insights into the research problem in order to investigate and refine the items that were believed to be important for the use of IT for KM in an organisation (Yin 1994). The interview protocol was designed in a way that respondents did not feel intimidated in any way during the interview. This was achieved by giving adequate detail and introduction to the questions being asked (Yin 1994). Prior to conducting the interviews, the questions were pre-tested with two senior executives in one Malaysian private company to ensure that they understood the questions and could provide informed responses.

The interview started by providing a brief introduction on the study undertaken by the researcher, along with the objective and purpose of the interview. Next, definitions on some key terms used in the interview were explained so that the respondents had the same understanding of the terms. The interviewer then began asking questions, as according to the prepared interview protocol.

The first section of the interview protocol was geared towards gaining an understanding of the organisation's KM implementation stage and to get a general idea of whether formal KM initiatives were established in the organisation. Some possible answers were also provided in order to assist the interviewee in answering the questions (e.g. 'Is your knowledge management programme "organisation wide" or located within a division or department?' and 'Who is primarily responsible for the KM programme in your organisation? Would it be the CEO, Chief Operations Officer, or Chief Information Officer?').

The second section in the interview protocol inquired about the role of IT in the organisation's KM. Next, respondents were asked to identify the various IT-based systems (e.g. knowledge management system, expertise locator system, collaboration system, workflow system, expert system, intelligent agent, and computer-based training) that were employed in their organisations to support their KM.

The third section of the interview protocol aimed to investigate the relevancy and appropriateness of the identified five dimensions of organisational factors for IT use in KM obtained from the review of the literature. The responses to these questions were measured with the aid of scales, where respondents were asked to rate the importance (on a scale of 'very important', 'important', 'less important' and 'not important') of 'management support and commitment', 'rewards and incentives', 'knowledge sharing culture', 'having a knowledge classification', and 'policies and procedures for using IT for KM' on the extent of IT adoption or use for KM in their organisations. They were also requested to explain or describe what these five dimensions mean in their organisations. Next, they were asked to suggest any additional characteristics or organisational factors that could enhance the level of IT use to support their organisation's KM.

In the last section, the respondents were asked to provide the three most important operational practices or management techniques that contribute to the use of IT for KM in their organisations. Each interview was taped and was about one to two hours in duration. A summary of interview questions, and their objectives, contained in the interview protocol is shown in Table 4-8.

Table 4-8 Summary of interview questions and their objectives

Section	Objective	Interview Questions
Section 1: Stage of KM implementation	To understand the organisation's KM implementation stage and to get a general idea of whether formal KM initiatives are established in the organisation	1 to 6
Section 2: IT role in KM	To understand the role of IT in the organisation's KM and identify the various IT-based systems employed	7 to9
Section 3: Factors that enhance the extent of IT use for KM	To investigate the relevancy of organisational factor dimensions and identify additional factors	10 to 15
General section	To get a general understanding of the three most important operational practices or management techniques that contribute to the use of IT for KM in the organisation	16 to 17

The following section presents the results of the interviews.

4.6.3 Interview results

As per the organisations' requests and the researchers' assurance, their identities were kept completely anonymous and confidential. As such, the four organisations interviewed were labelled as organisations A, B, C, and D.

i) Organisation A

The first organisation, organisation A, was one of Malaysia's leading IT solutions and services provider with more than 1,000 IT professionals. The organisation, with a number of subsidiaries, associates, and investments companies nationwide, provides comprehensive mission critical solutions for both public and private sectors.

The interview was carried out with the Practice and Compliance Manager who was also the business owner of the KM system employed in the organisation. The manager indicated that a formal KM program has been established in the organisation for about four years. She further elaborated that the program was justified as formal since the nature of KM efforts were systematic, and the efforts were supported and managed by a dedicated team as depicted in the organisation's roles and responsibilities organisation chart. She then identified communities of practice, best practices transfer, lessons learned transfer, collaboration process, and knowledge sharing forums as the KM processes that the organisation had adopted in its KM initiative.

When asked about IT roles in the organisation's KM, she clarified that IT is not the driver of the KM initiative; however, IT did play an important role in providing the required infrastructure support for KM processes. She then listed the knowledge management system (KMS), collaboration systems, workflow systems, expert systems, intelligent agents, and computer based training as the IT-based systems that were employed in the organisation to support their KM activities. Next the respondent was asked to rate the five dimensions identified from the literature analysis, based on their importance towards contributing to IT use for KM. The results are as indicated in Table 4-9.

Thinking about her entire KM programme, the respondent then listed the top three items that would enhance the adoption of IT for KM. These were promotion by the management on the benefits of using IT to support KM activities, having a comprehensive IT infrastructure to support KM processes, and organisational policies on employee self-improvement (for example, every employee should achieve a certain target of training hours per year).

ii) Organisation B

Organisation B, which specialises in computerised maintenance management systems (CMMS), is managed in Malaysia, United States, and Australia by a group of maintenance and IT practitioners. Their main activities are the design, development, production, and support of its CMMS software, with a customer base of more than 2000 user sites in over 80 countries worldwide.

The interview was carried out with the Chief Knowledge Officer (CKO) of the organisation who has been heading the KM unit that was established in 2001. The CKO identified on the job training, mentoring of new employees, knowledge sharing forums, best practices transfer, lessons learned transfer, collaboration and knowledge retention processes as the KM processes that were already adopted by the organisation for its KM initiative.

The CKO claimed that IT provided the essential infrastructure required for his organisation's KM. As the organisation advocates employee's self-learning to enhance one's skills and knowledge, the CKO believed that this learning process should be facilitated by a learning platform. He then claimed that IT has been providing such a required platform for learning, as well as providing the communicating bridge between the organisation's employees and customers worldwide. Knowledge management systems (KMS), collaboration systems, and computer-based training were identified as the main IT-based systems used in supporting the organisation's KM.

Table 4-9 shows the level of importance, as rated by the CKO, for the various organisational factors affecting the adoption of IT for KM as identified by the analysis of the literature.

For the top three items that would determine the use of IT in his organisation's KM, the CKO identified culture of freedom and trust, comprehensive IT infrastructure, and top management support.

iii) Organisation C

The third organisation was a large financial institution with over 450 offices in 14 countries worldwide, having more than 10,000 employees. The respondent was one of the project managers who was involved in the transformation and re-engineering of the organisation's major business processes, including the KM implementation project. The respondent, who was responsible for the setting up of the IT infrastructure for the KM project, explained that they were in the midst of completing the required comprehensive IT infrastructure to support their KM, with the next step of the project being to develop a global taxonomy for organisational knowledge. He stressed that it was very important to have IT infrastructure in place, for the KM technologies to 'ride on'. Nevertheless, he clarified that informal and ad hoc natures of KM efforts were already taking place throughout the organisation.

The respondent named communities of practice, best practice transfer, lessons learned transfer, collaboration and knowledge retention processes as KM processes that were already adopted by the organisation. The role of IT in KM was identified as the provider of the required network and infrastructure to support the flow of knowledge among employees within the organisation. Among the IT-based systems that were already employed in the organisation were expertise locator systems, collaboration systems, workflow systems, intelligent agents, and computer-based training. The respondent then rated the identified organisational factors influencing IT use for KM, and the results are as shown in Table 4-9.

The interview ended with the respondent listing the three most important factors affecting the extent of IT use for KM, which were organisational culture; complete KM processes for creating, storing, distributing, and applying knowledge; and a comprehensive IT infrastructure to support these processes.

iv) Organisation D

The last organisation interviewed was a leading manufacturer in the Malaysian food industry. The interview was conducted with the organisation's production manager, who was responsible for the day-to-day operation of the organisation's production line. The respondent revealed that the company had yet to develop a formal KM programme and that knowledge sharing and transfer activities, such as training and lessons learnt presentations in the organisation were conducted on an as-and-when-required basis. The respondent conveyed that the organisation did not own a specific vision to spell out the needs and importance of a KM initiative, and that what was more important was to have strategies that detail how knowledge should be managed.

The respondent named best practice transfer, sharing of lessons learned, and collaboration processes as the KM activities already employed in the organisation. She then stated the importance of IT as the enabling technology for many KM processes in the organisation, such as employees' collaborations and knowledge sharing activities. Among the IT-based systems that were already employed in the organisation to support their KM activities were online document management system, email, a workflow system, an expert system, and the Internet. However, she also indicated that without proper policies, procedures, and guidelines on using IT, such as the Internet, people would tend to abuse the tool. The respondent then rated the identified five dimensions of organisational factors affecting IT use for KM, and the results are as shown in Table 4-9.

The interview ended with the respondent listing the three most important factors for IT adoption for KM, which included a continuous training for employee development, organisational culture for knowledge sharing, and ongoing awareness program to communicate IT use to support KM activities in the organisation.

Table 4-9 Preliminary interview results

Organisational Factor	Organisation A	Organisation B	Organisation C	Organisation D
Management's support and commitment towards IT use for KM	Important	Important	Important	Very Important
Rewards and incentives	Less Important	Not Important	Less Important	Less Important
Knowledge sharing culture	Very Important	Very Important	Very Important	Very Important
Knowledge classification	Important	Important	Important	Important
Policies and procedures for using IT for KM	Very Important	Less Important	Very Important	Very Important

Although the interview data was not analysed statistically, they were valuable for this study's interpretations. A summary of the interview results, as listed in Table 4-9, indicates that all dimensions of the use of IT for KM obtained from the synthesis of related literature were perceived as 'very important' or 'important' in these organisations. The only exception was 'rewards and incentives', which was perceived as 'less important' and 'not important' by all four organisations. Nonetheless, one of the respondents indicated that 'rewards and incentives' could be an effective mechanism in encouraging employees to contribute knowledge to the knowledge repository once the KM programme in the organisation was fully implemented. This indicates that 'rewards and incentives' could still be an important factor for the use of IT for KM in the Malaysian listed organisations. Thus, it was decided to retain this factor for further investigation in this study.

The responses on the three most important operational practices or management techniques that contribute to the use of IT for KM in all organisations interviewed were compiled and listed in Table 4-10. It appeared that all factors that were considered to be most influential on the use of IT for KM in these organisations were already represented by the five dimensions that were identified from the literature, with the exception of the KM processes factor.

Table 4-10 Top three important factors for IT use for KM

Organisation	Factors for IT Use for KM
Organisation A	• Management's communication on benefits of using IT for KM • IT infrastructure to support KM processes • Policies on employees self-improvement
Organisation B	• Organisational culture that is based on trust • Comprehensive IT infrastructure for KM • Top management support
Organisation C	• Organisational culture for knowledge sharing • Appropriate KM processes • Comprehensive IT infrastructure for KM
Organisation D	• Continuous IT training • Organisational culture for knowledge sharing • Awareness programme on IT use for KM

In conclusion, the findings from the interviews generally supported the relevancy and appropriateness of four out of five proposed dimensions of the use of IT for KM in the Malaysian context. In addition, the practitioners in these organisations had also identified an additional factor that could be important towards enhancing the use of IT for KM, which was having appropriate KM processes for managing knowledge in an organisation. It was, thus, decided to include this factor in the study's investigation.

The section below discusses this new identified factor in more detail.

4.6.4 KM processes construct and revised research model

An additional construct of KM processes was added to the proposed research model, as another variable that directly affects the extent of IT use for KM in an organisation as identified by most of the interview respondents. The respondents described that having the appropriate KM processes to support the management of knowledge in an organisation would have a positive impact on the level of IT use for KM.

KM processes were discussed in Chapter 2 of this thesis, (Literature Review), and these processes were defined as the organisational processes that support the flow of knowledge in an organisation, that is the creation, storage, transfer and application of knowledge. This definition was derived from Gold, Malhotra, and Segars's (2001) argument that an effective KM initiative must include a comprehensive view of KM and should include the specific processes required to acquire, convert or store, retrieve, and apply knowledge. Additional support for the KM processes construct in the context of IT use for KM was provided by Kulkarni, Ravindran, and Freeze (2007) who asserted that management should review the readiness of their current processes to facilitate the required technology-based changes in order to successfully adopt IT for KM.

This study thus contends that the KM processes construct is represented by the integration of KM processes into an organisation, and is determined by the extent of knowledge creation, knowledge storage, knowledge transfer, and knowledge application processes in an organisation. These four main KM processes were discussed in detail in Chapter 2 of this thesis. It should be noted that KM processes, which represent the knowledge processes in an organisation, are not necessarily assisted by the use of IT. Examples of these processes include face-to-face meetings, brainstorming sessions, employee rotation programmes, cooperative projects across departments, and apprentices-mentors programmes. Having the appropriate business or KM processes to support KM activities is believed to enhance the use of IT to support KM in an organisation. Thus, the following hypothesis was also proposed in this study:

Hypothesis 8: *Having appropriate KM processes has a positive influence on the level of IT use for KM in Malaysian listed organisations.*

Table 4-11 below lists the definition of the KM processes construct and its sub-constructs.

Table 4-11 KM processes construct definition

Construct	Definition
KM Processes	The extent of knowledge creation, storage, transfer, and application processes in an organisation
• KM process for knowledge creation	The extent of an organisation's processes to acquire new knowledge or combine existing knowledge into new knowledge
• KM process for knowledge storage	The extent of an organisation's processes to extract an individual's tacit knowledge and codify it to an explicit form, and to make this knowledge available and accessible to others
• KM process for knowledge transfer	The extent of an organisation's processes to facilitate the dissemination and exchange of knowledge within the organisation
• KM process for knowledge application	The extent of an organisation's processes to use and apply knowledge for adjusting strategic direction, solving new problems, and improving efficiency and productivity

Figure 4-3 depicts the revised proposed research model, which incorporated the KM processes construct and its corresponding hypothesis (H8), developed based on the findings of the preliminary interviews.

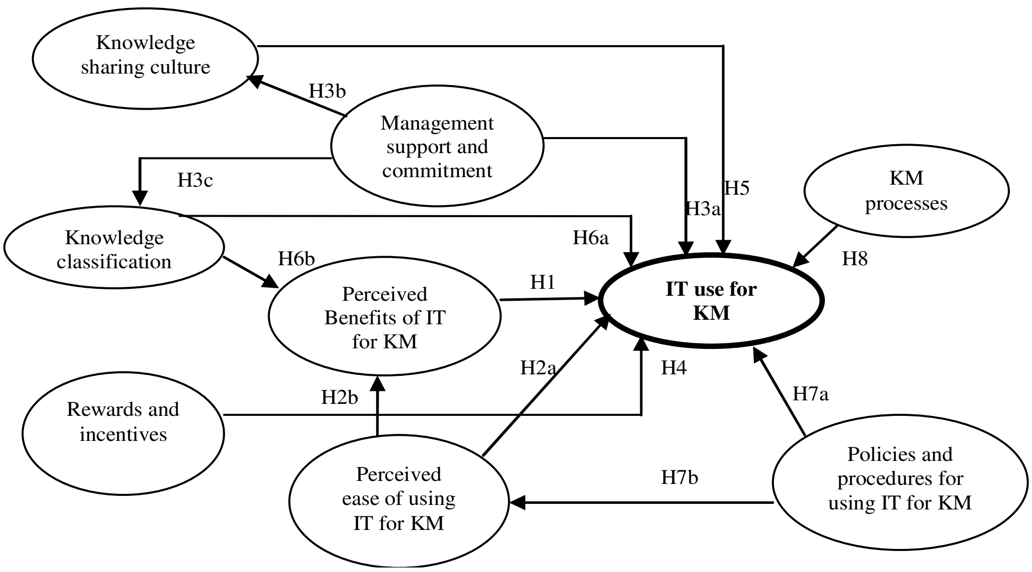


Figure 4-3 Revised research model

In summary, this section described the investigation of the organisational factors in the Malaysian context, and has verified the relevancy of all organisational factors. In addition, the investigation has also identified another factor that was deemed important for the use of IT for KM, and this was thus included in the study's investigation. Once the relevancies of the organisational factors were verified, the survey could then be designed to collect the quantitative data needed to test the hypotheses presented in this study. The next section discusses the development of the survey instrument of this study.

4.7 SURVEY INSTRUMENT DEVELOPMENT

As identified earlier, the research method adopted for this study's main data collection was a web-based survey or online questionnaire. The target audience or respondents for this survey were similar to the interview respondents, who were individuals holding at least a managerial position in an IT department in Malaysian listed organisations. These managers were considered to be the most appropriate 'informants' for this study as they were assumed to have the familiarity, experience, and good knowledge of the use of IT for KM in their organisations. In cases where there was no IT manager in a particular organisation, a KM or general administration manager was then chosen as the respondent for the organisation.

A questionnaire is a self-report data instrument that each respondent fills out as part of participating in a research (Johnson and Christensen 2004) and is used to obtain information about the attitudes, feelings, behaviours, perceptions, experiences, and personalities of the respondents. The aim of the questionnaire in this study was to collect data pertaining to the constructs identified in the research model.

The survey instrument development was divided into three different phases, which included the development of measures for the constructs in the study, the design of the survey questions, and the pre-test of the survey instrument. The sub-sections below discuss the phases of the survey instrument development in more detail.

4.7.1 Measurement of the constructs

This section discusses the procedure followed in constructing the measuring items used in the survey instrument to collect the main data for this study's investigation. Whenever possible, measuring items for the constructs were adapted from prior research in order to ensure the content validity of the scale used (De Vaus 2002).

The review of the relevant KM systems literature led to the identification and categorisation of the existing measures that were suitable for this research. Initial scale items for several of the constructs identified were adapted from multiple sources.

In this study, the IT use for KM construct was represented by the dimensions of IT use for knowledge creation, IT use for knowledge storage, IT use for knowledge transfer, and IT use for knowledge application sub-constructs. The scales for IT use for knowledge creation, storage, transfer and application constructs were developed using items adapted from the IT support for KM construct used in previous studies (Gold, Malhotra, and Segars 2001; Lin 2007; Wang, Klein, and Jiang 2007). The items were worded according to the needs of the study and for the purpose of improving the face validity of the items. Table 4-12 lists the measuring items adapted for the IT use for KM construct.

Table 4-12 Measuring items for IT use for KM construct

Sub-construct	Items	Adapted from
IT use for knowledge creation	In my organisation … 1. IT-based systems are used to acquire knowledge about new products/services within our industry 2. IT-based systems are used to acquire knowledge about competitors within our industry 3. IT-based systems (e.g. chat groups, blogs, online discussion forums) are used to integrate different sources and types of knowledge 4. IT-based systems (e.g. Internet, intranet, knowledge maps) are used to search for new knowledge	(Gold, Malhotra, and Segars 2001), (Wang, Klein, and Jiang 2007)
IT use for knowledge storage	In my organisation … 1. IT-based systems (e.g. knowledge repository, document management system) are used to store individual and organisational knowledge 2. IT-based systems (e.g. collaboration software) are used to store knowledge obtained from collaboration of teams 3. IT-based systems (e.g. knowledge database) are used to store lessons learned from completed projects 4. IT-based systems (e.g. product design databases) are used to store knowledge of the design of products	(Lin 2007), (Wang, Klein, and Jiang 2007)

Sub-construct	Items	Adapted from
IT use for knowledge transfer	In my organisation … 1. IT-based systems (e.g. web portals, intranets, online forums) are used to share knowledge throughout the organisation 2. IT-based systems (e.g. document management systems, online expert communities) are used to transfer organisational knowledge between individuals 3. IT-based systems (e.g. email, groupware, collaboration software, group decision support software) are used by employees to collaborate with others 4. IT-based systems (e.g. electronic meeting software, videoconferencing) are used to allow people in multiple locations to learn as a group from a single source 5. IT-based systems (e.g. chat, IM, email) permit employees to exchange knowledge directly with one another	(Gold, Malhotra, and Segars 2001), (Lin 2007), (Wang, Klein, and Jiang 2007)
IT use for knowledge application	In my organisation … 1. IT-based systems (e.g. help desk systems, troubleshooting systems, expert systems) are used to apply knowledge in solving new problems 2. IT-based systems (e.g. experts locator systems) are used to match sources of knowledge with problems and challenges 3. IT-based systems (e.g. simulation and modelling tools) are used to apply knowledge in development of new products/services 4. IT-based systems (e.g. business intelligence, competitive intelligence tools) are used to generate new opportunities with our partners 5. IT-based systems (e.g. group decision support systems) are used to apply knowledge to adapt to changes in competitive conditions 6. IT-based systems (e.g. business intelligence, competitive intelligence tools) are used to monitor our competitors and business partners	(Gold, Malhotra, and Segars 2001), (Wang, Klein, and Jiang 2007)

In this study, the KM processes construct was measured by the extent of knowledge creation, knowledge storage, knowledge transfer, and knowledge application capabilities in an organisation. The measuring items for the knowledge creation, storage, transfer and application sub-constructs were adapted from an original instrument developed by Gold, Malhotra, and Segars (2001) and from other studies measuring the KM processes and knowledge capability constructs (Becerra-Fernandez and Sabherwal 2001; Lin 2007; Wang, Klein, and Jiang 2007). Table 4-13 lists the measuring items adapted for the KM Processes construct.

Table 4-13 Measuring items for KM processes construct

Sub-construct	Items	Adapted from
Knowledge creation process	My organisation has … 1. processes for acquiring knowledge about our customers 2. processes for acquiring knowledge about our suppliers 3. processes for inter-organisational collaboration 4. processes for combining existing knowledge into new knowledge 5. processes for acquiring knowledge about new products/services within our industry 6. processes for benchmarking organisational performance	(Gold, Malhotra, and Segars 2001), (Lin 2007), (Wang, Klein, and Jiang 2007)
Knowledge storage process	My organisation has … 1. processes for organising knowledge 2. processes for classifying knowledge 3. processes for replacing outdated knowledge 4. processes for filtering the right and relevant knowledge 5. processes for recording knowledge in a medium from which it can later be retrieved by others	(Gold, Malhotra, and Segars 2001), (Lin 2007), (Wang, Klein, and Jiang 2007)
Knowledge transfer process	My organisation has the following processes to share knowledge … 1. On-the-job training 2. Learning by observation 3. Face-to-face meetings 4. Brainstorming retreats or camps 5. Cooperative projects across departments 6. The use of apprentices and mentors	(Becerra-Fernandez and Sabherwal 2001), (Wang, Klein, and Jiang 2007)
Knowledge application process	My organisation … 1. takes advantage of new knowledge 2. uses shared knowledge to improve efficiency 3. uses stored knowledge to adjust strategic direction 4. uses lessons learned from projects to improve subsequent projects 5. ensures effective interpretation and application of knowledge 6. effectively applies knowledge to critical competitive needs 7. quickly links sources of knowledge in solving problems 8. has processes for applying knowledge in development of new products/services	(Gold, Malhotra, and Segars 2001), (Lin 2007), (Wang, Klein, and Jiang 2007)

The measuring items for the knowledge sharing cultures, rewards and incentives, perceived benefits of using IT for KM, and perceived ease of using IT for KM constructs were adapted from studies of KM as an organisational capability (Gold, Malhotra, and Segars 2001), technological utilisation for KM (Moffett, McAdam, and Parkinson 2004), and knowledge management system (KMS) acceptance (Money and Turner 2005; Vitari et al. 2007). Table 4-14 lists the measuring items for the knowledge sharing culture, rewards and incentives, perceived benefits of using IT for KM, and perceived ease of using IT for KM constructs.

Table 4-14 Measuring items for other constructs

Construct	Items	Adapted from
Knowledge sharing culture	1. People within my organisation value an individual's experience and knowledge for the organisation's success 2. My organisation has systematic means of sharing knowledge to make decisions 3. It is a normal practice in my organisation to use IT to expedite knowledge sharing 4. People within my organisation value and encourage contributions made to the knowledge database 5. People within my organisation understand the importance of knowledge for the organisation's success 6. People within my organisation favour the use of online discussion tools (e.g. online forums, knowledge blogs) to share knowledge with others	(Gold, Malhotra, and Segars 2001), (Vitari et al. 2007)
Rewards and incentives	Management in my organisation … 1. provides a standardised reward system to induce knowledge sharing 2. provides incentives that encourage the use of IT to share knowledge with others 3. provides incentives for those who use IT to collaborate with others from different departments 4. rates performance based on an employee's contribution and sharing of knowledge with others 5. has a standardised reward system for those who contribute knowledge to the knowledge database	(Moffett, McAdam, and Parkinson 2004), (Vitari et al. 2007)
Perceived benefits of using IT for KM	In my organisation … 1. IT enables knowledge to be shared easily to improve job performance 2. IT enables efficient collaboration between people from different departments to improve productivity 3. IT enables effective searches of a system, database, or individual having specific knowledge 4. Knowledge networks (e.g. groupware, intranet, virtual communities) enable efficient exchange of knowledge among employees 5. IT makes knowledge easily accessible	(Money and Turner 2005), (Vitari et al. 2007)
Perceived ease of using IT for KM	1. It is easy to deposit knowledge into the knowledge database 2. It is easy to get the relevant knowledge by using IT 3. It is easy to use IT to manage knowledge using the procedures and/or guidelines provided	(Money and Turner 2005), (Vitari et al. 2007)

In addition, based on a review of the relevant literature in identifying influential organisational factors for IT use for KM, all the underlying issues and elements of the factors were carefully shaped into multiple-item measures for the rest of the constructs such as knowledge classification, policies and procedures of IT for KM, and management's support and commitment.

For example, knowledge classification measuring items are based on elements such as an organisation should use IT to manage knowledge and not just information (Alavi and Leidner 1999a; Davenport, De Long, and Beers 1998; Flanagin 2002); an organisation should have an enterprise-wide classification of knowledge (Jennex and Olfman 2004); and the taxonomy of knowledge adopted should be suitable for the organisation's needs (Butler, Heavin, and O'Donovan 2007) and adds values to the organisation (Damodaran and Olphert 2000).

The measuring items for policies and procedures of IT for KM, were developed based on certain determinants of a KM system's use, such as the establishment of policies, procedures and guidelines for using the system (Damodaran and Olphert 2000), while elements such as allocation for IT resources, training, and infrastructure for KM (Davenport, De Long, and Beers 1998; Jennex and Olfman 2004; Moffett, McAdam, and Parkinson 2004), management's champion on using IT for KM (Damodaran and Olphert 2000), and having dedicated roles to lead IT use for KM (Butler, Heavin, and O'Donovan 2007; Moffett, McAdam, and Parkinson 2004; Vitari et al. 2007) emerged as the basis for developing the measuring items for the management's support and commitment construct.

The findings from the interviews were also used to help operationalise the dimensions by identifying items or factors that could be used to measure the constructs identified in this study. For example, with regards to management support and commitment towards the use of IT for KM, the interview respondents have identified several factors that could reflect the level of management support and commitment towards the use of IT for KM. These factors include the management's communication on using IT for KM, employee's awareness program on the availability of IT tools for KM, management's allocation of adequate funding for IT tools and infrastructure, and effective training on using IT tools to support KM.

Similarly, factors that could contribute to measuring the policies and procedures of IT for KM construct were also identified from the interview responses. These factors include having policies that "spell out the use of IT for KM", and supplying adequate procedures and guidelines that could help in facilitating employees' use of IT to support their KM activities. Table 4-15 provides the list of measuring items developed based on existing literature and preliminary interview findings.

Table 4-15 Measuring items for other constructs—developed based on literature and preliminary interview findings

Constructs	Items	Developed based on
Knowledge classification	1. Management in my organisation has taken measures to determine the type of knowledge that we need 2. My organisation has a taxonomy or classification system for knowledge 3. Management in my organisation uses a clear distinction between knowledge (e.g. best practices, lessons learned) and information (e.g. operations/sales reports) 4. My organisation ensures that only knowledge (e.g. best practices, lessons learned) and not information (e.g. operations/sales reports) is stored into the knowledge database 5. In my organisation, knowledge in the knowledge database is being updated regularly	(Alavi and Leidner 1999a), (Butler, Heavin, and O'Donovan 2007), (Damodaran and Olphert 2000), (Davenport, De Long, and Beers 1998), (Jennex and Olfman 2004)
Policies and procedures for using IT for KM	1. My organisation provides procedures and/or guidelines to facilitate the use of IT to manage knowledge 2. My organisation has clear policies for IT use in contributing knowledge to the knowledge database 3. My organisation has clear policies for IT use in accessing knowledge in the knowledge database	(Damodaran and Olphert 2000), preliminary interview findings
Management's support and commitment	The management in my organisation … 1. clearly communicates the importance of using IT to support knowledge management activities. 2. allocates dedicated personnel to lead the use of IT in managing knowledge 3. allocates sufficient funds and resources to support IT infrastructure for knowledge management 4. provides adequate training for employees to use IT in managing knowledge effectively 5. understands the roles of IT in organisational knowledge management activities 6. believes that the benefits of using IT for knowledge management outweighs the costs of investing in IT	(Butler, Heavin, and O'Donovan 2007), (Damodaran and Olphert 2000), (Davenport, De Long, and Beers 1998), (Jennex and Olfman 2004), (Moffett, McAdam, and Parkinson 2004), (Vitari et al. 2007), preliminary interview findings

Similar to the scales used in previous studies, such as Gold, Malhotra, and Segars (2001), Lin (2007), and Wang, Klein, and Jiang (2007), all measuring items for the survey questionnaire were anchored by a five-point Likert scale ranging from one 'strongly disagree' to five 'strongly agree'. The Likert scale's approach of measuring concepts such as perceptions, opinions, and values involves providing a statement that reflects a particular perception, opinion, or value (Hair et al. 2003). Respondents indicate their level of agreement or disagreement with the statement by selecting one of the pre-coded categories or ratings that accompanied the statements.

4.7.1.1 Measures for control variables

The final section of the questionnaire consisted of items measuring the control variables identified in this study. First, to control for the possible size effect, organisational size was measured by the number of employees in an organisation, using ordinal scales (Purvis, Sambamurthy, and Zmud 2001). Second, to control for the possible industry effect, a nominal scale was used to classify the studied organisations into 12 groups of types of industry, which included manufacturing, IT services, financial services, business related services, telecommunications, agriculture, construction, oil & gas, property development & real estate, transportation & logistics, infrastructure & utilities, and others.

Lastly, the questionnaire also included an open-ended question allowing respondents to comment on any aspect of IT use for KM. The measurement for the constructs identified in the study was presented in this section. The next section discusses the methods adhered to in designing the questions for the survey questionnaire.

4.7.2 Designing survey questions

In a survey, individuals are asked to volunteer their time to complete a questionnaire for which they will receive no instant response, benefit, or gratification. If the questionnaire design makes the task difficult due to confusing questions, poor directions, or lengthy questions, people tend to choose not to spend their time to complete the survey (Dillman 2000). Thus, in constructing the survey questionnaire for this study, some important principles of questionnaire format to allow respondents to answer the questions easily and quickly were considered.

4.7.2.1 Wording questions

The survey questions were written in English, which is generally the medium of instruction in the Malaysian private sector. Although most of the measuring items in this study were adopted from prior research, attention was still given to content validity, readability, and formatting of the items in order to minimise the occurrence of misleading questions or inaccurate recording of responses. In addition, considerable attention was also given on the new measuring items that were developed based on the literature and preliminary interview findings, to ensure that they were unambiguous and useful questions.

De Vaus (2002) outlined a checklist that can be referred to in order to avoid problems with question wording. Below is a list of factors that were considered applicable to this study's questionnaire and have thus been taken into considerations.

i) Use simple language—jargons or technical terms should be accompanied with their definitions.

ii) Use shorter questions—shorter questions tend to be less confusing and ambiguous.

iii) Avoid double-barrelled questions—questions should be designed to ask about one thing at a time.

iv) Avoid leading questions—leading questions lead respondents to provide a response that they would not have given had the question been asked in a more neutral way.

v) Avoid negative questions—they can be difficult to understand.

vi) Avoid question that artificially create opinions—In some cases, respondents will have no opinion on certain issues, or the question is simply not applicable to them. In this study, for example, questions that assumed the organisation had a KM system, such as a knowledge database, needed to provide a 'not applicable' (N/A) response option.

4.7.2.2 Questionnaire length

With regards to the appropriate length of a survey questionnaire, De Vaus (2002) explains that it is difficult to isolate the effect of questionnaire length on survey response rates, from other affecting factors such as topic, sample type, and mode of administration. Further, the effect of questionnaire length would only be present in the initial phase of a survey and usually diminished in the follow-up phase. Thus, he recommends not making the questionnaire longer than was really necessary.

In deciding the number of statements or items needed to measure a construct, Hair et al. (2003) suggest a minimum of three statements or measuring items for a single construct are necessary to achieve acceptable reliability. It was decided that the finalised questionnaire, for the actual survey of this study, should have no more than four measuring items for each construct in order to avoid making the questionnaire longer than it should necessarily be. The reduction of the measuring items was conducted in the pre-testing and pilot study phases of the survey.

4.7.2.3 Ordering of questions

According to Dillman (2000), choosing the first question in a questionnaire is more important than any other item, as success in understanding the first question motivates respondents to continue with the survey. A questionnaire should begin with the most interesting question, which could draw the attention of the respondents, as opposed to demographic questions, such as age or education, as these can cause a lack of connectedness between the objectives of the survey and the respondents' understanding (Babbie 1990; Dillman 2000).

In this study, the questionnaire began with a close-ended question and ended with demographic questions. Questions relating to the use of IT for KM in the organisations were placed first in order to attract the potential respondent's attention as they were mostly IT managers.

To aid in answering the questions, the questionnaire was divided into three sections. The first section was comprised of 11 main questions measuring an organisation's extent of IT use to support KM, and the extent of organisational factors that could enhance IT use for KM. The second section had four main questions relating to the level of KM processes in an organisation. The third section consisted of a number of demographic questions concerning the organisation's size and type of industry, and the respondents' job title. This section also included an open-ended question to which respondents could provide general comments pertaining to the matters that were raised in the survey. Lastly, respondents were also asked to leave an email address should they like a copy of the final research report to be sent to them as a reward for completing the survey.

This section described the methods adhered to in designing the questions for the survey instrument. The developed questionnaire was subjected to a pre-test as discussed in the section below.

4.7.3 Pre-testing the survey instrument

Prior to the pilot survey, it was considered essential to pre-test the survey instrument to identify any ambiguous questions, problems in understanding the questions, or suggestions, if any, for revision of the questionnaire (Hair et al. 2003). Previously used questions, such as measuring items from existing studies, should also be evaluated since questions that were proven accurate and reliable in one context may not be accurate and reliable in this study's context of Malaysian listed organisations. Thus, pre-testing of the survey instrument was considered essential to ensure that the measurement scales were adapted and developed appropriately to the context of this study (De Vaus 2002).

Potential respondents for the pre-testing were profiled to ensure that these respondents understood the questions and could provide informed responses. The questionnaire for the web-based survey was sent to six IT executives, who were also familiar with KM and KM systems, in six different Malaysian private companies, two Information Systems (IS) academics, and two statisticians. In this testing phase, respondents were informed that the questions were being developed and they were requested to help improve them, and to focus on the questions' wording, clarity, and validity. They were asked how they would rephrase a question and whether there were alternative answers that they would have preferred. Both questionnaire forms and a covering letter were distributed to each respondent.

The pre-testing of the questionnaire elicited valuable comments from the respondents. Based on the feedback obtained, some questions were rephrased and some were dropped from the questionnaire. These changes are shown in Table 4-16, Table 4-17, and Table 4-18.

Table 4-16 shows the actions taken on the IT use for KM and KM processes measuring items based on the pre-testing results.

Table 4-16 Pre testing results for IT use for KM and KM processes items

Construct	Measuring Item	Participants' comment	Action taken
IT use for knowledge creation	My organisation has adopted IT-based systems to acquire knowledge about new product/services within our industry	'Does adopted means use or just installed?' — commented by two participants	Revised: Replaced with 'In my organisation, IT-based systems are used'
IT use for knowledge creation	In my organisation, IT-based systems (e.g. email, groupware, collaboration software, group decision support software) are used by employees to collaborate with others in the organisation	Two participants found the question was not relevant to the construct	Moved: under IT use for knowledge transfer construct
IT use for knowledge storage	In my organisation, IT-based systems (e.g. knowledge portals) are used to make stored knowledge available and accessible to others	Two participants found the question was not relevant to the construct	Dropped: not relevant
IT use for knowledge storage	In my organisation, IT-based systems (e.g. pointers to experts, skills 'yellow pages') are used to map the location (i.e. an individual, specific system, or database) of specific types of knowledge	Two participants found that the question was unclear. Three participants found that the question did not relate to the construct	Dropped: not clear and relevant
IT use for knowledge transfer	In my organisation IT permits employees to connect directly with customers	Two participants found the question is not clear	Revised: Replaced "connect" with "exchange knowledge"
IT Use for Knowledge Application	In my organisation, IT-based systems are used to apply knowledge to changing competitive conditions (e.g. group decision support systems)	Two participants found the question was unclear	Revised: the phrase 'to adapt to changes in competitive conditions' was included
Knowledge storage process	Has processes for absorbing knowledge from individuals into the organisation	One participant found the question was unclear	Dropped: not clear
Knowledge application process	Quickly applies new knowledge to critical competitive needs	Three participants found the word 'quickly' was awkward	Revised: the word 'quickly' was replaced with 'effectively'

Table 4-17 shows the actions taken on the measuring items for the organisational factors for IT use for KM, based on the pre-testing results.

Table 4-17 Pre testing results for other constructs' measuring items

Construct	Measuring Item	Participants' comment	Action taken
Knowledge classification	My organisation has a taxonomy for knowledge that will be stored in the knowledge management system	Two participants suggested a simpler word is used for 'taxonomy'	Revised: the word 'taxonomy' was replaced with 'classification'
Knowledge classification	In my organisation, employees are given the opportunity to decide on the knowledge that should be deposited into knowledge repositories.	Two participants found that this question did not relate to the classification of knowledge.	Dropped: not relevant
Knowledge classification	In my organisation, knowledge repositories have personalisation capabilities that provide knowledge that is relevant to the specific needs of employees.	Two participants found that this question did not relate to the classification of knowledge.	Dropped: not relevant
Knowledge classification	In my organisation, employees use knowledge mapping processes to identify and maintain important knowledge	How do you classify 'important' knowledge? —commented by three participants	Dropped: unclear
Perceived benefits of using IT for KM	In my organisation, employees are aware of the benefits of using IT in facilitating their knowledge management activities	One participant found the question was not relevant to the construct	Dropped: not relevant
Institutionalisation of the use of IT for KM	My organisation has clear policies on the use of IT to locate experts to solve problems.	One participant found that the question was too specific	Dropped: too specific question

Table 4-18 shows the actions taken based on the general comments given by the respondents.

Table 4-18 General comments on the questionnaire from pre-testing

Comments	Action taken
The questionnaire was very long—commented by four participants	Irrelevant and redundant questions were eliminated
Need to include N/A option in the answer scale	N/A option was included for items inquiring specific KM systems
Need to provide example of all the IT-based systems being asked in the questions—commented by all participants	Examples for all IT-based systems inquired were provided
Many people (incorrectly) assume that 'knowledge' and 'information' are synonymous.	Definitions of the term 'knowledge' and 'information' were included in the 'general instruction' part of the survey

Having developed the survey instrument for this study, the focus of the research design now shifted to ensuring the quality of the survey. The next section discusses the measures taken in order to assure the quality of the survey methodology adopted for this study.

4.8 SURVEY QUALITY ASSURANCE

As the survey instrument was developed, other factors that could enhance the quality of the survey, such as issues concerning the validity and reliability of the instrument, quality in a web-based survey, and the need to address survey error were also considered in this study. The sub-sections below provide the discussion of these issues in more detail.

4.8.1 Validity and reliability of research instrument

A scientific study must always address the two issues of validity and reliability so that the research instrument used in the study accurately and consistently measures what it is meant to measure (Hair et al. 2003). The following sub-sections present the measures taken to address the validity and reliability concerns of this study's research design.

4.8.1.1 Validity

Validity is achieved by using research instruments that measure what they are intended to measure, and when the measuring items actually tap into the construct of interest (Cavana, Delahaye, and Sekeran 2001). There are three basic ways in which validity of measures can be assessed, namely by means of assessing the content, construct, and criterion validity (Hair et al. 2003).

Content validity

Content validity of an instrument refers to the extent to which the questionnaire is able to measure the concept, or the theoretical constructs, usually by means of subjective assessments (Cavana, Delahaye, and Sekeran 2001; Hair et al. 2003). In other words, content validity is a measure of how well the elements of a concept have been defined.

There are at least three ways in which content validity can be achieved (De Vaus 2002). Firstly, specific points that described the investigated concept can be identified from the literature. Secondly, these specific points may be obtained from the analysis of qualitative data, for example, from interviews. Thirdly, to ensure that these specific points are representative of the concepts, the list of points can be referred to a panel of experts. In this study, the content validity of the instrument used was enhanced by developing the measuring items based on the relevant extant literature, and also on the findings of the interviews conducted in four Malaysian listed organisations during the preliminary investigation phase of the research, as described in section 4.7.1.

Construct validity

Construct validity of an instrument assess the extent to which the instrument measures the intended concept or construct (Hair et al. 2003). Multiple-item measures were used for the constructs in this research in order to improve the construct validity of the measures (Gold, Malhotra, and Segars 2001). In addition, construct validity can also be determined and improved by assessing the convergent and discriminant validity of the construct.

Convergent validity is the extent to which the measuring items are positively correlated with other measuring items of the same construct, whereas discriminant validity is the extent to which a particular construct does not correlate with other different constructs (De Vaus 2002). Unlike content validity, convergent and discriminant validity can be objectively and statistically tested. The results from the pilot study of the survey were used to statistically assess the convergent and discriminant validity of this study's instrument as reported in section 4.10 (Pilot study of the survey).

Criterion validity

Criterion validity is obtained by comparing a new measure with an existing and well-accepted measure of the concept. High correlation between the answers on both the new and the established measure indicates high criterion validity. However, De

Vaus (2002) identifies two problems associated with this approach. First, a low correlation between the new and existing measure could also indicate that the existing measure is invalid. Second, it may be difficult to find well-established measures, for the concepts in a study, which can be used to test the new measures. Due to these problems, it was decided not to use this approach in assessing the validity of the measures in this study.

4.8.1.2 Reliability

Reliability is achieved by using research instruments that produce the same results on repeated or different occasions (Cavana, Delahaye, and Sekeran 2001). Thus, a question that fails to achieve consistent responses is considered unreliable. The measures taken in order to improve the reliability of the questionnaire used in this study are discussed below.

De Vaus (2002) suggests that the best method of testing reliability of indicators is by having a set of questions or multiple-item indicators to measure the intended construct, rather than single-item indicators. Hence, the multiple-item measures used in this study could enhance the confidence that the constructs in this study were accurately assessed, and that the measurement of the constructs were consistent (Neuman 2003).

The reliability of a multi-items' measure can be tested by determining the degree in which the independent measuring items of the same construct correlate with one another. The most popular test of reliability for multi-item measures is the Cronbach's coefficient alpha. The acceptable level of reliability as recommended by De Vaus (2002) is when Cronbach's coefficient Alpha is 0.70 or more. Results from the pilot study of the survey were used to test the reliability of measures in this study, and the results are as reported in section 4.10 (Pilot study of the survey).

Another method of improving reliability that was adopted in this study included the care taken in wording the survey questions, as different interpretations of the same question could result in inconsistent answers. In particular, terms that were used in the questions should provide the same meaning to all respondents. Thus, a definition of terms was provided in the introductory section of the study's questionnaire so that the same meaning of terms could be applied by all respondents, which could further improve the reliability of the survey instrument.

The measures taken to address the validity and reliability of the research instrument were discussed in this section. The next section discusses the measures taken to raise the quality of the web-based survey method adopted in this study.

4.8.2 Ensuring quality in web-based survey

As the method for collecting data adopted in this study was a web-based survey, it was essential to consider the factors that could influence the quality of this type of survey. The following sub-sections describe the measures taken to ensure the quality of the web-based survey.

4.8.2.1 The use of online web-survey service

De Vaus (2002) recommends that the simplest way to ensure a smooth implementation of a web-based survey is to use a web-survey hosting service. These services simplify the process of writing the questionnaire, making it web compatible, placing it on the Internet, and receiving responses. The online web-survey hosting service selected for this study was QuestionPro (Survey Analytics 2009), which offered useful features to facilitate a smooth implementation of the survey as below:

(i) compiles responses in its own database—these responses can then be generated into .xls or .cvs format to be exported into statistical software packages;

(ii) provides templates for questions' designs;

(iii) sends email invitations to respondents as per provided mailing lists; and

(iv) allows responses to be sent automatically to the researcher via email, which provides a backup data files for the responses obtained from the survey.

4.8.2.2 Quality sample selection for web-based survey

Another factor that could raise the quality of a web-based survey is the selection of the sample for the survey (De Vaus 2002). A web-based survey should not rely on volunteer visitors to the survey website to get a good quality sample, as this will only produce a collection of responses.

As invitations to participate in this survey were sent via email, the quality of the sample that this survey could reach would depend on the quality of the mailing list used. Thus, in order to ensure that the email invitation reached its intended participant, instead of sending the survey to the organisations' general email addresses, it was decided that the survey should be sent to the specific email addresses of the IT or KM managers. Hence, a list of IT or KM managers' business email addresses was obtained from Malaysian listed organisations' official websites.

However, most organisations' websites did not supply the contact information of their management personnel. Thus, telephone requests for IT or KM managers' email addresses were also made to all organisations that did not supply the email addresses on their official websites. Explanations were made as to why the managers' email addresses were being recruited. Whilst most organisations were happy to oblige in providing the email addresses, a number of them refused on the basis that they were not interested in participating in the study, or that it was against their company's policies.

As a result, out of 994 Malaysian listed organisations, 980 email addresses of IT and KM managers were compiled from the organisations' official websites and through telephone requests, as the potential respondents of this study's survey. Care was taken to ensure that there was no double counting, i.e., the same organisation would not be included more than once in the sample.

4.8.2.3 Other measures

Other measures that were taken into consideration in order to improve the quality of the web-based survey method adopted in this study as recommended by De Vaus (2002), are listed below:

i) Unauthorised access to the questionnaire was prevented—the questionnaire was only provided to selected respondents. A specific URL was provided to respondents in the invitation emails to participate in the survey.

ii) The use of graphics features were minimised in the questionnaire—too many flashing graphics, changing features, and flashy colours would simply divert attention from the main purpose of the questionnaire page. Considering that the audience of the survey were professionals in managerial levels, the questionnaire was developed to appear as professional as possible.

iii) Explanations, definitions, and descriptions of key terms used in the questionnaire were provided in the front page of the questionnaire to ensure that all respondents shared a similar understanding of the terms to minimise confusion.

(v) Control on who filled out the questionnaire—in order to be sure that the questionnaire was filled out by the targeted person in an organisation, the questionnaire was sent to the exact email address of the respondents.

(vi) Ballot box stuffing—the web-survey service provided a mechanism to indicate if a particular email address had responded to the survey; this prevented receiving another response from that particular email address.

(vii) Out-of-date email address—this element was minimised by gathering respondents' email addresses from their organisations' current official websites and also through telephone requests made to the organisations.

(viii) Infrequent checking of email—the impact of this problem was minimal since the target respondents, comprised of IT and KM managers, would usually access their emails regularly.

(ix) Item non-response issue—item non-response was minimised in this study by using a response validation feature provided by the survey software. If a question requiring an answer was missed, the software highlighted the particular question and required the respondent to provide an answer before the respondents could proceed to the next page.

This section described the steps taken to ensure the quality of the web-based survey. Next, the following section discusses several types of survey errors and the appropriate measures taken to minimise the errors.

4.8.3 Survey error

In any survey research, necessary steps should be taken to minimise the four potential sources of survey error (Dillman 2000; Salant and Dillman 1994). These errors include sampling, non-coverage, measurement, and non-response errors. The following sub-sections discuss the types of errors and the measures taken to address them in this study.

4.8.3.1 Sampling error

Sampling error is the degree to which the selected sample does not represent the targeted population and is usually caused by the exclusion of certain members of the population from the sample (Dillman 2000). This type of error is highly dependent on the sample size and can be estimated with considerable precision. Section 4.5.1.5 of this chapter has discussed the sampling design of this study, in order to minimise the sampling error.

4.8.3.2 Coverage error

Coverage error results when not all members of the study's population are given equal chances to participate in the survey. Section 4.8.2.2 of this chapter discussed how all organisations listed on the Kuala Lumpur Stock Exchange's database were included in the mailing list to receive the email invitation to participate in the survey in order to minimise the coverage error of this study.

4.8.3.3 Measurement error

Measurement error is the result of poor question wording and questionnaire design, which can cause questions to be overlooked or bias to be introduced in the provided response (Dillman 2000). This type of error represents the difference between the answer given by the respondent and the true value that applies to that answer. Section 4.7.2 of this chapter has presented the guidelines followed in constructing the survey questions for the study, as well as in the overall questionnaire design in order to minimise measurement error. Further efforts taken to minimise this error were by conducting pre-tests and a pilot study of the questionnaire, which were described in sections 4.7.3 and 4.10 of this chapter. Additionally, measurement error that could result from the analysis of data collected was minimised by the use of a web-survey service that had the capability of preventing duplication or data loss, as data collected could be automatically imported to statistical software packages.

4.8.3.4 Non-response error

The last type of survey error is non-response error, which occurs in the case of non-respondents, who are different from those who respond in a way that can affect or introduce bias in the result of the study (Dillman 2000). The paragraphs below discuss the steps taken in order to maximise the response rate in this study and hence minimise non-response error.

Maximising response rates in web-based surveys

As demand for survey research is increasing, reports indicate that survey response rates have been falling, both in the USA and Europe (Porter 2004). Similar situations prevail in Malaysia, especially in cases where the unit of analysis of the survey is of private companies. For example, a survey conducted by Tan (2004) on private companies comprised of manufacturing and winners of Enterprise 25 companies had only obtained a response rate of 8.7%. Another survey conducted by Zoo and Aziz (2006) on Malaysian oil and gas contractors yielded a response rate of 16.7%. Similarly, a survey on Malaysian manufacturing companies also resulted in a low response rate of 10.2% (Sambavisan, Loke, and Abidin-Mohamed 2009).

Considering the general low response rate in Malaysian private companies' surveys, careful steps needed to be taken in order to maximise the response rate of this study.

Gaining cooperation in a web-based survey involves similar principles for any other sort of survey. However, De Vaus (2002) highlights several additional factors that need to be considered in order to increase response rate, particularly in a web-based survey, as below:

i) Method of administration

A web-based survey should be distributed to the selected sample in a way that makes respondents want to respond. One way of doing this is to email respondents an invitation to participate, together with an explanation of the survey and the URL of the survey website. The QuestionPro online survey service, which was used to design and host this study's survey, has the capability of sending email invitations to provided mailing lists. The invitation email serves as an introductory letter of the survey where it introduces the study, explains the study's objective and significance, and the importance of participation. Great care was taken in emailing the invitations as it was very important to avoid email spamming. Unsolicited email, such as spamming, is regarded as a breach of 'netiquette' that could generate hostility, and is ineffective, which may result in very low response rates and very poor quality data (De Vaus 2002). The survey invitation email for this study is included in Appendix C of this thesis.

ii) Assurances of confidentiality or anonymity

Many people are suspicious about anonymity and the confidentiality of the information that they provide over the Internet. Thus, assurance of respondents' anonymity and their responses' confidentiality was included in the email invitations to participate in the survey.

iii) Questionnaire appearance

Porter (2004) claims that the low response rates in Internet surveys might be due to the survey design. Similarly, Dillman (2000) reports that these low response rates could be due to the 'fancy' appearance of the survey websites. In the current study, suitable background colours, different fonts, question format grids, and alternative colours between adjacent questions were among the interface options that were used to make the survey webpage look more inviting and, more importantly, easy to read.

iv) Public value

Public value of the survey should be emphasised to encourage participation. In this study, the email invitations highlighted the purpose of the study, its objective, as well as its importance for the Malaysian listed organisations specifically, and to the country generally, in order to enhance respondents' perception of the value of the study, and thus motivate their participation.

v) Sponsorship and approval

Sponsorship and approval of the survey being conducted from reputable institutions may also enhance respondents' perception about the value of the study. In this study, a statement of the university's sponsorship under which the study was conducted, followed by two names, email addresses, and phone numbers were provided in the email invitations for those who might want more information about the study. The email invitation also explained that the current study was approved and supported by the Economic Planning Unit (EPU) Department of Malaysia, since the study can be used to provide some insights about managing the use of IT to support KM in Malaysian listed organisations, which could contribute to achieving a knowledge-based economy.

vi) Incentives

Non-material incentives can be provided with the survey in order to entice participation. In this study, the email invitations sent to potential respondents explained that an approved summary report of the study was offered to the respondents who completed the survey. It was also explained that there was a section in the survey where respondents could leave an email address where they wished the report to be sent to.

vii) Follow up non-respondents

Another important way of achieving reasonable response rates is to follow up non-respondents. This method can be very effective in web-based surveys, as non-respondents may forget to answer the questionnaire the first time they receive the email invitation. The invitation could also be pushed further below by other new incoming emails in their mailbox. In this study, the process of follow up was fairly straightforward. The web-survey service used in this study had a built-in capacity that allows reminder emails to be sent to only those who have not responded, which thus enabled the follow-up process to be done rather simply and cheaply.

The appropriate measures taken to minimise the four types of survey errors were discussed in this section. The next section discusses the ethical issues that were addressed in the research.

4.9 ETHICAL CONSIDERATIONS

The main purpose of research ethics is to ensure that the participating individuals and organisations are protected from adverse consequences or harm that may result from the research process (Zikmund 2003). This section addresses the ethical considerations for this study based on the five areas of research ethics, which include avoidance of harm, informed consent, voluntary participation, intent of the study, and privacy invasion (Cavana, Delahaye, and Sekeran 2001; Singleton, Straits, and Straits 1999)

4.9.1 Avoidance of harm

Ethical standards require that research participants should never be exposed to situations where they might be at risk or subjected to physical or psychological harm (Cavana, Delahaye, and Sekeran 2001; Singleton, Straits, and Straits 1999). Physical harm was not considered a potential risk in this study and psychological harm was eliminated with the respondents' voluntary participation.

4.9.2 Informed consent

Informed consent must be obtained from research participants, whether in explicit or implicit form (Singleton, Straits, and Straits 1999). In this study, the survey invitation emails sent to potential respondents provided enough information about the study undertaken in order for them to make informed decisions on whether or not to participate. Implicit informed consent was thus obtained in this study, when they responded to the survey.

The same measure was taken with the interview respondents in this study. Adequate information about the study was provided in the interview request emails sent to potential respondents. Respondents who agreed to participate had signed an 'informed consent' form before the interviews were conducted. The consent form for the interview is included in Appendix D of this thesis.

4.9.3 Voluntary participation

Research participants should not be forced or persuaded into participating in research (Cavana, Delahaye, and Sekeran 2001; Singleton, Straits, and Straits 1999). In addition to providing them with enough information to decide on participating, it must also be explained that their participation in the research is voluntary. In this study, potential respondents for both the survey and interview were informed, in the survey and interview invitation emails, of their rights of not taking part in the study and that participation was voluntary.

4.9.4 Intent of the study

The purpose of the research must be explained to the potential respondents in order not to mislead them about the true intent of the study (Cavana, Delahaye, and Sekeran 2001; Singleton, Straits, and Straits 1999). The intent of this study was fully explained to the potential interview and survey respondents in the invitation emails sent to them. In addition, the specific objectives and details of the interview and survey were also explained clearly in the invitation emails before data was collected.

4.9.5 Privacy invasion

Ethical standards require that researchers protect the right to privacy by providing guarantees on anonymity and confidentiality of the respondents (Singleton, Straits, and Straits 1999). In the email invitations for the interview and survey of this study, the participants were assured that their responses would be reported in aggregated form only and would not be identifiable with them personally, or with their organisations. Care and due diligence were exercised throughout all personal exchanges in order to respect and maintain the privacy and confidentiality of the participants.

Anonymity was also guaranteed for all participating organisations and individual participants. For example, in the survey invitation email, it was stated that the survey contained no personal details and hence respondents could not be identified from their responses. In addition, to ensure anonymity of participating organisations, steps that were taken included not reporting the precise product range, location, or size of the organisation.

Since this study intended to collect data from individuals, prior approval was required from Curtin University's Ethics Committee. An ethics approval application form was submitted together with the set of questionnaires. Subsequently, the study received ethics clearance for conducting the research from the Curtin University of Technology Human Ethics Committee with the reference number IS-09_07 (see Appendix E for clearance document).

In summary, the ethical concerns of the participating organisations and individual participants were adequately addressed in this study. The next section discusses the next research process, which involved a pilot study of the survey questionnaire to further refine the instrument for the actual survey.

4.10 PILOT STUDY OF THE SURVEY

A pilot study of the survey was conducted to ensure that the final form of the questionnaire items was reliable and valid. In addition, rather than relying solely on the respondents' subjective assessments about the questions, as in the pre-testing stage, the results of the pilot study could be used to objectively assess the questionnaire by analysing the respondents' answers. By administering a complete questionnaire, which was longer than the final questionnaire would be, the pilot study enabled tests for validity and reliability of the measures to be conducted. Moreover, information gathered in this stage was used to provide further indication of the appropriateness of the questions, revise questions where necessary, reorder questions, and shorten the questionnaire. Attention was also given to the final layout of the questionnaire to ensure that it was clear for the respondents.

Cavana, Delahaye, and Sekaran (2001) suggest that a questionnaire should be piloted with a reasonable sample of respondents who come from the target population or who closely resemble the target population. Thus, the instrument was administered online, using the QuestionPro survey service, to IT or KM managers in 150 Malaysian listed organisations (taken from the prepared mailing list of 980 email addresses, as discussed in section 4.8.2.2) via email invitations to participate in the survey. Similar to the actual survey, the email invitations included the introduction of the study; importance and purpose of the study; assurance on participants' privacy; and ethics approval of the study. The definitions of key terms and instructions on how to complete the survey were also provided on the first page of the questionnaire. In order to stimulate the final questionnaire administration, respondents were not told that the questionnaire was still under development.

There were 34 usable responses received for the pilot study. Correlations coefficients for all measuring items in each construct were computed and, as recommended by De Vaus (2002), items with coefficient values less than 0.3 were dropped.

To test the reliability of the measuring items, Cronbach's alpha coefficients were computed for all sets of items measuring each construct. Table 4-19 shows the number of items dropped after convergent validity and reliability analyses, and Cronbach's alpha values for the final set of measuring items for each construct.

Table 4-19 Reliability analysis results

Constructs	Sub-constructs	No. of items dropped	Final no. of items	Cronbach's alpha
IT use for KM	IT use for knowledge creation IT use for knowledge storage IT use for knowledge transfer IT use for knowledge application	1 0 2 2	3 4 3 4	0.779 0.930 0.885 0.914
KM processes	Knowledge creation process Knowledge storage process Knowledge transfer process Knowledge application process	2 1 2 4	4 4 4 4	0.919 0.939 0.878 0.923
Knowledge sharing culture		2	4	0.903
Knowledge classification		2	3	0.941
Policies and procedures of IT for KM		1	3	0.914
Rewards and incentives		1	4	0.960
Perceived benefits of using IT		1	4	0.932
Perceived ease of using IT for KM		0	3	0.831
Management's support and commitment		2	4	0.938
		Total no. of items:	**55**	

It was noted that overall, Cronbach's alpha values for the final set of measuring items were satisfactory, exceeding the cut-off level of 0.7 (De Vaus 2002). The numbers of questions were reduced from 78 questions in the initial questionnaire to 55 questions, in an attempt to attract more participation in the actual survey. The survey questionnaire is included in Appendix F.

In summary, the design of the research instruments with the objective to ensure the validity and reliability of the research findings was presented in this section. The next section discusses the next research process, which is the administration of the finalised survey questionnaire for the collection of the main data for this study.

4.11 MAIN DATA COLLECTION

The refined and finalised survey questionnaire from the pilot study was administered to the target population of this study in August 2009. TheQuestionPro web-based survey service was used to distribute email invitations to IT or KM manager in 830

(150 less organisations than the total of 980 organisations, which were used in the pilot study) Malaysian listed organisations.

As in the pilot study, the introduction, importance, and purpose of the study, assurance on participants' privacy, as well as information on ethics approval of the study were also included in the email invitations. Participants were offered a token of appreciation in the form of an approved final report of the study in order to entice their participation. Key terms' definitions, and instructions on how to fill out the survey, were provided on the first page of the questionnaire. The respondents were asked to contact the researcher should they have any questions or comments on the survey.

4.11.1 Response rate

Of the 830 email invitations sent, which were followed by three follow-up and reminder emails from the period of August to October 2009 to those who had not responded to the survey, 169 responses were received. Of these responses, one was removed due to invalid data (same response for all questions). This represents a usable response rate of 20.2%.

Despite declining response rates in Malaysian private companies' surveys, the response rate received for this study compared favourably with recent studies. For example, Tan (2004) received 6.8%, Zoo and Aziz (2006) received 16.7%, and Sambavisan, Loke, and Abidin-Mohamed (2009) received 10.2%. In addition, other international studies in similar research areas, such as Khalifa and Liu (2003) had received 19.1% response rates, Moffett, McAdam, and Parkinson (2002) had received 8.8% and Lin (2007) had received 23.5%. Thus, this study's response rate was also comparable with prior studies in similar research areas.

4.11.2 Data analysis technique

Once data were collected from a representative sample of the target population, the next step was to code and analyse the data to test the hypotheses developed for this study. As responses were automatically compiled in the web-survey service's database, they were conveniently generated into an Excel (.xls) file format and downloaded from the service. In the analysis phase, data collected from the survey instrument were statistically analysed to understand and interpret the results obtained for this study.

The SEM approach using PLS technique was used for the quantitative data analysis and graphical presentation of the results. The discussion of the data analysis technique adopted in this study will be discussed in more detail in Chapter 5 of this thesis, (Data Analysis and Results).

4.12 SUMMARY

The quantitative research approach was identified and justified in this chapter as the appropriate research approach to answer the research problem identified in this study, which was 'the low level of IT adoption to support KM in Malaysian organisations impedes effective KM in these organisations'. Based on the nature of the research problem, this chapter explained and justified the need for this hypotheses-testing study to utilise a quantitative research approach, using the survey methodology, and operating within the positivist research paradigm.

Following the justification of the selection of the web-based survey method to be employed, this chapter provided an overview of the research process undertaken in this study. Next, the design of the research was presented by describing the basic aspects of the research design. This was followed by a discussion of a preliminary investigation to verify the relevancy of the key variables in the context of the study. Then, details of the survey instrument development were presented, followed by a description of the appropriate measures that were taken to ensure the quality of the data collected from the survey. Next, the ethical considerations that were taken into account in the research approach were also presented. This was followed by a discussion of the pilot study and the results of the validity and reliability testing of the survey instrument based on the result of the pilot study. Finally, the actual survey administration to collect the main quantitative was described, including a brief description of the data analysis technique chosen to analyse the data.

Having laid the framework within which the study was carried out with due consideration for its validity, reliability, quality, potential errors, and ethical considerations, the next chapter presents the findings of the study and their analyses, in relation to the research problem and the proposed research model.

CHAPTER 5: DATA ANALYSIS AND RESULTS

5.1 INTRODUCTION

As data needed for this study was collected abiding by the research approach laid out in the previous chapter (Chapter 4), this chapter aims to describe the data analysis techniques chosen to analyse the data collected, and presents the results of the data analysis in relation to the proposed research model. The next section of this chapter presents the demographic profile of the participating organisations in this study. This is followed by an introduction to the structural equation modelling (SEM) approach with the partial least squares (PLS) technique that was used to analyse data collected in this study. Next, the two components of measurement and structural models in a PLS approach are described and the criteria used to assess both models are outlined. The following section then provides a discussion of the evaluation of the measurement model. Once the measurement model is assessed satisfactorily, the structural model is then evaluated. Finally, the research hypotheses are tested based on the results of the structural model and the results are presented in the last section of this chapter.

Figure 5-1 provides an overview of the sections presented in this chapter.

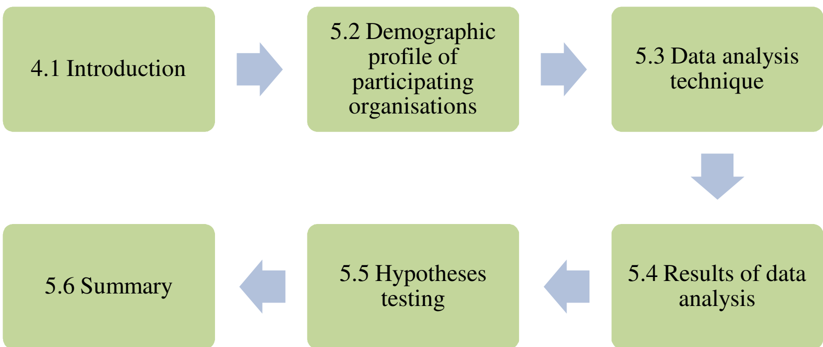


Figure 5-1 Overview of the sections in Chapter 5

The following section provides the demographic profiles of the organisations that participated in this study's survey.

5.2 DEMOGRAPHIC PROFILE OF PARTICIPATING ORGANISATIONS

This section provides an insight into the types of organisations and respondents that had participated in the survey. A total of 169 organisations responded to the survey. Upon receipt of the questionnaire, a quick scrutiny was made of the responses to spot any missing or invalid data. One case was found to be invalid data (same value for all responses), which resulted in 168 usable responses. After a preliminary scrutiny, all 168 usable cases were exported from the QuestionPro web-survey service and loaded into SPSS v.17 software for the purposes of:

i) generating the descriptive statistical reports,

ii) generating additional histograms, correlations, and frequencies to check for invalid and missing data, and

iii) generating an ASCII file for input into PLS-Graph software for further analysis.

Figure 5-2 illustrates the distribution of responses by types of industries across the Malaysian listed organisations. The participating organisations were categorised into 12 types of industries: Manufacturing, IT Services, Agriculture, Construction, Financial Services, Oil & Gas, Property Development & Real Estate, Telecommunication Services, Transportation & Logistics, Infrastructure & Utility, and Others. The largest number of respondents was from the manufacturing industry, representing 29.8% of the sample. The next highest were from IT services and services industries, which represented 17.9% and 11.3% of the sample respectively. The remaining industries exhibited a modest range of representation from a minimum of 1.8% (infrastructure & utility) to a maximum of 8.9% (agriculture). *Nevertheless, the responses distribution indicates that the sample is a representative of all industries across the Malaysian listed organisations.*

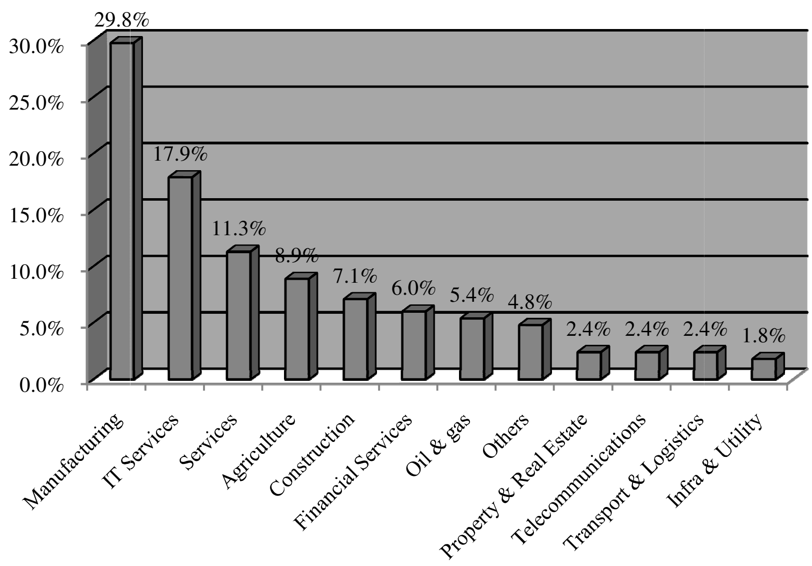


Figure 5-2 Distribution of responses by industries

Table 5-1 shows the size of the organisations that participated in the survey. The majority of the organisations were large companies with more than 500 employees (41.7%). Some 25.6% of the organisations were medium to large size (101-500 employees) companies, 17.3% were small to medium size (50-100 employees), while the rest (15.5%) were from small companies (less than 50 employees).

Table 5-1 Size of participating organisations

No. of Employees	Frequency	Percent
More than 500 employees	70	41.7
101–500 employees	43	25.6
50–100 employees	29	17.3
Less than 50 employees	26	15.5
Total	**168**	**100.0**

Table 5-2 lists the positions held by the respondents. The table shows that half of the respondents held the position of Chief Technology Officer (CTO) or IT Managers (50.0%). This was followed by the positions of Director or Chief Executive Officer (CEO) or General Manager at 19.6% and Senior Manager or Manager at 17.3%. A small percentage (10.1%) of the respondents held positions lower than the managerial level. This indicates that even though the survey email invitations were sent to specific respondents holding managerial and above positions, a number of the recipients had forwarded or delegated the invitations to their subordinates for completion. In this study, responses provided by these subordinates were considered to be representative of their managers' views on the topic being investigated in the survey. Finally, the position of Chief Financial Officer (CFO) was held by 3.0% of the respondents.

Table 5-2 Positions of respondents

Respondent	Frequency	Percent
CTO/IT Manager	84	50.0
Director/CEO/General Manager	33	19.6
Senior Manager/Manager	29	17.3
Senior Executive/Executive	17	10.1
CFO	5	3.0
Total	**168**	**100.0**

This section provided the demographic profiles of the organisations that have participated in the study's survey. The next section provides a description of the data analysis technique employed in this study.

5.3 DATA ANALYSIS TECHNIQUE

The SEM approach using PLS technique was chosen as the data analysis technique to analyse data collected in this study against the research model proposed in Chapter 3. SEM is a complex statistical approach for testing hypotheses about relationships between observed and latent variables (Bagozzi 1981; Hoyle 1995). In SEM, latent variables (LVs) are unseen variables that are measured using observed variables as indicators (Hair et al. 1995).

SEM has advantages over the first-generation techniques, such as principal components analysis, factor analysis and multiple regression methods, as it extends these techniques by providing the capabilities to 'i) model relationships among multiple predictors and criterion variables, ii) construct unobservable LVs, iii) model errors in measurements for observed variables, and iv) statistically test a priori substantive/theoretical and measurement assumptions against empirical data (i.e., confirmatory analysis)' (Chin 1998a, p. 7). Thus, SEM techniques provide researchers with a comprehensive means of assessing and modifying theoretical models, which have become increasingly popular in information systems research (Gefen and Straub 2005).

SEM techniques have also been increasingly used because of the availability of software packages such as LISREL, EQS, Amos, SEPATH, and ROMANA (Chin 1998a). These software packages apply SEM techniques using the covariance-based method, with the objective of obtaining goodness of fit. The covariance-based method uses a maximum likelihood (ML) function that attempts to minimise the differences between the sample covariance and those predicted by the theoretical model (Chin 1998a). Among the underlying assumptions of the covariance-based method are that the observed variables follow a specific multivariate distribution and the observations are independent of one another. As the covariance-based SEM is based on the concept of goodness of fit rather than significance testing, the method does not confirm a theory beyond reasonable doubt, but only demonstrates that the available data is consistent with the proposed theory (Hair et al. 1995). Further, the use of a covariance-based method could be problematic in obtaining a good fit for complex models with more indicators.

An alternative to the covariance-based SEM technique is known as partial least squares (PLS). PLS, which was first introduced by Herman Wold (Wold 1966), is a second-generation multivariate technique used to estimate the parameters of a structural model. The PLS method is designed to maximise prediction rather than fit, by minimising the variances of dependent variables, observed variables, and latent variables (Chin and Newsted 1999).

Table 5-3 lists the main differences between the covariance-based structural modelling approaches, such as LISREL, and the PLS approach.

Table 5-3 Comparison between covariance-based and PLS approaches

Criterion	Covariance-based approach	PLS approach
Objective	Parameter oriented	Prediction oriented
Required theory base	Requires sound theory base Supports confirmatory research	Applicable in scarcity of prior theory Supports both exploratory and confirmatory research.
Approach	Covariance based	Variance based
Assumptions	Stringent Assumption: normal distribution and independent observations (parametric)	Fewer assumptions: predictor specification (nonparametric) distribution free
Parameter estimates	Consistent in all conditions	Consistent as both indicators and sample size increase
Latent variable scores	Indeterminate	Explicitly estimated

Criterion	Covariance-based approach	PLS approach
Epistemic relationship between LV and its indicators	Can be modelled in reflective mode only	Can be modelled in either formative or reflective mode
Observations on indicators	Ratio preferred	Nominal, ordinal, and interval scaled
Implications	Optimal for parameter accuracy	Optimal for prediction accuracy
Model evaluation	Goodness of fit (overall model fit, e.g. insignificant x^2)	High R^2, jack-knifing or bootstrapping for significance test
Model complexity	Small to moderate complexity (e.g. fewer than 100 indicators)	Large complexity (e.g. 100 constructs and 1000 indicators)
Model identification	Potential identification problem	No identification problem
Sample size	At least 150–200 cases	10 times the largest number of predictors in the model

Source: Adapted from Chin and Newstead (1999)

Based on the comparisons between the PLS and covariance-based approaches highlighted in Table 5-3, it was decided that the PLS approach was preferable in this study due to a number of reasons. First, the PLS technique was more suitable to the nature of this study as it provided better prediction capability. Under this approach, it was assumed that all the measured variance was useful variance to be explained. Unlike the covariance-based method, PLS is used to maximise the prediction rather than to obtain goodness of fit.

Second, compared to a covariance-based approach, PLS does not assume any distributional form for measured variables like the covariance-based method, which prefers the normal distribution (Chin 1998b). As the PLS approach uses iterative algorithm that generally consists of a series of ordinary least squares analyses, it does not presume any distributional form for measured variables. Moreover, the PLS approach also has minimal demands on measurement scales which allows categorical to ratio level indicators to be used in the same model (Chin and Newsted 1999). Thus, this flexibility suited the nature of the data collected in this study.

Finally, the PLS approach can be used for analysis of a highly complex model with small sample sizes compared to the large number of variables. The covariance-based approach, however, requires a sample size of at least 150–200 cases. The rule of thumb in deciding the minimum sample size in PLS approach is as follows:

i) ten times the scale with the largest number of formative (i.e. causal) indicators, or

ii) ten times the largest number of structural paths directed at a particular construct in the structural model.

Based on the structural model of this study, the largest number of structural paths was eight, which were directed at the IT use for KM construct. Thus, the minimum sample size required for this study was 80, which was more than adequately met by the 168 cases of data collected.

The PLS software employed in this study was PLS-Graph (version 3.0), which was developed by Wynne Chin (2001) and has been used widely in IS research. The next sub-sections provide further discussion on the two components of model building in PLS: the measurement and structural models.

5.3.1 The measurement model

The measurement model is the component of the general model in which the relationship between the latent variables and their respective indicators are described (Chin 1998b). Latent variables are described as unobserved variables that are measured by the indicators or observed variables. To ensure the accuracy of the structural model analysis, the measurement model needs to be assessed to determine the validity and reliability of the indicators or measuring items. The convergent and discriminant validity of the research instrument indicates the strength of the measures used to test a proposed model. Thus, to ensure the accuracy of the structural model analysis, the measurement model has to be assessed first before a test for the significance of relationships in the structural model can be conducted.

There are two types of indicators that can be used to measure latent variables, and these are formative and reflective indicators. PLS supports both types of indicators. A latent variable with formative indicators implies that the indicators form, cause or change the variable (Chin 1998a; Fornell and Larcker 1981). The latent variable is also specified as the summation of the formative indicators associated with it (Barclay, Higgins, and Thompson 1995) and is drawn with an arrow from each indicator leading to the variable. Formative indicators do not assume that each indicator under a particular latent variable needs to have the same underlying concept (Chin 1998a).

In contrast, reflective indicators are assumed to be correlated or co-varied, and reflect the latent variable by representing the same underlying concept (Gefen, Straub, and Boudreau 2000). A latent variable with reflective indicators is drawn with an arrow from each indicator leading away from the variable. Indicators can be classified as reflective when the construct is relatively well defined based on theoretical knowledge and when the objective is to test a theory rather than build a theory (Chin 1998b). This was true for most of the constructs developed in this study except for IT use for KM and KM processes constructs, which were modelled as formative constructs in this study. Thus, the data analysis in this study, especially in the measurement model, was mostly for reflective variables only. The following sub-section describes the assessment criteria for a measurement model in PLS.

5.3.1.1 The measurement model assessment

The measurement model is assessed by examining the construct validity of the measuring items. Construct validity seeks agreement between a theoretical concept and a specific measuring device or instrument (De Vaus 2002), and can be divided into two sub-categories: convergent validity and discriminant validity. Construct validity of an instrument can be established by providing sufficient evidence for both convergent and discriminant validity and these are described in the sub-sections below.

(i) Convergent Validity

Convergent validity is shown when each measuring item correlates strongly with its associated theoretical construct (De Vaus 2002). The first assessment of convergent validity is to test the item reliability. Item reliability indicates the amount of variance in a measure that is due to the construct rather than to error (Fornell and Larcker 1981). Item reliability can be assessed by examining its loading to its corresponding latent variable. Each item, or indicator, must show a loading of 0.7 or more on the construct being measured (Hulland 1999).

In addition, Gefen and Straub (2005) suggest that convergent validity is shown when each of the measurement item loads with a significant t-value of at least 1.96 on its corresponding latent variable. Thus, the next criterion for assessing convergent validity is to examine the t-value of each item loading. Following the assessment of these two criteria, a rerun of the measurement model should be conducted after eliminating the indicators that did not meet the criteria.

The next assessment of convergent validity is to consider the internal consistency reliability (ICR), by examining internal consistency scores for each latent variable. ICR is similar to Cronbach's alpha, though without the assumption that all indicators are equally weighted (Barclay, Higgins, and Thompson 1995). ICR can be assessed by computing the composite reliability in PLS. The minimum value of composite reliability for each latent variable should be greater than 0.7 to demonstrate construct reliability.

In addition, internal consistency can also be assessed by checking the average variance extracted (AVE). The AVE was proposed by Fornell and Larcker (1981), and is a measure of the shared or common variance in a latent variable. In other words, AVE is a measure of the amount of variance in the item explained by the construct, relative to the amount due to measurement error (Fornell and Larcker 1981). In order to establish internal consistency reliability for a construct, the AVE for the particular construct should be greater than 0.5.

(ii) Discriminant validity

The next assessment of construct validity is the assessment of discriminant validity, which is the degree to which items differentiate between constructs, or measure distinct concepts (Gefen and Straub 2005). Discriminant validity is shown when each measurement item correlates weakly with all other constructs except for the one to which it is theoretically associated. Gefen and Straub (2005) suggest that discriminant validity can be assessed by using two procedures:

i) the correlation of the latent variable scores with the measurement items needs to show that the measurement items load higher on their respective variable and not on other variables; and

ii) an average variance extracted (AVE) analysis shows that the square root of every AVE is larger than the correlations among any pair of latent variables.

Similar to the above procedures, Barclay, Higgins and Thompson (1995) suggest that discriminant validity is assessed at both the indicator and construct level. At the indicator level, no manifest variable, or indicator, should load higher on other constructs than on the construct that it intends to measure. At the construct level, discriminant validity can be assessed by comparing the square root of average variance extracted (AVE) with the correlation of that particular construct with all other constructs.

This section provided a discussion of the measurement model and outlined the assessment criteria of the model using PLS. The next section describes the other component in the PLS model, which is the structural model.

5.3.2 The structural model

The structural model describes a set of relationships or paths that link the constructs in the model (Gefen, Straub, and Boudreau 2000). Before discussing the assessment of the structural model, it is important to note that structural modelling permits constructs to be modelled as second order constructs or factors, as discussed in the sub-section below.

5.3.2.1 Second order factor models

A second-order factor model is suitable when conceptual models are at a higher level of abstraction and reflect the first order factors (Chin 1998a; Rindskopf and Rose 1988). Unlike the standard first order factor, a second order factor is not directly connected to any measured items and is formed from the first order factors (Chin and Gopal 1995). Thus, a second order factor is measured by the observed variables of its first order factors that are measured using reflective indicators (Chin 1998a).

As illustrated in Figure 5-3, a second order construct can be modelled by using the molar or molecular approaches (Chin and Gopal 1995).

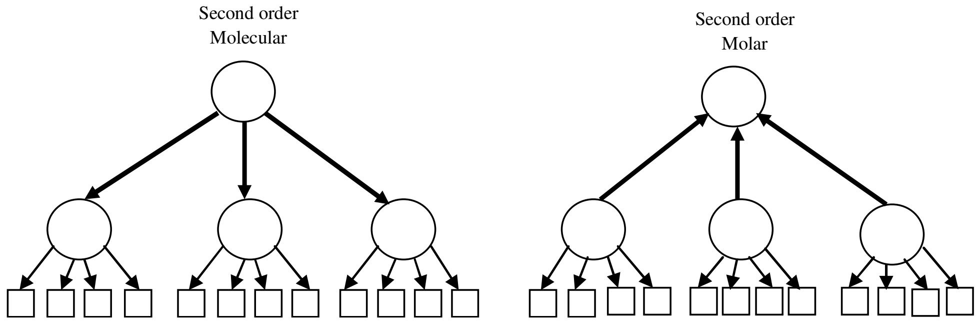


Figure 5-3 Second order constructs—molecular and molar approaches

In a molar approach, the relationships between the second order factors and the first order factors are designed as formative. This approach is appropriate when the first order factors are viewed as the causes of the second order factor and that they are not necessarily correlated. On the other hand, the relationship between the second order factors and the first order factors are designed as reflective in the molecular approach. This approach is suitable when the first order factors are viewed as reflective indicators of the second order factor, which represent the same underlying concept and are assumed to be correlated and co-varied. In summary, the relationship between the first order factors and the second order factors is formative in nature in the molar approach, whereas the relationship is reflective in nature in the molecular approach.

The assessment criteria for the structural model in PLS are discussed in the following section.

5.3.2.2 Structural model assessments

The assessment of the structural model involves the tests of the explanatory power of the independent variables, as well as the size and significance of the path coefficients. In order to evaluate the predictive ability or the explanatory power of the independent variables in the structural model, the R^2 value for each dependent variable can be computed (Chin 1998b). The interpretation of these values is the same as the R^2 values in a multiple regression analysis, whereby they indicate the amount of variance in dependent latent variables that is explained by the model. The dependent latent variables in this study's structural model are IT use for KM, knowledge sharing culture, knowledge classification, perceived ease of use, and perceived benefits of using IT for KM. The R^2 values of the structural equations for these dependent variables provide an estimate of the proportion of the variability in the variables that is explained by their respective independent variables.

The next assessment of the structural model is to determine the size and significance of the path estimates or coefficients. The standardised path estimates in the structural model can be examined and interpreted in the same manner as the path coefficients in regression. The path estimate indicates the strength of the relationship between latent variables. The bootstrapping re-sampling technique is used to the test the significance of the path coefficients (Chin 1998b). Through this method, PLS provides each path coefficient with t-values between each pair of constructs. The t-values are used to determine the p-value in order to assess the significance level of the path coefficient. The hypothesis for each path can then be tested by the significance level of its coefficient. The structural model in this study was tested on whether it was a valid representation to predict the level of IT use for KM by assessing the significance of the path coefficients of the proposed relationships between the constructs in the model.

Finally, in addition to the direct effects, the indirect and total effects of the independent variables on the dependent variables can also be assessed in the structural model. A direct effect represents the relationship between an independent and a dependent variable, while an indirect effect is the effect of an independent variable on a dependent variable through one or more intervening or mediating variables (Hoyle 1995). The sum of direct and indirect effects of an independent variable on a dependent variable is known as the total effect of the independent variable. In this study, the direct and indirect effects in the structural model were investigated to further explore the relationships among the constructs.

To conclude, this section provided a description of the data analysis technique employed in this study. The next section presents the results of the data analysis in the study.

5.4 RESULTS OF DATA ANALYSIS

This section reports the results of the data analysis following the assessment procedures and criteria described in the previous section. The analysis of missing values in the data collected is first presented. This is followed by a descriptive analysis of the constructs in the study. Next, the evaluation of the measurement model, based on the criteria discussed in section 5.3.1, to ascertain construct validity is discussed. The structural model is then assessed using the assessment criteria discussed in section 5.3.2. Finally, the direct, indirect, and total effects in the structural model are also analysed and the results are presented.

5.4.1 Missing value analysis

A preliminary analysis of missing data was first carried out to produce clean data for the PLS-Graph input data. The input data matrix for testing the proposed research model contained 168 cases and 55 indictors for each case, which results in a total of 9,240 data points. Among these data points, approximately 0.8% had missing values. All the missing values were in quantitative (interval) scales and most of them were from indicators for the knowledge sharing culture (a question that relates to a knowledge database in the organisation) and policies and procedures on IT use for KM. The possible reasons for this could be that, the respondents were not very sure if a knowledge database, policies, and procedures on the use of IT for KM were in use in their organisations.

The PLS-Graph program requires that all missing values are replaced with a coded value prior to processing. As the number of usable responses was only 168, it was decided to retain all cases for analysis. Consequently, it was decided to substitute all missing items using the expectation maximisation (EM) approach in the SPSS v.17 statistical software. Based on the EM approach, the missing values were replaced by the estimates calculated by the EM algorithm. The EM approach is an iterative procedure, in which it uses the estimation of the means, the covariance matrix, and the correlation of quantitative variables with the missing value. The approach is considered generally more superior than other substitution approaches, such as listwise, pairwise, and mean substitution approaches (Pallant 2007).

This section discussed the analysis of missing values in the collected data. The next section presents the descriptive analysis of the constructs in the study.

5.4.2 Descriptive statistics

Once the input data was ready for further analysis, a descriptive analysis was conducted for all indicators in the input data. The mean, minimum, maximum, and standard deviation values for each indicator in the input data were obtained through descriptive statistics in SPSS v.17. Appendix G outlines the descriptive statistics for all indicators showing sufficient range and variance.

The results of the descriptive statistics for all indicators for the IT use for KM construct are presented in Table 5-4. From the descriptive analysis, it appears that IT was used mostly to support the acquisition of knowledge regarding new product or services within an organisation's industry (IT_KC01). This is followed by the use of IT for the purpose of sharing knowledge throughout an organisation (IT_KT01), as well as for storing individuals' and organisational knowledge (IT_KS01). Further, the analysis shows that IT was used the least to match the sources of knowledge with problems and challenges (IT_KA02) in the organisations surveyed. The implications of these findings will be further discussed in Chapter 7 of this thesis, (Conclusions, Implications, and Further Work).

Table 5-4 Descriptive statistics for IT use for KM construct

IT use for KM	N	Minimum	Maximum	Mean	Std. Deviation
IT for knowledge creation					
IT_KC01	168	1.00	5.00	3.9520	.95283
IT_KC02	168	1.00	5.00	3.5927	1.07311
IT_KC03	168	1.00	5.00	3.3274	1.11332
IT for knowledge storage					
IT_KS01	168	1.00	5.00	3.8690	.93219
IT_KS02	168	1.00	5.00	3.4762	1.06637
IT_KS03	168	1.00	5.00	3.3512	1.17427
IT_KS04	168	1.00	5.00	3.5807	1.06849
IT for knowledge transfer					
IT_KT01	168	1.00	5.00	3.9286	1.06984
IT_KT02	168	1.00	5.00	3.5536	1.07089
IT_KT03	168	1.00	5.00	3.4167	1.24013
T for knowledge application					
IT_KA01	168	1.00	5.00	3.4762	1.11039
IT_KA02	168	1.00	5.00	2.9699	1.17063
IT_KA03	168	1.00	5.00	3.2500	1.18246
IT_KA04	168	1.00	5.00	3.1983	1.08458
Valid N (listwise)	168				

Next, the descriptive statistics of all the indicators for the KM processes construct were analysed. Table 5-5 presents the descriptive statistics of all KM processes' indicators. Based on the table, it appears that the most implemented KM processes were both of the knowledge transfer process, which were on-the-job training (KT01) and face-to-face meetings (KT02). Meanwhile, the knowledge storage process appears to be the least implemented KM process in the surveyed organisations. Items such as 'replacing outdated knowledge' (KS02) and 'filtering the relevant knowledge' (KS03) emerged to have the lowest mean value (both at 2.89). The implications of these findings will be further discussed in Chapter 7 of this thesis, (Conclusions, Implications, and Further Work).

Table 5-5 **Descriptive statistics for KM processes construct**

KM processes	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge creation process					
KC01	168	1.00	5.00	3.1429	1.01064
KC02	168	1.00	5.00	3.0461	.96241
KC03	168	1.00	5.00	3.1615	.94974
KC04	168	1.00	5.00	3.1795	1.03995
Knowledge storage process					
KS01	168	1.00	5.00	3.0476	1.07118
KS02	168	1.00	5.00	2.8869	1.05209
KS03	168	1.00	5.00	2.8929	1.01507
KS04	168	1.00	5.00	3.1012	1.03032
Knowledge transfer process					
KT01	168	1.00	5.00	3.8095	.97853
KT02	168	1.00	5.00	3.8036	.84243
KT03	168	1.00	5.00	3.1726	1.11601
KT04	168	1.00	5.00	3.4464	1.01344
Knowledge application process					
KA01	168	1.00	5.00	3.6667	.97678
KA02	168	1.00	5.00	3.4226	.99998
KA03	168	1.00	5.00	3.3810	1.03709
KA04	168	1.00	5.00	3.3571	1.04558
Valid N (listwise)	168				

Finally, the descriptive statistics of all indicators for the organisational factor constructs are presented in Table 5-6.

Table 5-6 Descriptive statistics for organisational factor constructs

Organisational Factor	N	Minimum	Maximum	Mean	Std. Deviation
Knowledge classification					
K_Cls01	168	1.00	5.00	3.3988	.96116
K_Cls02	168	1.00	5.00	2.8631	1.02031
K_Cls03	168	1.00	5.00	3.1905	1.03213
Knowledge sharing culture					
KSC01	168	1.00	5.00	3.8036	.89749
KSC02	168	1.00	5.00	3.2679	.91869
KSC03	168	1.00	5.00	3.2321	1.05520
KSC04	168	1.00	5.00	3.4090	1.06864
Policies and procedures					
PP01	168	1.00	5.00	3.2024	1.10827
PP02	168	1.00	5.00	3.1667	1.11316
PP03	168	1.00	5.00	3.2988	1.07853
Rewards and incentives					
RI01	168	1.00	5.00	2.3652	1.07981
RI02	168	1.00	5.00	2.3832	1.05953
RI03	168	1.00	5.00	2.3233	1.02232
RI04	168	1.00	5.00	2.6346	1.14442
Management support and commitment					
MSC01	168	1.00	5.00	3.1786	1.14422
MSC02	168	1.00	5.00	3.1488	1.18695
MSC03	168	1.00	5.00	3.0595	1.11443
MSC04	168	1.00	5.00	3.0357	1.12080
Valid N (listwise)	168				

The descriptive statistics indicate that a knowledge sharing culture was perceived, by the management in the organisations surveyed, as the most implemented organisational factor in the organisations, having the highest mean value of 3.8 for item measuring the extent to which an individual's experience is valued in an organisation (KSC01). This was followed by having policies and procedures for using IT for KM and a knowledge classification system. Further, the results denote relatively low mean values for the rewards and incentives construct. The mean values for all four indicators of rewards and incentives construct were below the mid-point value of 3, ranging from 2.32 to 2.63. This indicates that rewards and incentives was perceived as the least implemented organisational factor in the organisations surveyed. Further discussions of these results are presented in Chapter 7 of this thesis, (Conclusions, Implications, and Further Work).

This section presented the descriptive analysis of the constructs in the study. The following section provides the evaluation of the measurement model.

5.4.3 Evaluation of the measurement model

As discussed in section 5.3.1, the measurement model is assessed by examining i) individual item reliability, ii) internal consistency, and iii) discriminant validity (Barclay, Higgins, and Thompson 1995). The following sections present the assessment of the convergent and discriminant validity of the measuring items used to measure the constructs in the measurement model.

The measurement model to be tested in this study is shown in Figure 5-4.

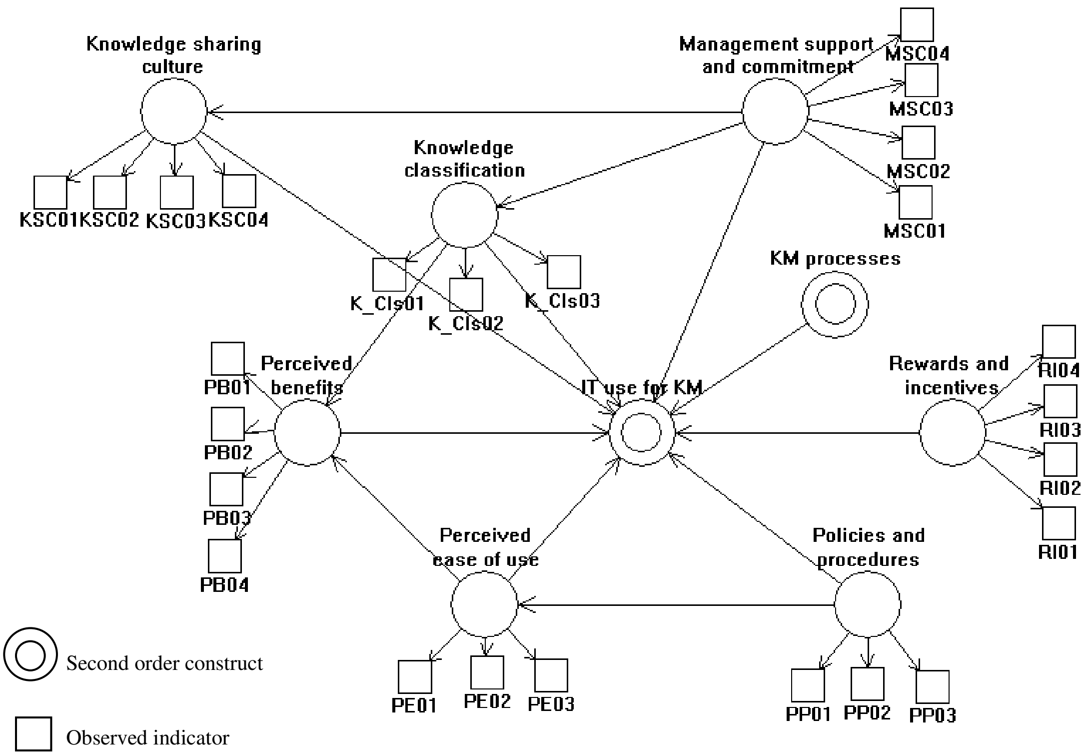


Figure 5-4 The measurement model

5.4.3.1 Testing for convergent validity

The convergent validity was assessed using PLS-Graph. The input data from SPSS were extracted into an ASCII file to generate a raw data file for input into the PLS-Graph software. A PLS-Graph measurement model was then built with all constructs linked to their relevant measurement items. A complete list of measurement item labels that were used in the assessment is provided in Appendix H. Indicators to all the latent variables were modelled as reflective indicators, with the exception of the IT use for KM and KM processes constructs that were modelled as formative constructs. The assessment of IT use for KM and KM processes constructs is presented in section 5.4.4 of this chapter.

The PLS-Graph output run provides the outer loading of each indicator to its corresponding latent variable. The t-values for each loading were then obtained using the bootstrap method in PLS-Graph. The output of the bootstrapping method generated by PLS-Graph is provided in Appendix I. Table 5-7 reports the loadings of the indicators for all constructs along with their respective t-values and the significance level of the loadings.

Table 5-7 Loadings of items in the measurement model

Construct and Items	PLS loadings	T-statistics	Significance Level
IT for knowledge creation			
IT_KC01	0.7983	32.059	0.01
IT_KC02	0.8593	43.4298	0.01
IT_KC03	0.7415	22.7815	0.01
IT for knowledge storage			
IT_KS01	0.8219	27.3	0.01
IT_KS02	0.8863	45.3258	0.01
IT_KS03	0.8655	34.4905	0.01
IT_KS04	0.8529	33.6789	0.01
IT for knowledge transfer			
IT_KT01	0.8971	65.1313	0.01
IT_KT02	0.8844	46.2689	0.01
IT_KT03	0.808	29.6469	0.01
IT for knowledge application			
IT_KA01	0.8364	29.8002	0.01
IT_KA02	0.8811	47.3559	0.01
IT_KA03	0.782	19.9074	0.01
IT_KA04	0.8282	31.469	0.01
Knowledge creation			
KC01	0.8868	33.0756	0.01
KC02	0.9037	57.9011	0.01
KC03	0.9136	64.5516	0.01
KC04	0.8499	31.9027	0.01
Knowledge storage			
KS01	0.9144	54.0836	0.01
KS02	0.9186	58.8015	0.01
KS03	0.9325	78.2646	0.01
KS04	0.9079	59.2703	0.01

Construct and Items	PLS loadings	T-statistics	Significance Level
Knowledge transfer			
KT01	0.8146	25.7372	0.01
KT02	0.8182	25.0322	0.01
KT03	0.8192	27.9084	0.01
KT04	0.8555	40.3302	0.01
Knowledge application			
KA01	0.8972	45.2217	0.01
KA02	0.944	105.0351	0.01
KA03	0.9403	70.5243	0.01
KA04	0.897	39.5555	0.01
Knowledge classification			
K_Cls01	0.8526	25.196	0.01
K_Cls02	0.8891	53.3166	0.01
K_Cls03	0.8647	38.0079	0.01
Perceived benefits			
PB01	0.8638	42.938	0.01
PB02	0.8509	22.4623	0.01
PB03	0.7985	20.0718	0.01
PB04	0.8667	31.1572	0.01
Perceived ease of use			
PE01	0.8094	21.8558	0.01
PE02	0.8732	41.1364	0.01
PE03	0.7373	19.8552	0.01
Knowledge sharing culture			
KSC01	0.8065	19.0252	0.01
KSC02	0.8737	38.7083	0.01
KSC03	0.8104	29.9329	0.01
KSC04	0.8415	37.4906	0.01
Policies and procedures			
PP01	0.9064	52.1143	0.01
PP02	0.9622	48.8823	0.01
PP03	0.9505	98.3371	0.01
Rewards and incentives			
RI01	0.9142	55.6692	0.01
RI02	0.9375	86.6857	0.01
RI03	0.9254	61.5942	0.01
RI04	0.8024	17.2457	0.01
Management support and commitment			
MSC01	0.8948	52.1057	0.01
MSC02	0.9115	61.3998	0.01
MSC03	0.9227	58.9302	0.01
MSC04	0.9324	84.0313	0.01

According to the statistical results in Table 5-7, overall, the condition of the loading scores was met in this study. All indicators loaded higher than 0.7 to their respective constructs. In addition, the table also shows that all indicators loaded with significant t-values of above 1.96, on their respective latent variable, which indicates that convergent validity was achieved.

The next assessment of convergent validity was to assess the internal consistency reliability. Table 5-8 reports the PLS-Graph bootstrapping results output for the composite reliability and AVE values for each latent construct. The Cronbach's alpha values were also computed and included in the analysis for comparison purposes.

Table 5-8 Reliability of constructs and their respective indicators

Construct	Composite reliability	AVE	Cronbach alpha
IT for Knowledge Creation	0.843	0.642	0.71
IT for Knowledge Storage	0.917	0.734	0.88
IT for Knowledge Transfer	0.898	0.747	0.82
IT for Knowledge Application	0.900	0.693	0.85
Knowledge Creation	0.938	0.79	0.90
Knowledge Storage	0.956	0.843	0.94
Knowledge Transfer	0.896	0.684	0.84
Knowledge Application	0.957	0.846	0.94
Policies and Procedures	0.958	0.884	0.93
Perceived Benefits	0.909	0.715	0.86
Perceived Ease of Use	0.849	0.654	0.73
Rewards and Incentives	0.942	0.804	0.92
Management Support	0.954	0.838	0.94
Knowledge Classification	0.902	0.755	0.90
Knowledge Sharing Culture	0.901	0.695	0.84

According to the statistical results in Table 5-8, the composite reliability values for all constructs were well above the cut-off value of 0.7, as discussed in section 5.3.1. Similarly, all constructs listed in the table demonstrated acceptable performances above the minimum value of AVE, which is greater than 0.5. Additionally, the Cronbach's alpha computed for comparison purposes also indicated values above the minimum requirement of 0.7 for all constructs. Thus, the reliability of all latent constructs in this study was verified and satisfied. The next step in assessing the construct validity in the measurement model was to test for discriminant validity, and this is presented in the section below.

5.4.3.2 Testing for discriminant validity

Discriminant validity was assessed using the assessment criteria discussed in section 5.3.1. The first assessment of discriminant validity was to examine indicators' loadings with respect to all constructs' correlations. The PLS-Graph output run provided the latent variable's score for each construct. These scores were extracted into the original data in SPSS. A bivariate correlation was then run, using Pearson correlations, to produce a correlation table between all constructs and indicators as shown in Table 5-9.

An examination of the cross-loadings between constructs and indicators in Table 5-9 shows that all manifest variables loaded higher to their respective intended latent variable compared to other latent variables. It can be seen in the table that the loading in each block was higher than any other block in the same rows and columns. The loading clearly separates each latent variable as theorised in the conceptual level. Thus, the output of the cross-loadings confirmed that the requirements of the first assessment of discriminant validity were satisfied.

The second assessment for discriminant validity was to examine the square root of the AVE of each construct to the correlations of this particular construct with all other constructs. The PLS-Graph produced the AVE for each latent variable from the bootstrapping method. The square root for each AVE was then manually calculated. Table 5-10 compares the square root of AVE of all constructs with the correlations between all constructs. It can be seen that the square root of AVE of all constructs were much larger than any constructs' correlations in the table. Thus the requirement of the second assessment of discriminant validity was also met. *By demonstrating evidence for both convergent and discriminant validity, it was thus confirmed that there was sufficient evidence for construct validity in this study.*

As the validity and reliability of the measurement model were tested satisfactorily, the quality of the structural model analysis can then be assured. The next section presents the evaluation of the structural model in this study.

Table 5-9 Cross-loadings of items to their respective constructs

	IT_KC	IT_KS	IT_KT	IT_KA	K_C	K_S	K_T	K_A	K_Class	P_B	PEOU	KSC	P_P	R_I	MSC
IT_KC01	.798	.388	.330	.252	.352	.339	.347	.389	.353	.303	.399	.406	.265	.234	.296
IT_KC02	.859	.367	.342	.347	.331	.300	.352	.367	.373	.358	.469	.431	.263	.314	.330
IT_KC03	.742	.506	.440	.469	.347	.373	.321	.391	.513	.311	.432	.483	.332	.418	.441
IT_KS01	.444	.822	.539	.521	.480	.438	.420	.545	.451	.406	.410	.489	.451	.265	.487
IT_KS02	.462	.886	.515	.533	.490	.427	.307	.464	.494	.310	.405	.409	.423	.424	.496
IT_KS03	.435	.866	.497	.613	.502	.480	.284	.508	.466	.376	.417	.477	.486	.438	.542
IT_KS04	.462	.853	.518	.562	.413	.361	.376	.468	.392	.323	.450	.410	.434	.303	.419
IT_KT01	.395	.446	.897	.574	.387	.411	.353	.405	.467	.575	.361	.492	.436	.330	.438
IT_KT02	.402	.580	.884	.655	.398	.484	.336	.468	.574	.500	.462	.540	.471	.383	.506
IT_KT03	.407	.542	.808	.565	.424	.406	.386	.420	.457	.413	.411	.454	.458	.345	.448
IT_KA01	.264	.461	.598	.836	.513	.493	.397	.435	.486	.423	.468	.520	.545	.350	.491
IT_KA02	.407	.577	.608	.881	.433	.478	.285	.462	.595	.445	.472	.539	.545	.493	.513
IT_KA03	.437	.586	.556	.782	.483	.435	.369	.466	.476	.365	.564	.455	.525	.342	.454
IT_KA04	.380	.545	.542	.828	.553	.513	.388	.492	.538	.395	.510	.429	.532	.414	.508
KC01	.363	.502	.442	.560	.887	.667	.534	.629	.495	.388	.528	.486	.559	.419	.585
KC02	.438	.557	.465	.585	.904	.736	.499	.689	.611	.376	.589	.529	.530	.480	.626
KC03	.341	.445	.405	.513	.914	.685	.404	.636	.507	.366	.470	.466	.567	.407	.558
KC04	.385	.452	.339	.450	.850	.669	.476	.636	.501	.395	.479	.508	.481	.395	.574
KS01	.404	.447	.447	.500	.719	.914	.500	.622	.602	.333	.564	.562	.605	.545	.642
KS02	.361	.445	.494	.542	.725	.919	.438	.644	.577	.349	.478	.527	.593	.526	.677
KS03	.352	.460	.443	.529	.733	.932	.452	.653	.606	.343	.558	.567	.616	.550	.688
KS04	.436	.476	.461	.545	.670	.908	.554	.612	.606	.330	.628	.543	.534	.519	.642
KT01	.329	.340	.337	.364	.441	.458	.815	.498	.382	.398	.463	.426	.355	.299	.434
KT02	.311	.243	.254	.233	.322	.306	.818	.481	.268	.240	.300	.228	.156	.197	.233
KT03	.411	.386	.469	.473	.516	.512	.819	.629	.432	.381	.467	.543	.469	.361	.526
KT04	.355	.362	.309	.354	.498	.473	.856	.642	.399	.323	.502	.451	.321	.308	.425
KA01	.425	.515	.485	.488	.665	.658	.670	.897	.571	.435	.527	.616	.462	.417	.628
KA02	.442	.525	.451	.540	.669	.644	.643	.944	.571	.388	.555	.581	.525	.416	.638
KA03	.444	.528	.454	.533	.658	.636	.617	.940	.535	.389	.536	.554	.492	.456	.628

	IT_KC	IT_KS	IT_KT	IT_KA	K_C	K_S	K_T	K_A	K_Class	P_B	PEOU	KSC	P_P	R_I	MSC
KA04	.448	.560	.445	.483	.689	.599	.578	.897	.522	.354	.559	.509	.440	.440	.567
K_Cls01	.474	.399	.479	.464	.485	.558	.413	.537	.853	.449	.603	.555	.467	.497	.575
K_Cls02	.417	.467	.543	.595	.503	.549	.347	.437	.889	.394	.621	.538	.550	.529	.531
K_Cls03	.457	.505	.486	.582	.563	.590	.409	.585	.865	.423	.617	.600	.551	.586	.651
PB01	.317	.312	.463	.365	.285	.256	.345	.297	.359	.864	.387	.487	.282	.258	.345
PB02	.328	.351	.432	.309	.358	.330	.369	.369	.337	.851	.344	.504	.295	.272	.410
PB03	.390	.405	.518	.512	.395	.333	.289	.367	.507	.798	.393	.506	.501	.382	.496
PB04	.339	.328	.539	.477	.413	.332	.364	.407	.445	.867	.392	.541	.471	.377	.485
PE01	.440	.556	.442	.585	.470	.452	.412	.467	.548	.412	.809	.619	.488	.493	.529
PE02	.467	.356	.404	.444	.482	.487	.435	.530	.657	.353	.873	.623	.533	.458	.557
PE03	.406	.271	.298	.434	.461	.538	.428	.434	.499	.322	.737	.562	.563	.447	.619
KSC01	.430	.405	.433	.407	.425	.431	.400	.508	.446	.485	.518	.806	.454	.328	.524
KSC02	.453	.460	.476	.548	.599	.550	.475	.604	.603	.512	.651	.874	.619	.360	.649
KSC03	.463	.366	.446	.441	.459	.476	.366	.476	.498	.503	.628	.810	.459	.407	.580
KSC04	.488	.497	.556	.546	.375	.533	.418	.456	.611	.509	.680	.842	.599	.527	.649
PP01	.329	.477	.501	.589	.551	.591	.350	.494	.559	.443	.590	.570	.906	.492	.660
PP02	.359	.492	.523	.605	.542	.602	.358	.476	.576	.438	.587	.620	.962	.545	.686
PP03	.322	.506	.459	.622	.604	.610	.400	.502	.562	.405	.657	.618	.950	.516	.678
RI01	.376	.393	.390	.446	.384	.498	.289	.415	.567	.296	.486	.420	.487	.914	.555
RI02	.421	.459	.426	.497	.473	.565	.317	.464	.563	.375	.561	.466	.552	.937	.591
RI03	.346	.363	.353	.425	.426	.508	.271	.416	.552	.328	.498	.411	.450	.925	.527
RI04	.295	.277	.285	.354	.436	.521	.399	.387	.538	.369	.520	.452	.488	.802	.550
MSC01	.367	.485	.509	.511	.603	.643	.424	.615	.591	.456	.567	.669	.628	.554	.895
MSC02	.437	.556	.484	.608	.615	.673	.459	.628	.640	.492	.641	.636	.671	.583	.911
MSC03	.459	.546	.520	.545	.632	.671	.488	.631	.642	.489	.692	.676	.638	.574	.923
MSC04	.364	.489	.452	.499	.562	.654	.419	.579	.594	.438	.657	.663	.691	.556	.932

Table 5-10 AVE, SQRT(AVE), and correlations of constructs

	AVE	**SQRT(AVE)**	IT_KC	IT_KS	IT_KT	IT_KA	K_C	K_S	K_T	K_A	K_Class	P_B	PEOU	KSC	P_P	R_I	MSC
IT_KC	0.642	0.80	1														
IT_KS	0.734	0.86	.526	1													
IT_KT	0.747	0.86	.464	.603	1												
IT_KA	0.693	0.83	.446	.650	.692	1											
K_C	0.79	0.89	.429	.550	.465	.594	1										
K_S	0.843	0.92	.422	.498	.502	.576	.775	1									
K_T	0.684	0.83	.425	.403	.413	.430	.537	.529	1								
K_A	0.846	0.92	.478	.578	.498	.556	.728	.689	.681	1							
K_Class	0.755	0.87	.516	.526	.579	.630	.595	.651	.448	.597	1						
P_B	0.715	0.85	.405	.411	.577	.490	.428	.369	.405	.425	.485	1					
PEOU	0.654	0.81	.542	.490	.475	.602	.582	.606	.524	.592	.706	.448	1				
KSC	0.695	0.83	.550	.520	.574	.585	.559	.599	.499	.614	.649	.603	.744	1			
P_P	0.884	0.94	.358	.523	.526	.644	.602	.639	.393	.522	.602	.456	.650	.642	1		
R_I	0.804	0.90	.403	.419	.408	.482	.479	.583	.352	.470	.619	.380	.575	.486	.551	1	
MSC	0.838	0.92	.444	.567	.537	.591	.659	.721	.489	.669	.674	.512	.699	.722	.718	.619	1

5.4.4 Evaluation of the structural model

Following the validation and refinement of the measurement model, the structural model could then be evaluated. The structural model consisted of the hypothesised relationship between latent variables identified in this study as shown in Figure 5-5.

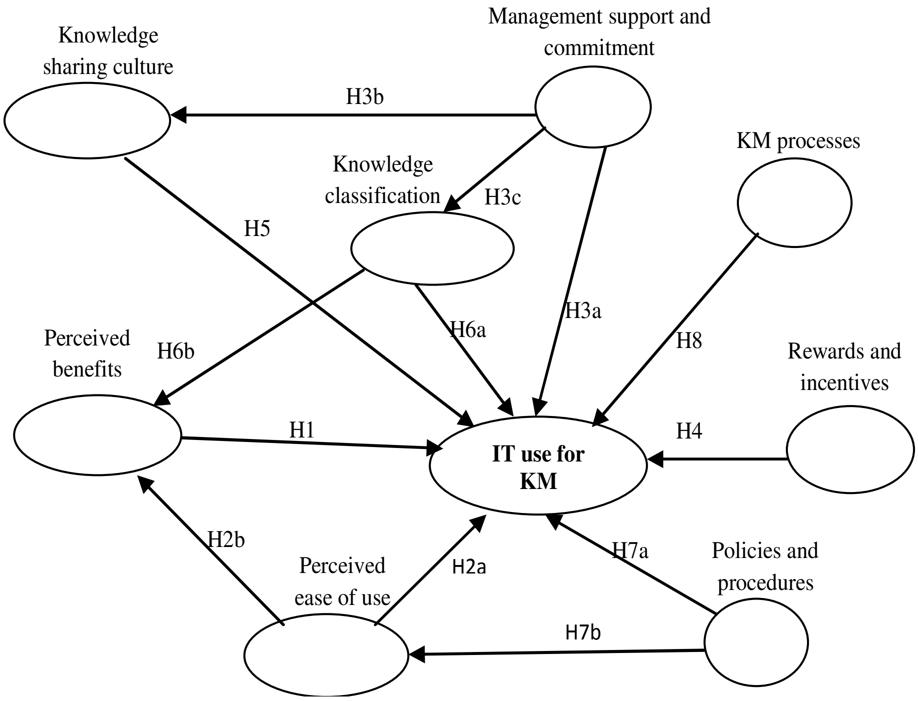


Figure 5-5 The structural model showing hypotheses to be tested

The analysis of the structural model involved a two-stage approach because the model consisted of second order factors. The IT use for KM and KM processes constructs were modelled as second order factors in the structural model. These second order factors, which are comprised of their respective first order factors, were first assessed in two separate sub-models (Figures 5-6 and 5-7). Next, the structural relationships were examined in a separate model, as shown in Figure 5-5, using the first order factors scores as manifest indicators for the second order factors of the IT use for KM and KM processes (Agarwal and Karahanna 2000; Yi and Davis 2003).

Considering the proposed research model discussed in Chapter 3, modelling IT use for KM and KM processes as second order factor constructs seemed to be appropriate for the PLS analysis of this study. Since PLS-Graph (Version 3.0) did not directly permit the representation of first and second order latent variables in the same model, it was necessary to assess the first order constructs associated with their respective second order constructs in a sub-model. The sub-structural models for the IT Use for KM and KM processes second order factors are shown in Figure 5-6 and Figure 5-7 below.

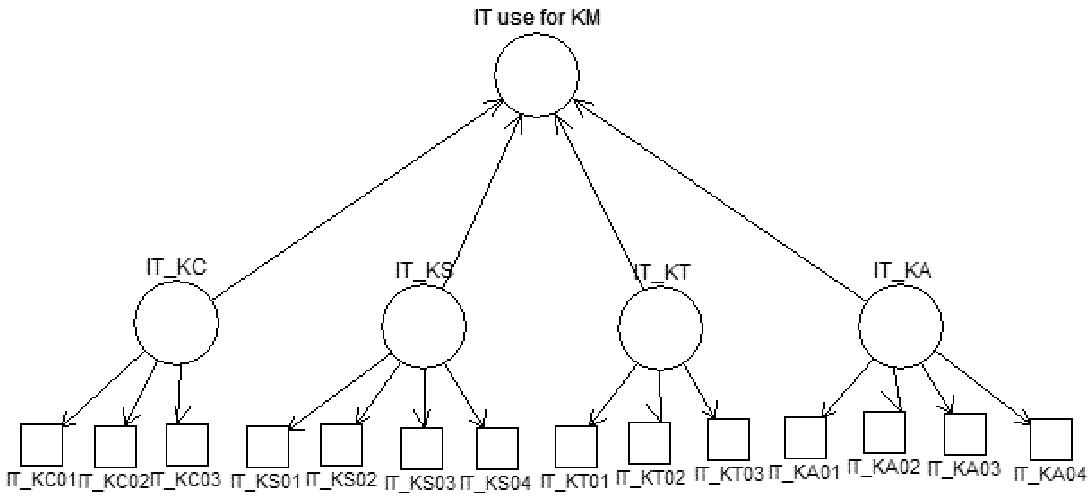


Figure 5-6 IT use for KM second order factor sub-model

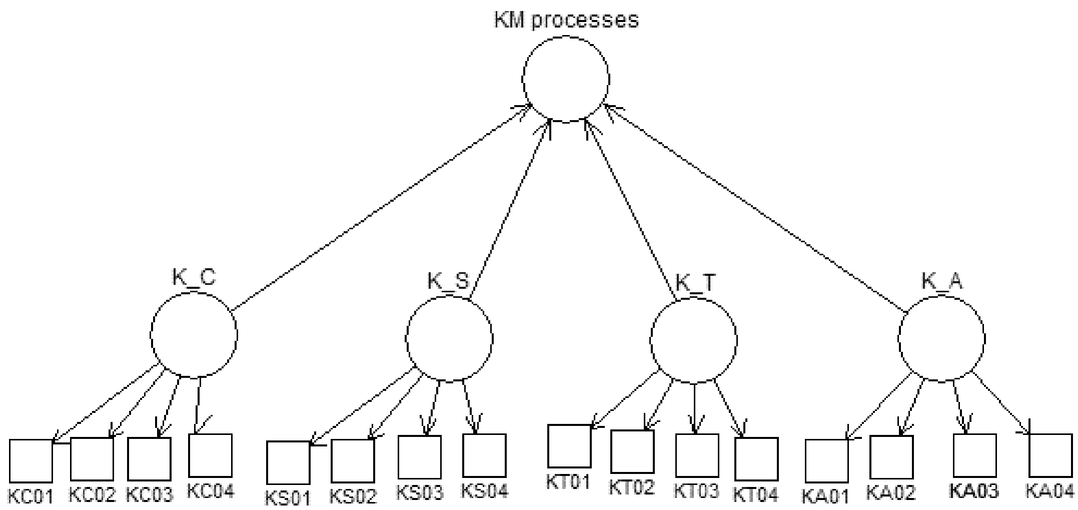


Figure 5-7 KM processes second order factor sub-model

In Figure 5-6, IT use for KM is set as the second order factor with its associated first order factors of IT use for knowledge creation, IT use for knowledge storage, IT use for knowledge transfer, and IT use for knowledge application. Similarly, in Figure 5-7, KM processes is set as the second order factor with knowledge creation process, knowledge storage process, knowledge transfer process, and knowledge application process as its associated first order factors.

The relationship between the second order factors and the first order factors was designed as formative, or a molar approach (Chin and Gopal 1995), due to these constructs being made up of the dimensions of their respective first order factors that are not necessarily correlated, as discussed earlier in sub-section 5.3.2.1. For example, in the IT use for KM second order factor, any change in the extent of IT use for knowledge storage in an organisation would not necessarily imply a corresponding change in the other first order factors, such as the extent of IT use for knowledge transfer or application. Next, the computed first order factors' scores obtained from the PLS-Graph output run were used as manifest indicators for the second order factors in the sub-models.

A different approach was used to assess the measurement properties of the two formative constructs. The assessment did not include the estimation of ICRs since formative indicators are not necessarily internally consistent (Chin 1998b; Roberts and Thatcher 2009). In addition, the AVEs were also not evaluated since the manifest indicators for formative constructs do not need to demonstrate convergent validity (Roberts and Thatcher 2009). Instead, the weights of the indicators were examined to provide evidence of construct validity of the formative constructs (Petter, Straub, and Rai 2007), as listed in Table 5-11. The indicator's weight was a measure of its contribution to the variance of its corresponding latent variable.

Table 5-11 Outer model weights for formative indicators

Construct/indicators	Weight	T-statistic
IT use for KM		
IT_KC	0.3310	3.00**
IT_KS	0.1474	1.70
IT_KT	0.2931	3.63**
IT_KA	0.4416	5.24**
KM processes		
K_C	0.2987	1.81
K_S	0.3239	2.06*
K_T	0.1523	1.43
K_A	0.3636	2.40*

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

An indicator is said to explain a significant portion of the variance in the formative construct when the indicator's weight is significant (Roberts and Thatcher 2009). In the case of the IT use for KM construct, three indicators (IT_KC, IT_KT, and IT_KA) were significant and one indicator (IT_KS) was not significant. For the KM processes construct, two indicators (K_S and K_A) were significant and the other two indicators (K_C and K_T) were not significant. In the case of formative constructs, conceptual reasoning holds more influence than statistical results when deciding whether or not to drop formative indicators (Petter, Straub, and Rai 2007; Roberts and Thatcher 2009). As the insignificant indicators contribute conceptually to their intended construct, it was decided not to drop them in the study's data analysis.

Table 5-12 lists the composite reliability, AVE, and Cronbach's alpha values for the formative constructs. However, it should be noted that these values are not meaningful for formative constructs. The traditional approach of reporting the ICR, AVE, and Cronbach's alpha for PLS measurement model does not apply to formative constructs since these values are not theoretically or empirically meaningful to formative constructs (Bollen 1984; Roberts and Thatcher 2009).

Table 5-12 Construct reliabilities and AVEs

Construct	Composite reliability	AVE	Cronbach's alpha
IT use for KM	0.888	0.665	0.837
KM processes	0.920	0.742	0.886

The following sub-sections present the evaluation of the structural model that was based on the assessment criteria discussed in section 5.3.2.

5.4.4.1 Predictive ability of the model

As described in section 5.3.2, the structural model was firstly evaluated based on the predictive power of the model or explanatory power of the independent variables, which could be assessed by the R^2 value of the dependent constructs. The R^2 value indicates the amount of variance in dependent variables that is explained by the independent variables. Thus, the larger the R^2 is, the higher is the predictive ability of the model. A bootstrap output for the structural model was generated by using PLS-Graph software to obtain the R^2 value of each dependent variable, path coefficients for each pair of independent and dependent variables, and t-statistics values for each path coefficient in the structural model. The bootstrap output is provided in Appendix J.

The results of the bootstrapping were extracted into the structural model and the results of the model are presented in Figure 5-8.

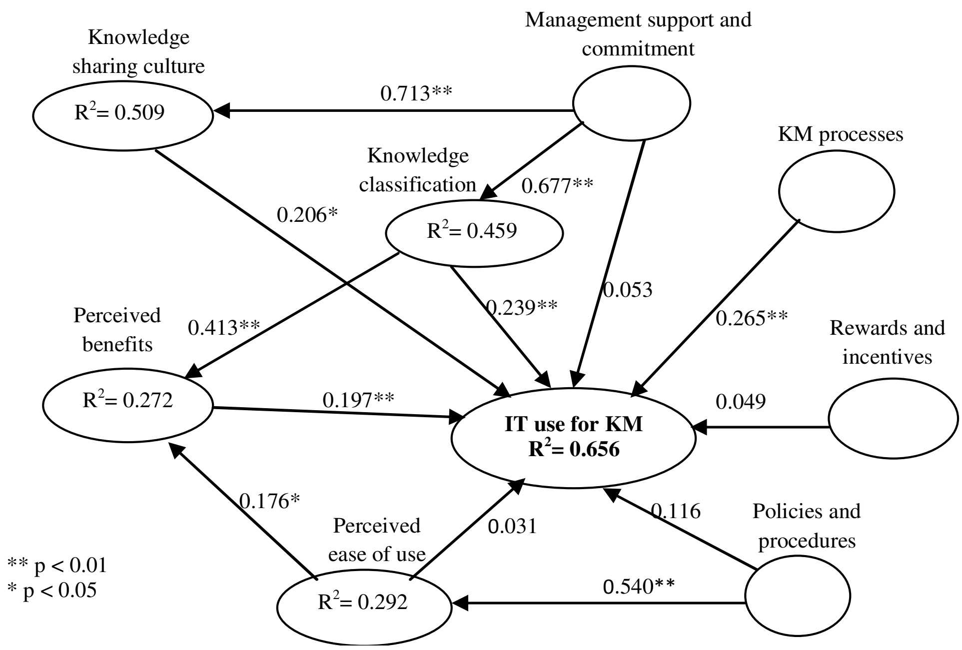


Figure 5-8 The results of structural model

The R^2 for each dependent construct can be found within each construct in the PLS output diagram. The results of R^2 in the structural model are listed in Table 5-13, which shows acceptable R^2 values for all the dependent constructs.

Table 5-13 R^2 values for dependent constructs

Dependent construct	R^2
IT Use for KM	0.66
Knowledge Sharing Culture	0.51
Knowledge Classification	0.46
Perceived Ease of Use	0.30
Perceived Benefits	0.27

The R^2 values for the IT use for KM, knowledge sharing culture, and knowledge classification constructs appeared to be very strong. The R^2 value of 0.66 for the IT use for KM construct indicates that the KM processes, perceived benefits, perceived ease of use, policies and procedures, management support and commitment, knowledge classification, knowledge sharing culture, and rewards and incentives constructs accounted for 66% of the variance in the IT use for KM construct.

In addition, the management support and commitment construct appeared to explain 51% and 46% of the variance in the knowledge sharing culture and knowledge classification constructs respectively. Finally, the R^2 values for the perceived ease of use and perceived benefits constructs were relatively lower, with 30% of the variance in the perceived ease of use construct explained by the policies and procedures construct, while 27% of the variance in the perceived benefits construct was explained by the knowledge classification and perceived ease of use constructs.

The predictive ability of the structural model was presented in this section. The next section discusses the path coefficients assessment to determine the relative strength of the effect of each independent construct on the dependent construct.

5.4.4.2 Path coefficients assessment

In the results of the structural model shown in Figure 5-8, path coefficient values are shown for every path, or relationship, between each independent construct and its dependent construct. In order to test the significance of the path coefficients in the structural model, t-statistics for all path coefficients were extracted using a bootstrapping analysis in PLS-Graph as discussed in section 5.3.2. The hypothesis for each path was then tested based on the t-values generated. Table 5-14 lists the path coefficients, observed t-statistics, and significance level for each path in the structural model. As can be seen from the table, some of the paths were significant and some were not. Section 5.5 of this chapter provides a discussion of the hypotheses testing based on the results of the path coefficients test.

Table 5-14 Summary of path coefficients test

Dependent and Independent Constructs	Path Coefficient	Observed T-statistics	Significance level
IT use for KM (R^2 = 0.66)			
KM processes	0.2650	3.1261	0.01
Knowledge classification	0.2400	3.1069	0.01
Knowledge sharing culture	0.2060	2.1921	0.05
Perceived benefits	0.1970	2.6860	0.01
Policies and procedures	0.1160	1.3439	Not significant
Rewards and incentives	0.0490	0.8632	Not significant
Perceived ease of use	0.0310	0.4953	Not significant
Management support and commitment	0.0530	0.5986	Not significant
Knowledge sharing culture (R^2 = 0.51)			
Management support and commitment	0.7130	20.5037	0.01
Knowledge classification (R^2 = 0.46)			
Management support and commitment	0.6770	15.9078	0.01
Perceived ease of use (R2 = 0.30)			
Policies and procedures	0.540	8.9333	0.01
Perceived benefits (R^2 = 0.27)			
Knowledge classification	0.4130	5.0149	0.01
Perceived ease of use	0.176	2.2178	0.05

The path coefficients assessment was presented in this section. The next section provides the analysis of the direct, indirect, and total effects in the structural model.

5.4.4.3 Direct, indirect, and total effects assessment

The structural model shows the effect of each independent variable on the dependent variable according to the conceptual research model. Each independent variable was modelled to have a direct effect on IT use for KM construct. In addition to the direct effects, or relationships, reported in Table 5-14, relationships may also be indirect in a manner that the relationship between two variables in a model is mediated by one or more intervening variables.

Path coefficient analysis was used to calculate the indirect effects for each dependent construct (Chin 1998b). The indirect effects can be calculated by multiplying each path coefficient along an indirect route from an independent to the dependent construct. Further, Chin (1998) suggests that only the significant path coefficients need to be considered in the calculation. The significance of each indirect effect in the structural model of this study was tested by using Sobel's test (Sobel 1982) in which the Z value was calculated as:

$$Z = \frac{ab}{\sqrt{(a^2 s_b^2 + b^2 s_a^2)}}$$

In the equation, a and b are the path coefficient values from variable a to the mediating variable, and from the mediating variable to variable b, whereas s_a and s_b are the standard error values for the path coefficients. These values were obtained from the PLS-Graph bootstrap output. The null hypothesis saying that the indirect effect is zero is rejected when the Z value is greater than 1.96.

The total effects of an independent variable on a dependent variable were calculated as the sum of the direct and all the indirect effects that were found to be significant (Igbaria, Guimaraes, and Davis 1995). The direct, indirect and total effects between independent variables and the dependent variables in the structural model were calculated, based on the path coefficient values, and are presented in Table 5-15.

Table 5-15 The direct, indirect, and total effects assessment

	Direct effects					Indirect effects					Total effects				
	Dependant variables					Dependant variables					Dependant variables				
Independent Variables	**KSC**	**KCls**	**PEOU**	**PB**	**IT_KM**	**KSC**	**KCls**	**PEOU**	**PB**	**IT_KM**	**KSC**	**KCls**	**PEOU**	**PB**	**IT_KM**
Management support and commitment	**0.68**	**0.71**	**-**	**-**	**-**	**-**	**-**	**-**	**0.28****	**0.37****	**0.68**	**0.71**	**-**	**0.28**	**0.37**
Knowledge classification	**-**	**-**	**-**	**0.41**	**0.24**	**-**	**-**	**-**	**-**	**0.08***	**-**	**-**	**-**	**0.41**	**0.32**
KM processes	**-**	**-**	**-**	**-**	**0.27**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.27**
Knowledge sharing culture	**-**	**-**	**-**	**-**	**0.21**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.21**
Perceived benefits	**-**	**-**	**-**	**-**	**0.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.2**
Perceived ease of use	**-**	**-**	**-**	**0.18**	**-**	**-**	**-**	**-**	**-**	**0.03**	**-**	**-**	**-**	**0.18**	**-**
Policies and procedures	**-**	**-**	**0.54**	**-**	**-**	**-**	**-**	**-**	**0.1***	**0.02****	**-**	**-**	**0.54**	**0.1**	**0.02**

** $p < 0.01$, * $p < 0.05$ (calculated using Sobel's indirect effect test)

As can be seen in Table 5-15, although the management support and commitment construct did not have a significant direct effect on the IT use for KM construct, this construct appeared to have significant indirect effects on the IT use for KM construct through the mediation of the knowledge sharing culture, knowledge classification, and perceived benefits constructs. In fact, the table shows that the management support and commitment construct appeared to have the largest total effect of 0.37 on the IT use for KM construct.

Next, the knowledge classification construct was found to have the second largest total effect on the IT use for KM construct, showing its total effects of 0.32, only slightly less than that of the management support and commitment construct's total effect on the IT use for KM construct.

In addition, the analysis indicated that the indirect effect of the perceived ease of use construct on the IT use for KM construct was not significant. However, although the policies and procedures construct did not exhibit any significant direct effect on the IT use for KM construct, policies and procedures was observed to demonstrate a significantly low (0.02) indirect effect on the IT use for KM construct through the mediation of the perceived ease of use and perceived benefits constructs.

The direct, indirect, and total effects in the structural model were presented in this section. The section below describes the analysis of the control measures in the study's data analysis.

5.4.4.4 Control measures

Further analysis was carried out to ensure that the results were not due to the co-variation with control variables. The control variables identified in Chapter 3 of this thesis were organisational size and type of industry. The structural model with the inclusion of the control variables demonstrated that both control variables had no significant effect on the IT use for KM construct (see Appendix K). The results of including the control variables in the structural model did not alter any of the significance levels of the path coefficients and variance explained in the IT use for KM dependent construct. Thus, the results of the hypotheses tests appeared to be stable and independent of the control variables.

In summary, the results of the study's data analysis, which include analysis of missing values, descriptive analysis of constructs, evaluation of the measurement and structural models, as well as the direct, indirect, and total effects were presented in this section. The next section presents the results of the hypotheses investigated in this study.

5.5 HYPOTHESES TESTING

The hypotheses developed for this study can now be tested based on the results of the path coefficients test summarised in Table 5-14. The results for each hypothesis in the structural model are summarised in Table 5-16.

Table 5-16 Summary of hypotheses testing results

H	Hypothesis statement	T-statistic	Significance level	Results
H1	Perceived benefits of using IT for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations	2.69	0.01	Supported
H2a	Perceived ease of use of IT to support KM has a positive influence on the level of IT use for KM in Malaysian listed organisations	0.5	Not significant	Not supported
H2b	Perceived ease of use of IT to support KM has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations	2.22	0.05	Supported
H3a	Management support and commitment has a positive influence on the level of IT use for KM in Malaysian listed organisations	0.6	Not significant	Not supported
H3b	Management support and commitment has a positive influence on the knowledge sharing culture in Malaysian listed organisations	20.5	0.01	Supported
H3c	Management support and commitment has a positive influence on the extent of knowledge classification in Malaysian listed organisations	16.0	0.01	Supported
H4	Rewards and incentives has a positive influence on the level of IT use for KM in Malaysian listed organisations	0.86	Not significant	Not supported
H5	Knowledge sharing culture has a positive influence on the level of IT use for KM in Malaysian listed organisations	2.2	0.05	Supported
H6a	Having a knowledge classification system has a positive influence on the level of IT use for KM in Malaysian listed organisations	3.11	0.01	Supported
H6b	Having a knowledge classification system has a positive influence on perceived benefits of using IT for KM in Malaysian listed organisations	5.01	0.01	Supported
H7a	The policies and procedures for IT use for KM has a positive influence on the level of IT use for KM in Malaysian listed organisations	1.34	Not significant	Not supported
H7b	The policies and procedures for IT use for KM has a positive influence on the perceived ease of using IT for KM in Malaysian listed organisations	8.93	0.01	Supported
H8	Having appropriate KM processes has a positive influence on the level of IT use for KM in Malaysian listed organisations	3.13	0.01	Supported

The results of the structural model assessment supported Hypothesis 1, which proposed that perceived benefits of using IT for KM enhanced the level of IT use for KM. The perceived benefits of using IT for KM construct had a significant positive relationship with the level of IT use for KM with a path coefficient value of 0.2. Moreover, the positive relationship was found to be significant at 0.01 level.

The path coefficients of perceived ease of using IT for KM was tested against the level of IT use for KM and perceived benefits of using IT for KM for Hypotheses 2a and 2b. The findings showed that the effect of perceived ease of use, on IT use for KM was not significant. On the other hand, perceived ease of use demonstrated a significantly low positive effect on the perceived benefits of using IT for KM, with a path coefficient of 0.18. Thus, Hypothesis 2a was rejected, while Hypothesis 2b was supported in this study.

For the management support and commitment construct, its path coefficient was tested against the level of IT use for KM, knowledge sharing culture, and knowledge classification for Hypotheses 3a, 3b, and 3c. The results of the structural model revealed that management support and commitment had a strong positive relationship with knowledge sharing culture and knowledge classification, with path coefficient values at 0.71 and 0.68 respectively. In addition, both path coefficients were significant at 0.01 levels. However, management support and commitment was found to have no significant direct effect on the level of IT use for KM. Thus, Hypotheses 3b and 3c were supported while Hypothesis 3a was rejected.

The relationship between rewards and incentives and the level of IT use for KM was tested in Hypothesis 4. The results of the structural model indicated that the relationship between rewards and incentives and IT use for KM was not significant. Thus, Hypothesis 4 was not supported in this study.

In contrast, the results of the structural model were found to provide support for Hypothesis 5 as knowledge sharing culture exhibited a moderately positive influence (path coefficient 0.21) on IT use for KM. Moreover, the relationship between knowledge sharing culture and IT use for KM was found to be significant at 0.05 level.

The path coefficient of knowledge classification was tested against the level of IT use for KM and perceived benefits of using IT for KM, for Hypotheses 6a and 6b. The results of the structural model indicated that knowledge classification had a positive relationship with the level of IT use for KM with a path coefficient value of 0.24 and at a significance level of 0.01. Similarly, knowledge classification was found to demonstrate a positive significant effect on the perceived benefits of using IT for KM, with a path coefficient value of 0.41 and at a significance level of 0.01. Thus, both Hypotheses 6a and 6b were supported in this study.

Next, Hypothesis 7a was rejected based on the results of the structural model. The results indicated that there was no significant relationship between the institutionalisation of IT for KM, which is represented by the policies and procedures for using IT for KM, and the level of IT use for KM. Nevertheless, policies and procedures for using IT for KM demonstrated a positive effect on the perceived ease of using IT for KM (Hypothesis 7b) in the structural model, with a path coefficient value of 0.54 and at a significance level of 0.01. Thus, while Hypothesis 7a was rejected, Hypothesis 7b was supported, based on the results of the study.

Finally, Hypothesis 8 was tested by examining the path coefficient of the KM processes construct to the level of IT use for KM. The results showed that KM processes had a positive relationship with the level of IT use for KM. The relationship was also found to be significant at a level of 0.01 with path coefficient value of 0.27. Thus, Hypothesis 8 was accepted based on the results of the structural model.

In brief, the results of the hypotheses testing were presented in this section and will be further discussed in Chapter 6 of this thesis (Discussion).

5.6 SUMMARY

This chapter described the data analysis techniques chosen to analyse the data collected and presented the results of the data analysis in relation to the proposed research model. The demographic profile of the organisations that have undertaken the survey for this study was firstly presented. Then, SEM approach using PLS technique was introduced and described as the data analysis technique that was used to analyse data collected from the survey. This was followed by the analysis of missing values, a descriptive analysis of constructs, and an assessment of the measurement model using the PLS-Graph software, which provided the results of construct validity of the study. The measurement model assessment confirmed that the constructs used in this study were effectively operationalised by their respective indicators, which allowed for the assessment of the structural model to be conducted next.

The evaluation of the structural model provided the results of the explanatory power of the set of independent variables for each dependent variable, as well as the size and significance of the paths between each pair of constructs in the model. In addition to the direct effects, the paths in the structural model were also tested for indirect effects between independent and dependent variables. Based on the results of the structural model assessment, the hypotheses developed in this study were tested and the results were presented. The results of the data analysis in this chapter will be compared and contrasted in light of extant literature discussed in Chapter 3 (Research Problem and Framework), and are presented in the next chapter, Chapter 6, (Discussion).

CHAPTER 6: DISCUSSION

6.1 INTRODUCTION

The results of data analysis presented in the previous chapter (Chapter 5) are discussed in this chapter. The aim of this chapter is to compare and contrast the findings of this study with what has been documented in the relevant research literature, which is mainly of studies conducted outside of Malaysia, investigating one or more of the constructs studied in this research. The second section of this chapter compares and contrasts the results of the hypotheses testing, as presented in Chapter 5 of this thesis, (Data Analysis and Results), with the results of prior relevant studies. The third section presents a discussion of the application of TAM in the context of this study, particularly on the performance of specific adapted TAM constructs with regards to the extent of IT use for KM in the organisations studied. Next, the discussions of the effects or non-effects of the investigated organisational factors on the extent of IT use for KM, in light of extant studies, are presented. This is followed by a discussion of the comments made by a number of respondents in the open-ended question of the survey. Finally, the predictive capability of the refined research model of this study is compared and contrasted with the predictive capabilities of other models reported by extant studies in the similar area of IT use for KM or KM systems' use.

Figure 6-1 provides an overview of the sections presented in this chapter.

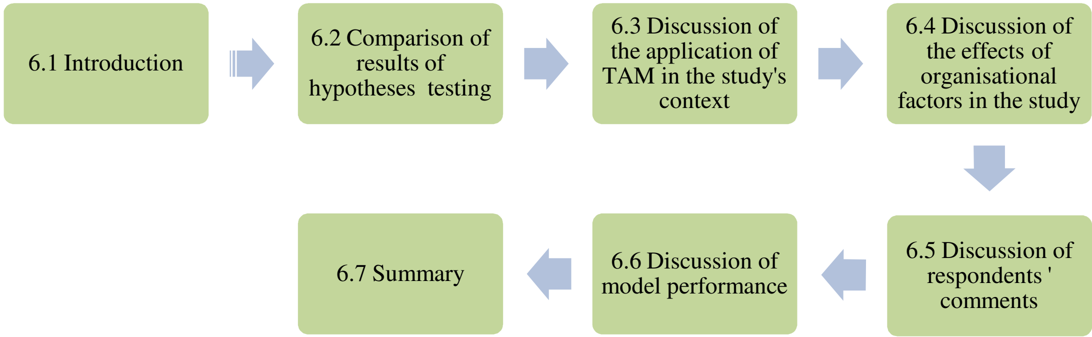


Figure 6-1 Overview of the sections in Chapter 6

The following section provides a discussion of the hypotheses testing results presented in Chapter 5 of this thesis, (Data Analysis and Results).

6.2 RESULTS OF HYPOTHESES TESTING—COMPARISON WITH PRIOR STUDIES

A number of hypotheses concerning the adoption and use of IT for KM in Malaysian listed organisations were formulated after a review of the relevant literature and the preliminary interviews in four Malaysian listed organisations. The hypotheses were tested using PLS path coefficient analyses and the results are summarised in Table 6-1 along with the results of prior studies, which were placed in order based on the extent of their support for the hypotheses. The results of the current study were found to be generally consistent with prior studies except for the effects of perceived ease of use, management support and commitment, and rewards and incentives, on the extent of IT use for KM. The detailed discussions of the effects of the constructs, as well as the possible explanations for the lack of support for a number of the constructs in the study are presented in sections 6.3 and 6.4 of this chapter.

Table 6-1 Results of hypotheses compared with prior studies

Hypothesis	Dependant Variable	Independent Variable	This Study	Prior Study
Hypothesis 1	IT use for KM	Perceived benefits	Supported	Money and Tuner (2005) in the USA: Supported Jennex and Olfman (2006) in the USA: Supported Ong et al. (2005) in Taiwan: Supported Kuo and Lee (2009)in Taiwan: Supported Wu and Li (2007) in Taiwan: Supported Vitari et al. (2007) in Italy: Supported He, Qiao, and Wei (2009) in China: Supported Kulkarni, Ravindran, and Freeze (2007) in the USA: Not supported
Hypothesis 2a	IT use for KM	Perceived ease of use	Not supported	Ong et al. (2005) in Taiwan: Supported Kuo and Lee (2009) in Taiwan: Supported Money and Turner (2005) in the USA: Supported (weak in the presence of perceived benefits mediation) Vitari et al (2007) in Italy: Supported (low) Keil, Beranek, and Konsynski (1995) in the USA: Not supported Dasgupta, Granger, and McGarry(2002) in the USA: Not supported Lee, Cheung, and Chen (2005) in Hong Kong: Not supported Lu, Yu, and Lu (2001) in Taiwan: Not supported
Hypothesis 2b	Perceived benefits	Perceived ease of use	Supported	Money and Turner (2005) in the USA: Supported Ong et al. (2005) in Taiwan: Supported Kuo and Lee (2009) in Taiwan: Supported Clay, Dennis, and Ko (2005) in the USA: Supported Vitari et al. (2007) in Italy: Supported (low) Lewis, Agarwal, and Sambamurthy (2003) in the USA: Not supported
Hypothesis 3a	IT use for KM	Management support and commitment	Not supported	Kulkarni, Ravindran, and Freeze (2007) in the USA: Supported Purvis, Sambamurthy, and Zmud (2001) in the USA: Supported
Hypothesis 3b	Knowledge sharing culture	Management support and commitment	Supported	Vitari et al. (2007) in Italy: Supported
Hypothesis 3c	Knowledge classification	Management support and commitment	Supported	Kulkarni, Ravindran, and Freeze (2007) in the USA: Supported Purvis, Sambamurthy, and Zmud (2001) in the USA: Supported
Hypothesis 4	IT use for KM	Rewards and incentives	Not supported	Subramaniam and Soh (2009) in the USA: Supported Kulkarni, Ravindran, and Freeze (2007) in the USA: Supported Moffett, McAdam, and Parkinson (2004) in the UK: Supported Kankanhalli, Tan, and Wei (2005) in Singapore: Supported (under strong identification factor) Al-Busaidi and Olfman (2005) in Oman: Not supported

Hypothesis	Dependant Variable	Independent Variable	This Study	Prior Study
Hypothesis 5	IT use for KM	Knowledge sharing culture	Supported	Subramaniam and Soh (2009) in the USA: Supported Kankanhalli, Tan, and Wei (2005) in Singapore: Supported Al-Busaidi and Olfman (2005) in Oman: Supported
Hypothesis 6a	IT use for KM	Knowledge classification	Supported	Halawi, McCarthy, and Aronson (2008) in the USA: Supported Khalil and Elkordy (2005) in the UK: Supported Purvis, Sambamurthy, and Zmud (2001) in the USA: Supported
Hypothesis 6b	Perceived benefits	Knowledge classification	Supported	Halawi, McCarthy, and Aronson (2008) in the USA: Supported Lai, Wang, and Chou (2008) in Taiwan: Supported Hong et al. (2002) in Hong Kong: Supported Clay, Dennis, and Ko (2005) in the USA: Supported Kulkarni, Ravindran, and Freeze (2007) in the USA: Not supported
Hypothesis 7a	IT use for KM	Policies and procedures	Not supported	No prior studies
Hypothesis 7b	Perceived ease of use	Policies and procedures	Supported	No prior studies
Hypothesis 8	IT use for KM	KM processes	Supported	No prior studies

In addition, the proposed research model was tested using PLS structural model assessment and the model was found to explain over 60% of the variances in the extent of IT use for KM in Malaysian listed organisations. A detailed discussion of the predictive capability of the model is presented in section 6.6 of this chapter.

6.3 THE APPLICATION OF TAM IN THE CONTEXT OF THE STUDY

Based on the results of the hypotheses testing, the performance of the two primary TAM constructs of perceived benefits and perceived usefulness, that were adapted in this study to explain the extent of IT use for KM in Malaysian listed organisations, is discussed in the following sub-sections.

6.3.1 Perceived benefits of using IT for KM

The results of the study extend the support of one TAM construct, the perceived benefits of using IT for KM, in the context of IT adoption for KM in Malaysian listed organisations. As hypothesised in Hypothesis 1, perceived benefits were found to positively affect the level of IT use for KM, which thus, corroborates the results of prior studies that have shown positive impacts of perceived benefits, or usefulness, on the attitude and intention to use KM systems and consequently enhance the use of the systems (Clay, Dennis, and Ko 2005; He, Qiao, and Wei 2009; Jennex 2006; Kuo and Lee 2009; Money and Turner 2005; Ong et al. 2005; Vitari et al. 2007; Wu and Li 2007). This finding indicates that the perception of the benefits of using IT for KM in meeting users' needs is useful for predicting its continued use. In other words, the adoption and use of IT-based systems to support KM are the results of users' acknowledgement of the capabilities of the systems to contribute to the accomplishments of their job tasks (Huysman and Wit 2004). *This finding, thus, confirmed that the linkage between expectations of benefits and IT use for KM is attractive to employees in Malaysian listed organisations, and, thus, is important to motivate their use of IT to support KM.*

Although the effects of the perceived benefits of using IT for KM concur with numerous prior KM system studies as mentioned earlier, it does however contradict the findings of Kulkarni, Ravindran, and Freeze (2007), which indicate an insignificant effect of perceived usefulness and KM systems' use. A plausible reason provided was that the KM initiatives in their study may still be in initial stages. It was suggested that at this stage, the mere existence of new KM systems, for example, a knowledge repository, may be an adequate driver for its use. In other words, at its introductory stage, users are motivated to use any form of reusable knowledge supplied by the KM system, which subsequently improves their perceptions on the benefits of using the system. However, Kulkarni, Ravindran, and Freeze (2007) also cautioned that this limited perception on the benefits of the system may not be sufficient to drive the internalisation of the system usage to support employees' knowledge activities in the long-run.

With regards to the predictive power of the perceived benefits construct in explaining IT use, it should be noted that perceived benefits has shown a lower predictive power (path coefficient 0.2) with respect to other determinants in the research model, and, thus, did not appear as the most important determinant of IT use for KM in this study. Other KM system studies have also shown lower explicative powers of this construct (Money and Turner 2005; Vitari et al. 2007). A possible explanation is that the predictive power of perceived benefits may be reduced with respect to the contributions of other important determinants in the context of IT use for KM. This infers that the traditional methodologies to improve the characteristics of IT-based systems to support KM would not prove to be very effective in enhancing the extent of its use. Instead, initiatives to enhance the external variables or the organisational factors with higher predictive power as identified by this study would be more effective. The influences of these organisational factors will be discussed in detail in section 6.4 of this chapter.

This section provided a discussion of the effect of the perceived benefits of using IT for KM on the extent of IT use for KM in Malaysian listed organisations. The following section discusses the effect of perceived ease of use of IT for KM in the study.

6.3.2 Perceived ease of use of IT for KM

Perceived ease of use (defined as perceived ease of using IT for KM in this study) is another TAM construct that was adapted in this study. Based on the hypotheses testing results in the structural model evaluation section, there was no significant relationship found between perceived ease of use and the extent of IT use for KM (Hypothesis 2a). The effects of perceived ease of use were also found to be inconsistent in prior studies of KM systems' use. While some KM system studies have found a significant positive effect of perceived ease of use on KM systems' use (Kuo and Lee 2009; Ong et al. 2005), there are also KM system studies that have reported non-significant (Dasgupta, Granger, and McGarry 2002; Keil, Beranek, and Konsynski 1995; Lee, Cheung, and Chen 2005; Lu, Yu, and Lu 2001) or relatively low effects of the construct (Money and Turner 2005; Vitari et al. 2007).

There are a number of possible explanations for the lack of support of perceived ease of use in this study. One of them could be that the mere existence of IT-based systems that are designed to provide users with access to reusable knowledge is perceived as an adequate motivation for their use (Kulkarni, Ravindran, and Freeze 2007). For example, IT-based systems for KM could be perceived as enabling users to accomplish their decision tasks much more efficiently than they would without the aid of the systems. Thus, a simple KM system, such as a knowledge document repository, even without sophisticated features like personalisation capabilities or index-based search, could already be a sufficient motivator for its use. This infers that users will accept the limitation of ease of use as long as they perceive the system is useful in their job (Davis, Bagozzi, and Warshaw 1989). On the other hand, users will not tolerate and use a system that is not useful regardless of how easy it is to use the system (Money and Turner 2005). Thus, in Malaysian listed organisations, IT is used to manage knowledge regardless of the perception of its ease of use.

Another possible explanation for the lack of support for perceived ease of use is as what has been suggested by Clay, Dennis, and Ko (2005), that perceived ease of use may be important only in the initial acceptance stage of a technology. Its direct impact, however, diminishes after the technology has been used for a substantial period of time. This could be true in the context of the organisations studied, in which the IT-based systems used for KM were no longer in their introductory stage and had already been implemented in the organisations for a considerable period of time.

Lastly, a salient factor to consider for the lack of significance of perceived ease of use in predicting the use of IT for KM is the specific KM context within which IT is being utilised in the organisations studied. As suggested by Kankanhalli et al. (2003), within a KM context, the effect of perceived ease of use on the extent of IT use can be offset in the face of collective outcomes of the influence of perceived benefits and particularly the strong influences of other organisational factors. This could explain the insignificant relationship between perceived ease of use and IT use for KM in this study, as the effect of perceived ease of use could be lowered by the introduction of other organisational factors pertinent to the use of IT for KM.

Nevertheless, the results of the study indicate a significant positive relationship between perceived ease of use and perceived benefits of using IT for KM (Hypothesis 2b) as expected. This finding is consistent with prior studies adopting TAM to explain KM systems adoption (Kuo and Lee 2009; Money and Turner 2005; Ong et al. 2005) that have reported a significant positive effect of perceived ease of use on perceived benefits or usefulness of using a KM system. This study's outcome, thus, validates the contention that a technology with high ease of use promotes an increased sense of its usefulness.

Contrary to this finding, however, certain studies had demonstrated a lower (Vitari et al. 2007) and also insignificant (Lewis, Agarwal, and Sambamurthy 2003) effect of perceived ease of use on perceived benefits. Lewis, Agarwal, and Sambamurthy (2003) attribute this discrepancy to their respondents who were relatively inexperienced with technology use and suggest that experience may moderate the relationship between perceived ease of use and perceived benefits.

In brief, consistent with many KM system studies (Clay, Dennis, and Ko 2005; Lee, Cheung, and Chen 2005; Lu, Yu, and Lu 2001), the significant positive impact of perceived ease of use IT for KM on the perceived benefits of using IT for KM in this study indicates that removing the difficulties that would allow users to perceive using a technology as easy would have a direct positive effect on its perceived benefits. *Thus, the results of this study verified that improving the accessibility and usability of IT-based systems in the organisations studied is important to enhance their users' perception on the systems' benefits, which in turn promotes their use.*

This section has provided the discussions of the effects of TAM's primary constructs applied in the context of this study. The next section presents a discussion of the effects of the organisational factor constructs as hypothesised in the research model.

6.4 DISCUSSION OF THE ORGANISATIONAL FACTORS' EFFECTS IN THE MODEL

The statistical results of this study presented in Chapter 5 have confirmed that organisational factors, namely, having KM processes to manage knowledge in an organisation, the perceived benefits of using IT for KM, having a knowledge classification for KM, and a knowledge sharing culture, have significant positive impacts towards the extent of IT use to support KM in the organisations studied. The explicative power of these factors on the extent of IT use for KM was found to be very strong (R^2 = 0.66). This indicates that management in the surveyed organisations should focus on the improvements of these identified organisational factors in order to enhance the use of IT to support KM in their organisations. The sub-sections below discuss the effects of the organisational factors in the study, in light of prior studies' findings.

6.4.1 KM processes

The results of the PLS structural model assessment indicate that having appropriate KM processes to support KM activities exhibits the strongest direct positive influence on the adoption of IT use for KM in the surveyed organisations (Hypothesis 8). Interestingly, the importance of this variable towards the adoption of IT for KM was only identified during the preliminary interviews with a number of Malaysian listed organisations. This factor was not initially considered because it was not explicitly identified by the KM systems' studies reviewed earlier in Chapter 3 of this thesis. Nevertheless, this finding was found to be consistent with relevant literature suggesting the positive influence of having appropriate business processes to support the flow of knowledge in an organisation, towards the extent of IT adoption to support KM in the organisation (Aurum, Daneshgar, and Ward 2007; Butler, Heavin, and O'Donovan 2007; Hendriks 2001; Jennex 2006; Xu and Quaddus 2007).

In addition, the above finding validates the suggestion that the lack of KM processes governing how knowledge in an organisation is created, classified and stored, shared, and applied, limits the effectiveness of the KM systems and hence impedes their utilisation (Bals, Smolnik, and Riempp 2007). Similarly, this outcome also provides support to prior KM researchers' contentions that success in utilising IT to support KM cannot be achieved without the appropriate processes and rules for sharing knowledge (Huysman and Wit 2004; Ruiz-Mercader, Meroño-Cerdan, and Sabater-Sánchez 2006). Consequently, IT-based systems for KM will not be used when the need to share knowledge is limited. *Hence, this finding confirmed that the absence of appropriate KM processes will result in IT being underutilised for KM purposes in the organisations studied.*

The positive effects of KM processes on IT use for KM also confirmed the interview respondents' views, in the preliminary phase of the study, on the importance of having appropriate KM processes to support the management of organisational knowledge in order to encourage employees' utilisation of IT for KM. Appropriate KM processes that support the creation, storage, transfer, and application of knowledge can necessitate the use of IT to enable the capturing of knowledge in order to assist in its conservation, dissemination, and future application to improve problem solving, decision making, and innovative skills. Thus, it is essential for the management in these organisations to look into the readiness of their KM processes so that these processes can be enabled and enriched by IT, as indicated by the findings of this study.

6.4.2 Knowledge classification

As posited in Hypothesis 6a, having a knowledge classification for KM was found to be an important factor in predicting the level of IT use for KM in the surveyed organisations. This finding is in line with the empirical evidence provided by Purvis, Sambamurthy, and Zmud (2001) and Halawi, McCarthy, and Aronson (2008) in their investigation of the assimilation of knowledge platforms and KM systems' success. Further, this finding validates the belief that with a knowledge classification in place, IT-based systems can then be designed to provide the accessibility and usability of the right knowledge to the needful recipients in an organisation (Aurum, Daneshgar, and Ward 2007; Hendriks 2001).

The inference of this finding is that a classification system of knowledge permits the appropriate knowledge categorisations according to the need of various business units or departments within an organisation. This would subsequently enhance the capability of IT-based systems to provide useful knowledge that is of high quality and reusable, which in turn encourage the use of the systems (Ong et al. 2005). *Thus, the results of this study confirmed that having a knowledge classification, which improves the quality of the content of knowledge, is influential in motivating user adoption of IT for KM.*

The result of the study also indicates that knowledge classification exhibits the expected positive influence on the perceived benefits of using IT for KM (Hypothesis 6b). This finding is consistent with prior studies of KM systems' use, that have suggested that the quality of knowledge contained in the KM system is a key driver of positive perceptions of its usefulness (Clay, Dennis, and Ko 2005; Hong et al. 2002; Lai, Wang, and Chou 2008). Useful content of knowledge that is of high quality and can be reused appears to add value to IT-based systems for KM and enhances users' perception on the benefits of using the systems.

This positive impact of knowledge classification on perceived benefits also supports the statements of prior studies asserting the importance of introducing certain criteria that can be used to determine the knowledge that is most critical for an organisation (Butler, Heavin, and O'Donovan 2007; Damodaran and Olphert 2000; Davenport, De Long, and Beers 1998). As discussed in Chapter 3 of this thesis, these criteria are useful in guiding users to work out what is considered knowledge, as opposed to information, which should be preserved and made accessible to others. Moreover, the criteria for identifying and classifying knowledge can help users to assess whether knowledge can be stored and reused in its original form, or needs to be converted in order to be meaningful and useful to others (Damodaran and Olphert 2000). Hence, having a knowledge classification system enables organisations to appropriately classify knowledge, making them relevant to users' needs. *In summary, this finding confirmed that the relevancy of knowledge, which is achieved by having a knowledge classification system, as an important antecedent of perceived benefits of using IT to support KM in Malaysian listed organisations.*

Contrary to the above finding, however, Kuo and Lee (2009) had reported an insignificant relationship between having a knowledge classification system that enhances the quality of knowledge, with perceived usefulness of a KM system. Their findings indicate that knowledge quality will only exhibit a direct positive effect on perceived usefulness when the fit between the job task and the KM system is high. This suggests that KM systems need to be designed to supply the right knowledge for the specific tasks that users do. Thus, it was suggested in their study that, having a knowledge classification system that merely distinguishes knowledge from data and information, without the ability to support the various contexts in which that knowledge can be applied, will not deliver the right knowledge to fit users' specific tasks.

Kuo and Lee (2009) further elaborate that, from the perspective of the users, IT-based systems for KM need to capture the right knowledge with sufficient content to help users accomplish their tasks, and in turn improve their job performance. Without this capability, these systems will be not be perceived as useful to KM regardless of the knowledge content that they offer. Consequently, in relation to the knowledge classification in this study, it is important to be concerned with the design of the knowledge classification system so that knowledge can be categorised and contextually fitted to the requirement of tasks that users need to accomplish.

To determine the implications for practice, it is noted that knowledge classification is significantly affected by the level of management support and commitment as posited in Hypothesis 3c. This finding supports previous studies of the KM system, which enumerate that instead of a direct impact on the extent of IT use for KM, management support and commitment exhibits an indirect impact through its effects on the quality of knowledge content that can be adapted as required by an organisational context (Kulkarni, Ravindran, and Freeze 2007; Purvis, Sambamurthy, and Zmud 2001). Further, Purvis, Sambarmurthy, and Zmud (2001) elaborate that rather than influencing the technology use itself, management support would reveal its influence on IT use for KM through its enabling of several structuring actions, among which is the embedding of useful knowledge within knowledge databases.

The inference of the above finding is that management that is committed to KM will pay more attention toward improving the quality of knowledge and reducing the knowledge gaps that exist within their organisations by identifying the crucial knowledge to be preserved and improving the quality of knowledge by means of cleansing and categorising this knowledge to meet user-specific requirements (Butler, Heavin, and O'Donovan 2007). IT can then be used to capture and disseminate the classified knowledge to various business units or departments within the organisation. *Thus, the results of the study confirmed that support and commitment exhibited by management in the studied organisations is an important influencing factor, which determines the extent of knowledge classification that improves the quality of the content of knowledge shared within the organisations.*

6.4.3 Knowledge sharing culture

Knowledge sharing culture was found to exhibit the expected direct positive effect on the extent of IT use for KM as advanced in Hypothesis 4, which confirmed that a knowledge sharing culture enhances the willingness of individuals to use IT for the purpose of creating, storing, sharing and applying knowledge. This finding is consistent with what has been stated by numerous studies of KM systems (Al-Busaidi and Olfman 2005; Aurum, Daneshgar, and Ward 2007; Benbya and Belbaly

2005; Butler, Heavin, and O'Donovan 2007; Damodaran and Olphert 2000; Davenport, De Long, and Beers 1998; Desouza 2003; Subramaniam and Soh 2009). This finding thus validates the role of a knowledge sharing culture in encouraging individuals' use of IT to share their knowledge with others.

Further, the above finding also indicates that the establishment of an appropriate knowledge sharing culture, which is represented by a culture that believes in the importance of employees' knowledge and experiences for an organisation's success, is required before employees are motivated to use IT for KM purposes. Moreover, an organisational culture in which the norm is to use IT to share knowledge, such as by having discussions on the online forums or communities of practice, will foster the use of IT for KM within the organisation.

Additionally, this finding is also consistent with the findings of Alavi, Kayworth and Leidner (2006) suggesting that individuals' ways of using KM technology are influenced by their organisational values. For example, an organisational culture that embraces collaborative values, such as cooperation, caring, and support will tend to focus more on the use of IT to facilitate social networks, such as the use of email, instant messaging software, and online forums. Alternatively, an organisational culture that emphasises innovativeness will emphasise the use of IT to improve existing methodologies, work processes, and innovative skills. Consequently, employees embracing the innovativeness culture will emphasise the utilisation of IT for the purpose of developing and accumulating intellectual capital, such as the utilisation of knowledge portals, search engines, and expert locator system. *In summary, the effect of a knowledge sharing culture on IT use for KM in this study, confirmed that an organisation in which its employees enjoy having discussions of knowledge, keen to help others, and believe in the importance and benefits sharing and reusing knowledge, will see a higher level of IT use to support KM in the organisation.*

6.4.4 Management support and commitment

The results of the study indicate that there was insufficient evidence to support the direct influence of management support and commitment on the extent of IT use for KM in the organisations surveyed (Hypothesis 3a). This is contrary to the findings of a number of previous studies, which have provided empirical evidence for management support, demonstrated by the belief in the importance of IT and commitment of management, as having a direct positive influence on KM systems' use (Al-Busaidi and Olfman 2005; Kulkarni, Ravindran, and Freeze 2007). However, a study by Damodaran and Olphert (2000) had also observed the lack of effect of management commitment and belief in the strategic importance of KM systems on users' uptake of the systems. The authors attributed this lack of association to the considerable shortfall between management's communication of the benefits of KM technology and its actual delivery, which could also be a possible reason for the inadequate support for the management support and commitment factor in this study.

Nevertheless, the assessment of the study's structural model indicates that management support and commitment exhibit a significant indirect effect, on the extent of IT use for KM, through its significant intermediate effect on knowledge sharing culture (Hypothesis 3b). The assessment of the study's structural model also indicates that management support and commitment contributed to over 50% of the amount of variance in knowledge sharing culture. This supports the assertions of studies that have emphasised the importance of management commitment in establishing a strong knowledge sharing culture, by providing an environment that is conducive for sharing knowledge in order to achieve successful implementation, as well as promote the use of a KM system (Benbya and Belbaly 2005; Jennex and Olfman 2006; Subramaniam and Soh 2009). Further, this finding also concurs with the empirical evidence provided by Vitari et al. (2007) on the positive influence of the management, such as business unit directors, in establishing an organisational norm of using KM systems to support knowledge activities.

In addition, this finding is also in line with Davenport, De Long, and Beers' (1998) claim on the importance of management support and commitment in promoting a knowledge-oriented culture, among other factors, for the success of KM systems implementations. They describe that, management efforts that are deliberate and systematic in appreciating the value of individual and organisational knowledge, encouraging knowledge sharing within and across departments, and motivating the use of IT to support KM activities would all contribute to the required knowledge sharing culture that enhances the extent of IT use for KM.

Furthermore, the comments obtained from the open-ended question in the survey also provided support for this finding. The statement made by one of the respondents emphasised the 'need to have a top down commitment to cultivate the knowledge management culture in any organisation' for the purpose of enhancing the use of IT for KM in that organisation. *Thus, the findings of this study confirmed the importance of management support and commitment to enhance the knowledge sharing culture required to motivate the use of IT for KM.*

Similarly, management support and commitment was also observed to exhibit a significant indirect effect on the extent of IT adoption for KM through its significant intermediate effect on knowledge classification (Hypothesis 3c). The results of the study's structural model indicate that management support and commitment contributed 46% of the amount of variance in knowledge classification. This direct positive influence of management support and commitment on knowledge classification (Hypothesis 3c) has been discussed in sub-section 6.4.2 of this chapter in detail.

Finally, the analysis of the direct, indirect, and total effects in Chapter 5 of this thesis reveals that although there was no significant direct effect from management support and commitment, it did however exhibit the largest total effects (indirect and direct effects) on IT use for KM through its intermediate effects on knowledge sharing culture and knowledge classification. This finding thus adds to the existing collective knowledge regarding the influence of management support and commitment by confirming that its effect on IT use for KM occurs through specific IT-use mediation actions, rather than directly on IT use itself (Purvis, Sambamurthy, and Zmud 2001). The inference of this finding is that it is crucial for management to focus more on establishing the required knowledge sharing culture and knowledge classification to mould employees' motivation to use IT for KM. More implications with regards to the indirect effects of management support and commitment on the extent of IT use for KM will be discussed in detail in the implications section in Chapter 7 of this thesis.

6.4.5 Policies and procedures

The results of the study fail to indicate any significant association between policies and procedures for IT use for KM and the extent of IT use to support KM (Hypothesis 7a). Policies and procedures for IT use for KM in this study context are used to measure the extent of the institutionalisation of IT use for KM in an organisation. This finding contradicts what has been suggested by a number of KM system studies (Benbya and Belbaly 2005; Damodaran and Olphert 2000; Huysman and Wit 2004). The inference of this finding is that the mere existence of policies and procedures for the use of IT for KM is not adequate to drive the institutionalisation of IT use to support KM in the organisations surveyed. For example, policies that are not properly implemented and monitored are less likely to obtain adherence from the intended users.

In addition, policies that are established to enforce the use of IT to support KM may be perceived by employees as making their use of IT for KM mandatory, as indicated by a case study of KM practices in two software development organisations (Aurum, Daneshgar, and Ward 2007). One of the study's participants relates that forcing people to contribute knowledge to a KM system, for example, is the wrong way to encourage knowledge sharing and, hence, will not contribute to the use of the system to share knowledge. Similarly, a study of the management of knowledge sharing practices in ten large companies argues that knowledge sharing cannot be forced upon individuals, as people will only share knowledge when there is a personal motivation to do so (Huysman and Wit 2004). Thus, making the use of IT to manage knowledge mandatory by establishing policies for its use would not motivate users to use IT for KM purposes. As a result, policies and procedures for IT use for KM fail to enhance the adoption of IT for KM when they are seen as forcing the use of IT to manage knowledge, which could explain the lack of support for the policies and procedures factor in this study.

In order to investigate the effect of policies and procedures further in the research model, it is noted that although policies and procedures for IT use for KM did not have a significant direct effect on the extent of IT use for KM, the construct did, however, exhibit a significant indirect positive effect through the mediation of the perceived ease of using IT for KM construct (Hypothesis 7b). The results of the study show that policies and procedures for IT use for KM caused 30% of the variance in perceived ease of using IT for KM. This finding verified that the effect of policies and procedures on the use of IT for KM was only indirect through its intermediate effect on perceived ease of use.

Subsequently, this finding appears to corroborate the suggestion made by Damodaran and Olphert (2000) in their study that, failure to provide adequate support, such as guidelines and procedures, will lead to the perception of difficulties of using a KM system and consequently impede its acceptance and continued use. *Thus, this finding confirmed that policies and procedures for IT use for KM enable users in the organisations surveyed to effectively use IT for KM, and, in turn, enhances their perception on the ease of using IT for KM.*

6.4.6 Rewards and incentives

Although numerous studies have proven that rewards and incentives positively affects the use of KM systems (Jennex and Olfman 2004; Kulkarni, Ravindran, and Freeze 2007; Lai 2009; Moffett, McAdam, and Parkinson 2004; Subramaniam and Soh 2009), there is insufficient evidence to indicate a similar effect from rewards and incentives on the use of IT for KM in the surveyed organisations. Rewards and incentives was found to have no significant effect on the extent of IT use for KM (Hypothesis 5), based on the results of this study. This finding, however, is in line with what was highlighted by Malhotra and Galletta (2003) that using incentives, especially extrinsic in nature such as monetary incentives, does not guarantee the use of a KM system.

Further, another study also indicates that providing intrinsic rewards, such as praise and recognition, rather than extrinsic ones could be more effective in motivating users to use KM systems (Kulkarni, Ravindran, and Freeze 2007). It was described in the study that reward mechanisms that are more intrinsic in nature, such as those that appreciate and commend the individuals who use KM systems to share their knowledge, can help induce the use of the systems. Thus, a possible explanation for the non-effect of this factor in this study, could be that extrinsic rewards and incentives may not be as effective as intrinsic rewards and incentives to motivate the use of IT for KM in Malaysian listed organisations.

Another possible explanation might lie in what was observed by Kankanhalli, Tan, and Wei (2005), in their study of the use of electronic knowledge repositories in Singapore. It is noted in the study that the relationship of organisational rewards appeared to be directly linked to the usage of the knowledge repositories. However, the findings of the study also suggest that the relationship between the usage of the repositories and organisational rewards appeared to be stronger when users' identification with the organisation was strong. In other words, users tend to be motivated by organisational rewards and use the KM system more when they share the same interests as the organisation. The study concluded that if users do not have a strong sense of identification with their organisations by sharing the same interests, offering rewards will not motivate them to contribute to the repositories. Hence, the lack of the identification between users and their organisations could also be another possible explanation for the insignificant effect of rewards and incentives to motivate the use of IT for KM in this study.

Apart from studies in Western countries, previous KM system studies, such as in Oman (Al-Busaidi and Olfman 2005) and in Korea (Bock and Kim 2002; Bock et al. 2005), have also found none or negative effect of rewards and incentives on KM systems' use. The inference that could be made from these findings is that the non-effect of rewards and incentives may be unique from those of Western studies (Alavi and Leidner 1999a; Jennex and Olfman 2004; Kulkarni, Ravindran, and Freeze 2007; Moffett, McAdam, and Parkinson 2004), which have observed direct positive influences of incentives, aimed at promoting knowledge sharing and teamwork, on KM systems' use. Thus, the unique cultural aspect of the Eastern or Asian countries could also be a possible factor explaining why users perceived rewards and incentives as insignificant in motivating their use of IT for KM in Malaysian listed organisations. Contrary to the organisations in Western countries, organisations in the Eastern or Asian countries might consider rewards and incentives as an unfeasible policy to enhance their adoption of IT for KM, as illustrated by the research participants in Malaysia. This suggests that implementing a rewards and incentives system in Malaysian organisations, or to some extent in Eastern or Asian countries, has little or no effect on IT use for KM.

This section has presented the discussion of the effects of the organisational factor constructs as hypothesised in the research model. The next section discusses the comments made by the survey respondents with respect to the use of IT for KM in their organisations.

6.5 DISCUSSION OF RESPONDENTS' COMMENTS

The comments made by the respondents, in the comments section of the survey, highlighted some interesting issues that are worth discussing. For example, one of the respondents stated that it was timely for this type of study to be conducted in Malaysia, as many KM initiatives are currently being launched in the country. The respondent also would like a report of the study to be extended to him/her so that he/she could use the report to convince the top management about the importance of setting up a knowledge centre in the organisation. This indicates that, the scarcity of studies examining the use of IT for KM in Malaysian organisations necessitates the relevant studies to be conducted, in order to provide the essential justification and evidence for management to make informed decisions in the acquisitions of required funds and resources to support the implementation IT for KM.

Additionally, a number of respondents acknowledged that their organisations were still new in applying KM and that they were still in the process of learning how to set up KM practices for their organisations. Hence, it was rather expected that certain management in these organisations would still be perplexed about what actually constitutes KM. Thus, it was also inevitable that some IT and even KM managers equate KM initiatives as IT initiatives. As indicated in one of the comments, KM is in fact seen as another IT initiative in his/her organisation.

In regards to IT infrastructure and tools for KM, one respondent commented that the required infrastructure and tools were already available in his/her organisation. However, the management in the organisation failed to see the relevant return of investment (ROI) to proceed with utilising the infrastructure and tools for KM purposes. Moreover, the respondent indicated that the Malaysian business owners were typically not open to a collaborative knowledge sharing environment and often managed through an authoritarian top down approach, which led to little appreciation of the use of IT for KM. Nevertheless, another respondent highlighted the need for a systematic approach to store and retrieve knowledge to enable his/her organisation achieve faster and better results, which indicates the management's awareness of the ability of IT to facilitate systematic storage and retrieval of knowledge.

In relation to the use of IT for KM, one respondent suggested that without strong management support and participation, these initiatives will not achieve the desired results. Moreover, another respondent pointed out that without proper direction from the management, IT-based systems for KM, such as collaboration software, online chats, and online forums have become mere socialising tools amongst the employees in his/her organisation. Thus, this validates the need for strong management participation in any IT implementations for KM; without someone to lead, govern, and monitor the initiative, there is a danger that users will misuse IT for other purposes than its original objective of supporting KM.

Lastly, another respondent had provided support for the importance of having a knowledge classification system for IT use for KM. The respondent stated that the management should make the relevant knowledge accessible to the end users through the use of knowledge taxonomies and indexing. Another issue highlighted by the respondent was the need to standardise the format of knowledge content for reuse. The respondent contended that the format of knowledge content should be standardised by using the right simplified language so that it can be appropriately reused and applied in the desired context. This respondent's view signifies the management's awareness and realisation of the importance of having a knowledge classification to support their KM initiative and subsequently facilitate their use of IT to support KM. However, they might not have realised that the most important step in developing a knowledge classification system is to firstly recognise any knowledge gaps in their organisations by identifying the knowledge that needs to be preserved and reused to help them achieve their strategic objectives. Thus, the practical implications enumerated in the next chapter, on the conclusion, implications, and future work of the study, can help to outline the important requirements that need to be set up by the management in these organisations in order to effectively implement IT for their KM.

This section has provided a discussion of the comments made by the survey respondents in the open-ended question of the survey. The next section discusses the study model's predictive power as compared to prior adoption of TAM in its original form as well as extensions of TAM, in explaining the use of IT-based systems for KM.

6.6 DISCUSSION OF THE RESEARCH MODEL

The model developed in Chapter 3 was formulated as a means to provide the answers to the research questions identified in this study. The model has shown acceptable quality, though some of the hypothesised paths were not supported. The model, showing only the significant paths, is as displayed in Figure 6-2.

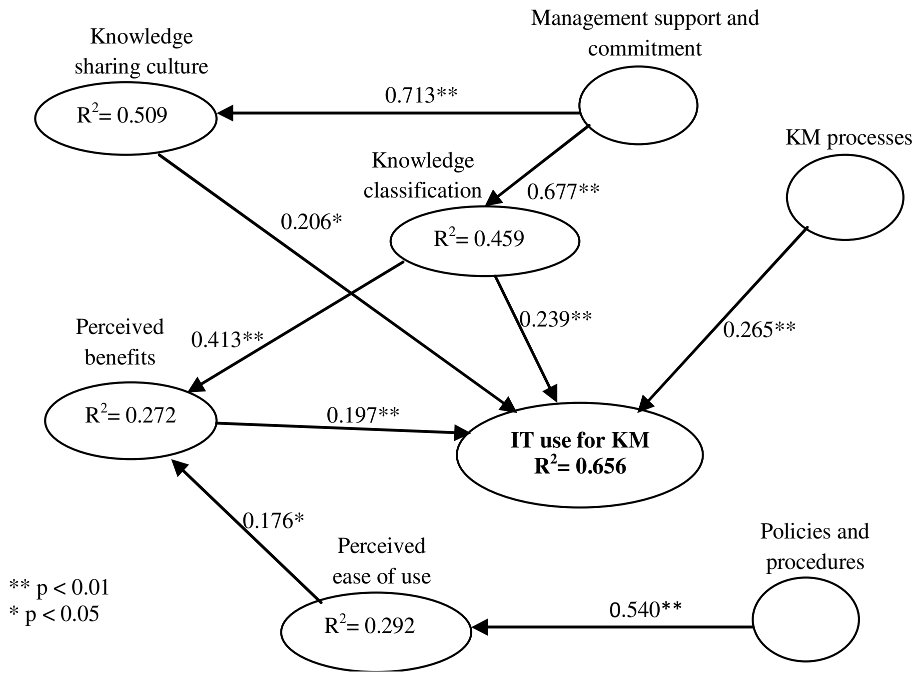


Figure 6-2 The research model showing significant paths

The following sub-sections discuss the model's performance in light of previous studies of IT-based systems for KM.

6.6.1 Comparison with other KM systems' studies

Firstly, the explanatory power of the final model of this study is compared with the explanatory power of models in prior studies that have adopted the traditional TAM to explain the use or intention to use a KM system. As can be seen in Table 6-2, this study's model exhibits a higher explanatory power of 66% when compared with prior studies, such as Money and Turner (2005) and Venkatesh et al. (2003), with models' explanatory powers of 51% and 37% respectively.

The high explanatory power of this study's model could be due to the extension of the original TAM to incorporate the additional constructs of organisational factors. As indicated by Money and Turner (2005), although prior research suggests that TAM-based user acceptance research can serve as a basis for investigating KM systems user acceptance, it is anticipated that other factors associated with the complex socio-cultural and organisational implications of the adoption of IT for KM must also be explored.

Table 6-2 Comparison with other KM systems' studies

Authors	Study	Setting	Country	Constructs considered	R^2
Money and Turner (2005)	KMS use	One organisation	USA	TAM constructs	0.511
Horton et al. (2001)	Intention to use Intranet	Banking and engineering companies	UK	TAM constructs	0.33
Aman (2010)	This study	Malaysian listed organisations	Malaysia	TAM and organisational factor constructs	0.66

6.6.2 Comparison with other studies extending the TAM

Next, the current study model's explanatory power is compared with prior studies that have extended the original TAM to include other constructs explaining the acceptance or use of KM systems. Based on Table 6-3, it appears that these studies generally have higher explanatory power than the studies that had only considered the TAM traditional constructs to explain KM system use. For example, Vitari et al.'s (2007) model's explanatory power is at 57%, Kuo and Lee's (2009) model's is at 55%, Wu and Li's (2007) model's is at 58%, and Ong et al.'s (2005) model's is at 61%. These explanatory powers are however, still lower than the current study's final model, which is at 66%.

The high explanatory power of this study's model could be due to the extension of TAM by incorporating the constructs of organisational factors that were not considered in the other studies. Further, since all of the studies in the comparison did not consider specific factors that are related to a country's unique culture, it is conceivable that the different levels of the explanatory power are not due to the specific culture-related factors of the countries in which the studies were undertaken.

Table 6-3 Comparison with other studies extending the TAM

Authors	Study	Setting	Country	Constructs considered	R^2
Vitari et al. (2007)	KMS acceptance	2 large organisations	Italy	Subjective norm, incentive, organisational culture, organisational structure	0.57
Kuo and Lee (2009)	KMS adoption	Large companies	Taiwan	Information quality, task-technology fit	0.546
Wu and Li (2007)	KMS use	Large corporations	Taiwan	KM orientation (human or system focus), emotions, social influence	0.581
Ong et al. (2005)	KMS acceptance	Semiconductor manufacturing companies	Taiwan	Subjective norm, perceived power security	0.61
Lu, Yu, and Lu (2001)	Intention to use DSS	University students	Taiwan	Cognitive styles	0.56
Dasgupta, Granger, and McGarry(2002)	Use of e-collaboration tool	University students	USA	Level of user experience	0.47
Aman (2010)	This study	Malaysian listed organisations	Malaysia	TAM and organisational factor constructs	0.66

6.6.3 Comparison with other Malaysian studies

The review of the literature indicates that TAM has not been adopted to explain the use of IT for KM or KM systems' use in a Malaysian setting. Thus, it was not possible to compare the explanatory power of the current study's final model with other Malaysian studies. Nevertheless, the explanatory power of the final model was compared with other Malaysian studies adopting TAM to explain the use of IT-based systems, such as Internet banking (Lallmahamood 2007), mobile commerce (Wei et al. 2009), e-government service (Lean et al. 2009), e-recruitment (Tong 2009), and general computer usage (Zain et al. 2005). As shown in Table 6-4, the explanatory power of the final model is also higher when compared to the explanatory power of these studies' models. The extension of TAM by incorporating the organisational factors' constructs that were not considered in the other studies might also explain the high explanatory power of this study's model.

Table 6-4 Comparison with other Malaysian studies adopting TAM

Authors	Study	Setting	Country	Constructs considered	R^2
Lallmahamood (2007)	Intention to use Internet Banking	ICT professionals and students	Malaysia	Perceived security and privacy	0.532
Wei et al. (2009)	Intention to use Mobile commerce	Mobile phone users	Malaysia	Social influence, trust, perceived cost	0.541
Zain et al. (2005)	Actual computer usage	Manufacturing firms	Malaysia	User involvement, task characteristics, systems characteristics, user experience, top management support, information quality	0.57
Lean et al. (2009)	Intention to use e-govt service	Malaysian citizen/employee	Malaysia	Trust and DOI constructs	0.44
Tong (2009)	Intention to use e-recruitment	Malaysian employees	Malaysia	Perceived privacy risk, performance expectancy, application specific self-efficacy, perceived stress	0.372
Aman (2010)	This study	Malaysian listed organisations	Malaysia	TAM and organisational factor constructs	0.66

In conclusion, this study has extended TAM, while retaining its parsimony and technology use focus, with the inclusion of six external variables of organisational factors that were theoretically justified to have positive influences on the use of IT for KM within the Malaysian listed organisations' context. These variables were identified from the literature and the preliminary interviews conducted in Malaysian organisations. The application of TAM in this study appears to produce an overall favourable predictive capability compared to prior studies that have adapted and/or extended TAM to explain the adoption and use of various KM systems.

6.7 SUMMARY

In summary, this chapter has compared the findings of this study to the extant literature. This chapter began with a discussion of the effects of TAM constructs applied in the context of the study. This was followed by discussions of the effects of the organisational factor constructs in the model as compared with related studies. Next, certain comments made by the survey respondents in the open-ended questions were highlighted and discussed. Subsequently, the model's predictive ability of IT use for KM in this study was compared with prior studies that have adopted the traditional TAM, and also with those that have made extensions to the original TAM, to explain the adoption and use of KM systems. Finally, the study's model predictive power was also compared with prior Malaysian studies that have adopted TAM to explain general IT-based systems' usage.

Having discussed the results of the data analysis presented in Chapter 5 of this thesis, the next chapter provides the conclusions to the research questions developed in the study, the study's limitations, the implications for both research and practice, and the opportunities for future research.

CHAPTER 7: CONCLUSION, IMPLICATIONS, AND FURTHER WORK

7.1 INTRODUCTION

Using the commonly applied and supported model of technology adoption, the technology acceptance model or TAM (Davis 1989), as described in Chapter 3, this research examined the adoption or usage of IT for KM in Malaysian listed organisations. The research objective was to understand the organisational factors that could enhance the use of IT for KM, and the extent of the influence in a Malaysian listed organisations setting. The study set out to answer one major and two minor research questions as outlined in Chapter 3 (Research Problem and Framework). A research model and its associated hypotheses were proposed to answer the research questions and the model was tested to validate the hypotheses. The results of the study were presented in Chapter 5 (Data Analysis and Results). The discussion of the results and explanations for the findings were offered in Chapter 6 (Discussion). Subsequently, the aims of this chapter are to provide the conclusions of how the research questions were answered by the study, the discussion of the limitations of the study, as well as the study's implications for both research and practice. Finally, discussions of the directions for future research are also offered at the end of the chapter.

Figure 7-1 provides an overview of the sections presented in this chapter.

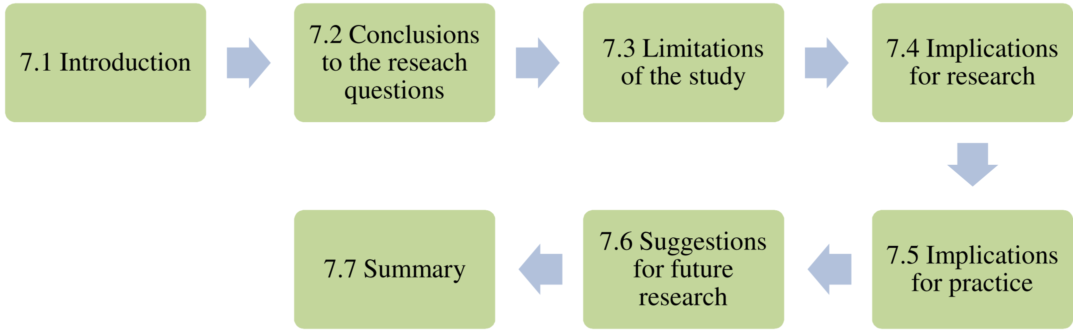


Figure 7-1 Overview of the sections in Chapter 7

The following section presents the conclusions to how the results of this study answer the research questions posed in this study, based on the findings presented in Chapter 5 (Data Analysis and Results).

7.2 CONCLUSION TO THE RESEARCH QUESTION

Based on the need to understand the organisational factors that could enhance the use of IT for KM in Malaysian organisations as identified in Chapter 3, the research major question was posed as follows:

Research Question: 'What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?'

The following research minor questions were developed to provide a focus for this study's investigation:

- Research minor question 1: what are the organisational factors that enhance the use of IT to support KM?
- Research minor question 2: how do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?

The conclusion to the first minor question of this research is presented in the section below. This is followed by a section discussing the conclusion to the research major and second minor questions, as both questions seek answers that are specifically within the context of Malaysian listed organisations.

The first minor question for the study was:

What are the organisational factors that enhance the use of IT to support KM?

The organisational factors that enhance the use of IT to support KM were identified through a synthesis of extant studies on the use of IT for KM, which included the studies of acceptance of IT-based systems to support KM or KM systems. The details of the synthesis process were described in section 3.5.2 of Chapter 3, (Research Problem and Framework). The synthesis indicates that the organisational factors that enhance the use of IT for KM can be grouped into five themes, and these are listed below, in the order of frequency of times cited in the literature reviewed:

i. management support and commitment for the use of IT for KM;

ii. rewards and incentives for using IT for KM;

iii. knowledge sharing culture;

iv. knowledge classification; and

v. institutionalisation of IT use into normal work practice.

Following further discussions of the themes, it was decided in the study that the institutionalisation of IT use into normal work practice can be operationalised and represented by the policies and procedures for IT use for KM.

In addition, a series of interviews conducted in a number of Malaysian listed organisations identified another organisational factor that could enhance the extent of IT use for KM, which is having appropriate KM processes to manage knowledge in an organisation. As a result, these six organisational factors were augmented in the research model as external variables, so that their impact on the use of IT to support KM in Malaysian listed organisations could be investigated.

Next, the research major question for the study was:

What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?

Additionally, the second minor question for the study was:

How do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?

The testing of the hypotheses formulated in the study contributes to answering the research major and second minor questions. The details of the hypotheses testing are provided in section 5.5 of Chapter 5, (Data Analysis and Results). Table 7-1 below provides a summary of the effects of the identified organisational factors on the extent of IT use for KM in Malaysian listed organisations.

Table 7-1 The organisational factors' effects on IT use for KM

Organisational factor	Effect on IT use for KM
Management support and commitment	Strong indirect positive effect
Rewards and incentives	No effect
Knowledge sharing culture	Medium direct positive effect
Knowledge classification	Medium direct positive effect
Policies and procedures for IT use for KM	Weak indirect effect
KM processes	Strong direct positive effect

In addition, it is also noted that the TAM construct of perceived benefits of using IT for KM had a moderate direct positive impact, while perceived ease of use of using IT for KM had no significant effect on the extent of IT use for KM in Malaysia.

Thus, based on the results of the study, it can be concluded that the organisational factors of KM processes, knowledge classification, and knowledge sharing culture were identified to exhibit strong to moderate direct positive effects on the extent of IT use to support KM in Malaysian listed organisations.

Further, the analysis of the direct, indirect, and total effects in Chapter 5 of this thesis indicates that, although there was no significant direct effect from management support and commitment, this organisational factor did however exhibit the largest total positive effect (indirect plus direct effects) on IT use for KM by means of its intermediate effects through other organisational factors, namely, the knowledge sharing culture and knowledge classification. Similarly, the effect of policies and procedures for using IT for KM on IT use for KM was only indirect and was mediated by the perceived ease of use and perceived benefits of using IT for KM.

Thus, it can also be concluded that the organisational factors of management support and commitment demonstrated strong indirect effect, while the policies and *procedures of using IT for KM demonstrated weak indirect effect on the extent of IT use for KM in the Malaysian listed organisations.*

Finally, the results of the study allowed a deduction that the organisational factor of rewards and incentives for using IT for KM did not have any significant effect on the extent of IT use to support KM in the Malaysian listed organisations.

In summary, the results of the hypotheses testing permitted the theoretical model proposed in Figure 4-3 of Chapter 4 of the thesis (Research Methodology and Design), to be refined and extended to that illustrated in Figure 7-2 below.

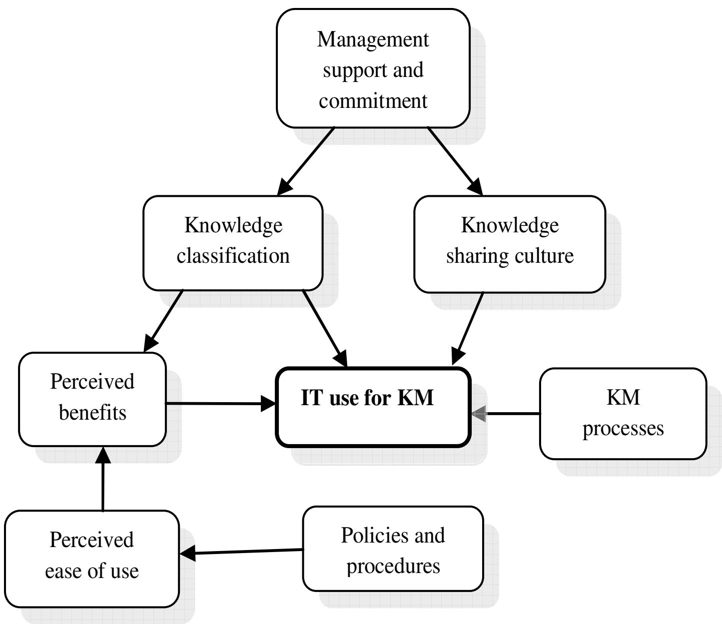


Figure 7-2 The final research model of the study

The final model of this study illustrates the need for organisational support to augment the use of IT for KM in Malaysian listed organisations. The evidence provided by the IT and KM practitioners who participated in this study indicates that the key to the adoption or use of IT for KM in Malaysian organisations draws on a range of related organisational factors that operate at all levels and functions within an organisation. The organisations must therefore examine these organisational issues before evaluating the adequacy of their IT-based systems and infrastructure, and making decisions on whether improvements in these areas are necessary to support their KM initiatives. The inference is that, in order to enhance the use of IT to support KM, these organisations must work on multiple fronts that include securing management support and commitment to promote a culture of sharing knowledge and improve the quality of knowledge with the objective of enhancing employees' perceptions of the benefit of using IT for KM, as well as establishing the appropriate KM processes to support the management of knowledge in the organisations.

Table 7-2 provides a summary of the conclusions to the research questions posed in this study.

Table 7-2 Conclusions to the research questions

Research question	Conclusion
Research minor question 1: what are the organisational factors that enhance the use of IT to support KM?	Based on a synthesis of the relevant literature and a series of interviews in a number of Malaysian listed organisations, the organisational factors that enhance the level of IT adoption or use to support KM are identified as following: i. management support and commitment for the use of IT for KM; ii. rewards and incentives for using IT for KM; iii. knowledge sharing culture; iv. knowledge classification; v. policies and procedures for the use of IT for KM; and vi. Appropriate KM processes to manage knowledge.
Research major question: What organisational factors enhance the level of IT adoption or use to support KM in Malaysian listed organisations?	Based on the results of the hypotheses testings, the organisational factors that enhance the level of IT adoption or use for KM in Malaysian listed organisations are: i. Appropriate KM processes to manage knowledge; ii. knowledge classification system; iii. knowledge sharing culture; iv. management support and commitment; and v. policies and procedures for IT use for KM.

Research question	Conclusion
Research minor question 2: How do the identified organisational factors influence the use of IT for KM in Malaysian listed organisations?	Based on the results of the hypotheses testings, the answers to this research minor question are as below: i. KM processes, knowledge classification, and knowledge sharing culture have strong to moderate direct positive influences on the level of IT adoption or use to support KM in Malaysian listed organisations. ii. Management support and commitment has a strong indirect positive influence on the extent of IT use for KM in Malaysian listed organisations through the mediation of knowledge classification and a knowledge sharing culture. iii. Policies and procedures for using IT for KM has a weak indirect positive influence on the extent of IT use for KM through the mediation of perceived ease of use and perceived benefits of using IT for KM.

This section provided the conclusions of this study based on the research's major and minor questions. By answering the research questions, the study has moved forward the body of knowledge about the use of IT for KM, specifically in understanding the organisational factors that enhance IT use for KM in Malaysian listed organisations. The next section discusses the limitations of the study.

7.3 LIMITATIONS

Prior to discussing the implications of the study's findings, certain limitations inherent in the study should be acknowledged. Due to the limited number of studies on IT use for KM or KM systems in Malaysia, the information available on the subject was garnered from studies in other countries. This might not reflect the actual situation in Malaysia due to the specific national environment and factors that might influence an individual's use of IT for KM (Zailani, Ong, and Shahnon 2006). However, the appropriateness and relevancy of the information garnered from studies in other countries were investigated in a series of preliminary interviews in Malaysian listed organisations as a measure to possibly overcome this limitation to a certain extent.

The next possible limitation to be considered is that, the study had utilised a cross-sectional survey across all industrial sectors of Malaysian listed organisations. The results on a broad-scale cross-sectional study may not be valid and generalisable to all industrial sectors. Despite this limitation, a measure was taken to counteract this by means of introducing the type of industry as a control variable in the model. The testings of the structural model did not indicate any significant association between the type of industry and the extent of IT use for KM. Thus, the results of the study are considered valid and are not biased by different industrial sectors.

Another possible limitation of the study is its utilisation of a single respondent for each organisation and its reliance upon self-reported usage. Thus, the potential concern is that there might be respondents' biases in the responses and views expressed in the survey. However, the individuals responding to the survey were IT and KM managers, and thus, they are expected to have specific organisational responsibility in their answers to the questions. Therefore, the organisational role of the respondents reduces the severity of concerns about the biases in respondents' views (Purvis, Sambamurthy, and Zmud 2001). Similarly, it is anticipated that the organisational responsibilities of the respondents could lower the potential common method variance (CMV) effect that responses obtained from perceptual anchored measures, such as the ones used in this study, are subjected to (Sharma, Yetton, and Crawford 2009). The use of behaviourally anchored or even systems-captured measurements is believed to significantly lower the CMV threat. Nevertheless, Sharma, Yetton, and Crawford (2009) indicate that the effect of CMV cannot be evaluated in individual studies, and that judgement regarding the validity of theories should be based on an evaluation of the cumulative empirical studies, rather than the findings of any individual study (Hunter and Schmidt 2004).

Further, the selection of the contextual variables in this study has rendered only variables of organisational factors were investigated in this study. Other external factors such as national IT plan and infrastructure, as well as environmental factors might have an effect on the adoption of IT for KM in the organisations studied. Thus, the factor composition of the model should not be regarded as exhaustive and further research on factors affecting user uptake of IT for KM as well as their relevance is required. Nevertheless, the high predictive ability of the model (R^2 = 0.66) allows for a higher probability that the level of IT use for KM can be strongly explained by the set of organisational factors identified.

Finally, since this research has been limited to the Malaysian organisations' context, the IT use for KM model developed may not apply to organisations in other countries. Moreover, the explanation of the results may not also be assumed to apply to other developing countries. Even though there are similarities in some cultural values of the Malaysian culture with other developing Asian countries, for example, one must not confidently assume that the results will be applicable to all developing countries. Thus, it may be inappropriate for the model to be used in its entirety for the purpose of examining the extent of IT use for KM in other countries.

This section has identified certain limitations of the study and the relevant measures that were taken to address and overcome these limitations where possible, in order to maximise the overall value of this research and its findings. The next section provides the implications of the findings for both research and practice.

7.4 IMPLICATIONS FOR RESEARCH

Despite the limitations mentioned in the previous section, the findings of this study have formed useful implications for research, in particular in the area of IT use for KM.

First and foremost, the current study has moved the body of knowledge forward by conducting an assessment of the applicability of TAM in the context of IT support for KM. The extension of TAM in this study entails that when TAM is applied to the context of IT use for KM, the perceived benefits, or usefulness, construct remains a determinant of IT use, although its influence is not as strong as in the general IS context (Vitari et al. 2007). In addition, the application of TAM in the IT use for KM context has produced a non-significant effect in the perceived ease of use construct on the level of IT use for KM. Nevertheless, the application of TAM in the context of IT use for KM in this study has shown that the perceived ease of use construct remained as a significant determinant of perceived benefits.

Given that other TAM constructs such as 'attitude' and 'intention' were discarded from the research model, the application of TAM in this study was helpful to the extent of explaining the effects of TAM's key independent variables of perceived benefits of using IT for KM and perceived ease of using IT for KM. The justification for the elimination of both ‘attitude’ and ‘intention’ constructs from the research model were already discussed in section 3.5.1 of Chapter 3 (Research Problem and Framework) in this thesis. Moreover, given the manner in which certain TAM constructs were discarded and other constructs of organisational factors were added to the research model, UTAUT could probably produce a slightly higher variance in IT use for KM, simply because UTAUT has the additional moderating variables of ‘gender’, ‘age’, ‘experience’ and ‘voluntariness of use’. Nevertheless, as the focus of this study in on the adoption of IT for KM by the Malaysian listed organisations, and not on the adoption of IT by individual persons, the effects from the moderating variables may not be relevant in this study.

Second, the extension of TAM by the augmentation of a number of organisational factors in this study also indicates that special considerations are needed for TAM applications in the IT use for KM domain. In essence, this study has demonstrated empirically that, apart from the perceived benefits of IT for KM, other organisational factor dimensions, namely, the appropriate KM processes, knowledge classification, and knowledge sharing culture, should be considered in order to improve the predictive power of TAM in explaining the extent of IT use for KM within an organisation.

Third, the demonstration of the application of TAM within a Malaysian context raised a legitimate question of whether the findings could be generalised to other countries. In other words, in what ways are the Malaysian listed organisations different from other organisations that the results could not be applied in other countries? This question suggests that a number of characteristics unique to a country, such as its culture, infrastructure, level of education, and the developing nature of its economy may need to be considered when applying the study’s research model in the context of other countries. Thus, arguably, the model of this study can conceivably be applied to countries having a similar background to Malaysia.

Finally, another important point to note is the fact that business operations and processes in large organisations, as the case of most of the Malaysian listed organisations in this study, may not be vastly different from any large organisations in other countries. Thus, this also indicates that the model could well be applicable to large organisations in another country. Obviously, this requires the testing of the model in other contexts or countries to ascertain how the results would differ or be comparable. Nevertheless, the study within the Malaysian context provides a useful extension of research on IT adoption for KM that can be a basis for future studies in other countries or contexts.

This section has discussed the research implications of this study. The next section provides discussions about the practical implications of this study.

7.5 IMPLICATIONS FOR PRACTICE

The findings of this study were presented in Chapter 5, (Data Analysis and Results), based on the analysis of data collected. The outcomes of the data analysis evidently have important implications for KM strategies in the organisations surveyed. The proposed research model was refined and the organisational factors that enhance IT use for KM within Malaysian listed organisations were confirmed. Thus, the refined model could assist the Malaysian organisations by providing a set of organisational factors that contributes to the adoption of IT to support KM. Collectively, the results of this study indicate the circumstances under which organisational measures to promote the use of IT to support KM activities may be more effective. These results offer suggestions to management on how to promote IT usage for KM as discussed in the sub-sections below.

7.5.1 Management support and commitment

The first implication for practice is that the influence of management support and commitment occurs through specific IT-use mediation actions rather than directly on IT use itself (Purvis, Sambamurthy, and Zmud 2001). The absence of a direct influence, however, does not suggest that the management in these organisations should ignore this organisational element. Considering the indirect effects of management support and commitment on the extent of IT use for KM, the implication for management is that, instead of focusing solely on the use of IT, management should focus on the efforts to establish a knowledge classification system and to cultivate a knowledge sharing culture in their organisations. Thus, the implications of these two organisational factors are discussed in detail in the following sections.

7.5.2 Knowledge classification

The results of this study have confirmed that having a knowledge classification that improves the quality of knowledge content enhances potential users' perceptions about the benefits of using IT to manage knowledge. This indicates that the relevance and appropriateness of knowledge needs to be made aligned with users' needs. The implication is that before deploying the necessary IT-based systems and infrastructure to support KM, it is essential that management take up initiatives to determine the most important and relevant knowledge that needs to be preserved, shared, and reused towards creating their organisation's competitive advantages. As knowledge creation and storage processes were reported as the least implemented KM processes in the organisations surveyed, it is thus important that the leadership focuses on efforts to identify the critical knowledge and how knowledge creation and storage can be embedded within the existing organisational processes, possibly with the help of available IT-based systems and infrastructure.

The next step is to design a taxonomy or classification of knowledge that is comprehensible to users, as well as covers enough details to be useful (Marwick 2001). The goal of creating knowledge taxonomies is to make it easier for users to deposit and search for knowledge. For example, organisational knowledge can be classified according to the various business functions within an organisation. Another way to classify knowledge is by aligning the layout of a KM system to the organisational structure, so that the knowledge taxonomy could readily map to the core functions in the organisational structure (Butler, Heavin, and O'Donovan 2007). In the case of project management, knowledge categories can be further broken down to the different time phases and processes within a project, such as knowledge on sales forecast, project planning, and project delivery.

Further, management could establish new roles and responsibilities, such as content experts or editors, who are responsible to monitor the quality and updates of knowledge according to the developed knowledge classification system. This is to ensure that IT can be used to provide useful knowledge that meets the demands of various business units or departments within an organisation.

Establishing a knowledge classification could be the most important strategy for management as it is also the major determinant of perceived benefits of using IT for KM, which consequently leads to the enhancement of the extent of IT use for KM. Compared with perceived ease of use, perceived benefits is clearly a more important influence on the use of IT for KM in these organisations. Thus, management could consider launching campaigns to demonstrate the features of IT-based systems and their benefits in supporting KM. When users are made aware of the features availability, they are more likely to discuss the advantages and disadvantages of using the KM system. Once users perceive that the advantages outweigh the disadvantages, they will be more likely to use the system.

7.5.3 Knowledge sharing culture

The positive effect of knowledge sharing culture in this study suggests that management should be aware that any IT deployment for KM will be relatively unsuccessful if it is not accompanied by an organisation-wide cultural change towards an appreciation of the value of knowledge (Moffett, McAdam, and Parkinson 2004). The implication for this is that the management could determine whether an appropriate knowledge sharing culture already exists in their organisations. In the absence of such, managers must give close attention to developing the proper knowledge sharing culture in parallel with the introduction of IT for KM. In other words, what needs to be addressed by the management is the question of how to stimulate a need to share knowledge among employees. It is only when this need exists that available technologies are likely to be used for knowledge sharing purposes (Huysman and Wit 2004). For example, the need to share knowledge could be achieved by promoting a strong teamwork within employees' workgroups. The management could then encourage the use of IT features to facilitate the social network within and among the workgroups. Thus, Malaysian organisations could work to attain a strong knowledge sharing culture that values an individual's experience and knowledge, and fosters the use of IT to share knowledge.

In addition, some of the general areas for improvement in relation to nurturing the appropriate knowledge sharing culture include having a few active and committed users, who could promote and effectively help to develop the necessary cultural values (Bals, Smolnik, and Riempp 2007). For example, management could identify community leaders who could promote the value of collaboration, caring, and support within their communities. The establishment of these key positions, which are responsible for the coordination of knowledge acquisition and sharing within the communities, could be the key drivers of a knowledge sharing culture. Besides encouraging and moderating the KM activities in their organisations, these new roles could also promote the use of IT by emphasising its potential benefits for KM.

Finally, regular communications about the benefits of knowledge sharing could also be undertaken by these organisations, as the lack of a defined communication about the benefits of knowledge sharing is regarded as a major limiting factor in the development of user acceptance of a technology (Bals, Smolnik, and Riempp 2007). Thus, the new identified roles could also, regularly, communicate and promote the results achieved from sharing and reusing knowledge activities in their organisations by providing positive feedback and sharing success stories achieved by their organisations.

7.5.4 KM processes

As indicated by the study's findings, having appropriate KM processes to manage knowledge in an organisation has the largest direct positive influence on IT use for KM. Therefore, the management in the studied organisations could look into reviewing their organisational KM processes to identify the knowledge users and the type of knowledge that need to be captured and reused by these users. Focus should be given more on developing the required knowledge creation and storage processes, as these processes were identified as the least implemented KM processes in these organisations.

Next, the management could look into the ways of how IT can be developed to support the flow of this identified knowledge from its creation, to storage, to transfer, and eventually to the application of the knowledge. In other words, the management could undertake efforts to determine how activities to manage knowledge can be embedded within the organisational processes, conceivably with the help of the available IT tools and infrastructure.

7.5.5 Implications from non-significant findings

Of equal importance is the insight that can be drawn from the non-significant findings of this study. For example, rewards and incentives were found to have no significant effect on IT use for KM. The implication is that the management could attempt to provide more intrinsic (non-monetary) rewards rather than relying on extrinsic (monetary) rewards to encourage the use of IT to support KM in their organisations. Intrinsic rewards for using IT for KM can be in the form of personal recognition from direct supervisors and peers, as well as in the improvement of employees' daily tasks and learning processes (Huysman and Wit 2004).

Alternatively, instead of establishing a reward system, management could as well focus their efforts on nurturing a knowledge sharing culture in their organisations. Research suggests that organisations with a well-established knowledge sharing culture did not have to utilise monetary incentives and rewards, as sharing knowledge has naturally become part of their organisational culture (Butler, Heavin, and O'Donovan 2007). Therefore, these organisations did not perceive the importance of offering monetary rewards or incentives to induce knowledge sharing among their employees.

Next, the management in the organisations surveyed could also look into creating the appropriate policies and procedures of using IT for KM. As indicated by the study's findings, policies and procedures on the use of IT for KM led to individuals' perceived ease of use, which had in turn led to improved perceptions on the benefits of using IT for KM, and consequently motivated individuals' use of IT to support KM. Accordingly, the management could take up necessary efforts to ensure that the policies and procedures are established with the objective being to facilitate the use of IT to manage knowledge, rather than to make the use of IT mandatory.

7.5.6 IT use for knowledge application

In addition to the implications of the effects of organisational factors on the extent of IT use for KM, the descriptive analysis of the IT use for KM construct, which represents the current state of the IT adoption for KM in Malaysian listed organisations, also holds an important implication for the management in these organisations. Given the broad picture of the level of IT use for KM across the Malaysian industries, the management in these organisations could then identify the KM areas that are not adequately facilitated by IT use, and could thus take the necessary measures to improve the level of IT support in these areas. In particular, the findings of the study have specifically pointed out that IT use to support the application of knowledge was still considerably low in these organisations. Thus, the management could endeavour to adopt more IT-based systems to support the reuse, leverage, and exploitation of their organisational knowledge with the objectives being to, among others, solve new problems, adjust strategic directions, make more informed decisions, as well as improve organisational efficiency.

In conclusion, this section outlined several important implications for the management with respect to IT use for KM. Considering the number of recommendations made in this section, it is important that the management prioritise these initiatives based on how critical they are for their organisations. For instance, these recommendations could be prioritised according to their impact on the extent of IT use for KM and their benefits for the organisations. Thus, in order of priority, the management could begin by focussing on efforts to develop a knowledge classification system first, as the study indicates that although the influence of the knowledge classification factor was the second highest on IT use for KM, the establishment of this factor was still considerably low in the organisations. Hence, in order to develop an effective knowledge classification system, the management could start by taking up initiatives to determine the type of knowledge that needs to be preserved, shared, and reused for their organisations' competitive advantages.

Having developed the classification of knowledge, efforts can then be focused on establishing KM processes to support the creation and storing of knowledge. As indicated by the results of the study, having these KM processes has the largest direct positive influence on IT use for KM. Thus, with the knowledge classification in place, the next priority is to establish the appropriate KM processes, with emphasis on the knowledge creation and storage processes, as these processes were identified at the least implemented KM processes in these organisations.

By focusing on the weak organisational factors that have high impact on the extent of IT use for KM, this serves as a solid starting point for the management to prioritise their commitment and effort in order to enhance their utilisation of IT to support their KM initiatives. The next section presents the suggestions for future research.

7.6 FUTURE WORK

The discussed limitations and implications in the previous sections have singled out several avenues for future research. For example, future research can extend the study's refined model to account for the remaining unexplained variance in IT usage for KM by the organisations. Given that the results of this study show that the refined model can explain up to 66% of the variance in IT use for KM, further studies can be carried out to validate and improve this model by incorporating additional external variables to suit IT adoption for KM study.

For instance, factors such as organisational structure were not included in this study due to research has reported a low support for this construct (Vitari et al. 2007), as well as the difficulty of measuring the construct as discussed in section 3.5.2 of Chapter 3 in this thesis. Nevertheless, Xu and Quaddus (2007) suggest that the flexibility or the rigidity of an organisational structure is likely to have an influence on the use of a KM system, indicating that this organisational factor could be worthy of further investigation.

In addition, other theory-based constructs, such as those from the task-technology fit model (Goodhue and Thompson 1995), the social cognitive theory (Compeau, Higgins, and Huff 1999), and perceived power security (Markus 1983) can also be incorporated into the model, conceivably to further help in explaining the extent of IT use for KM. Moreover, since this study is specific to a national context, a factor that may be worthwhile to be included in future studies could be the influence from the government on the adoption of IT to support KM.

Further, the lack of significant association between perceived ease of use and IT use for KM indicates that this relationship is worthy of further investigation. One possible influencing factor in relation to perceived ease of use is the fit between user tasks and the tools provided to accomplish the tasks. Thus, future research could also look into how the task and tool fit influences perceived ease of use and consequently enhances the extent of IT use for KM.

With regards to the survey instrument of the research, future work could include the use of both subjective and objective measures for the research variables, as self-reported scale measures introduce the possibility of method bias as indicated in the limitations section. As the survey respondents in this study were users from managerial levels, future research could also be interested in obtaining data from the general user level. Data obtained from this level of employees would be worth further investigation, especially to further validate the effect of rewards and incentives mechanisms on the extent of IT use for KM from their point of view.

This study has provided broad and generalisable results about the adoption of IT for KM within Malaysian listed organisations by utilising a cross-sectional analysis to empirically test the model's underlying relationships and hypotheses. However, more studies can be carried out to gain a substantial and more complete picture of IT adoption for KM within Malaysian organisations. Thus, it is recommended that intensive case studies or in-depth interviews be employed to find more in-depth causes and effects.

Finally, future research could also focus on longitudinal investigations involving samples from different countries or of different characteristics. Similarly, independent investigations may also be carried out for different organisation types or within a specific type of industry. This could determine the appropriateness of the model in other different contexts.

7.7 SUMMARY

As the need to manage knowledge effectively becomes more important in Malaysian organisations, it is of paramount importance that these organisations manage their knowledge effectively by identifying the factors that could enhance their extent of IT adoption to support their KM initiatives. This study focused on the use of IT for KM as they are the fundamental enablers of Malaysian organisations' KM initiatives, yet the factors affecting their use for KM are not well understood.

This chapter began with a review of the research questions, presented in Chapter 3, (Research Problem and Framework), to determine whether the study had provided answers to the questions. The review concluded that the research major and minor questions were sufficiently addressed and answered by the study. Next, the limitations of the study were highlighted and discussed. Relevant measures were taken, wherever possible, so as to mitigate the impact of these limitations to a certain extent. Notwithstanding these limitations, this study has formed several important implications to both research and practice as discussed in the implication section. Finally, the last section of this chapter made several suggestions for the avenues of future research as singled out by the limitations and implications of this study.

In conclusion, this research has moved the body of knowledge forward by providing an understanding of the way in which IT should be implemented to support KM in the Malaysian listed organisations. Based on an extension of the TAM, this research has identified three direct and two indirect determinants of organisational factors for the use of IT for KM. An understanding of the organisational factors enhancing the extent of IT use for KM provides a guideline for the Malaysian organisations in developing better KM and IT strategies in order to promote and encourage the use of IT to support the organisations' KM initiatives.

By focussing beyond the deployment of IT, this research has responded to the call of prior studies that suggest the exploration and examination of the influence of organisational factors on the extent of IT use to support KM and thus, addressed the scarcity of studies on IT use for KM, particularly in the Malaysian context. Additionally, in terms of its original theoretical contributions, this study has demonstrated that the application of TAM in the context of IT use for KM should consider the integration of the organisational factors identified, in order to enhance the model's predictive capability. Further, the study within the Malaysian context has provided a useful extension of research on IT adoption for KM that can be a basis for studies of organisations in other countries or of different characteristics.

In terms of practical contribution, on top of specific implications for each of the organisational factors investigated, this study has provided recommendations on how the management could prioritise their commitments and efforts in order to enhance their utilisation of IT to support their KM initiatives. This study emphasised that it is fundamental for Malaysian organisations to firstly identify the type of knowledge that needs to be created, preserved, shared, and reused in order to attain their strategic benefits. Having determined this critical knowledge, efforts can then be focused on establishing the appropriate KM processes to support the creation and preservation of the knowledge.

Equipped with a better understanding of the issues surrounding the extent of IT use for KM, the management in Malaysian listed organisations could therefore undertake the necessary steps to foster IT use for KM which would help to bridge the gap between the perceived importance of IT for KM and the actual IT usage for KM. These initiatives could help strengthen the foundation for the transformation of the nation into a knowledge-based economy and accelerate economic growth. Moreover, enhancing the level of IT use for KM could well be an effort to improve the declining rate of Malaysian knowledge generation organisations and, thus, drive the country's national innovation agenda back to its desired level of progress.

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Appendix A: Interview request email

[Date]
[Correspondent]
[Position]
[Address1]
[Address2]
[Address3]

Dear Sir/Madam,

Re: Research on the use of IT for KM in Malaysian organisations.

I am a PhD candidate at the school of Information Systems, Curtin University of Technology, Western Australia undertaking research on the use of information technology (IT) to support knowledge management (KM) in Malaysian organisations.

The perspective of your organisation on issues affecting IT use for KM in Malaysia will not only benefit the industry but would also provide an opportunity for stakeholders to benefit from understanding the issues involved in managing IT or system-oriented KM, as well as provide a sufficient guide for the implementation of the industries' KM strategies for a higher chance of successful KM. Previous studies on KM in the Malaysian context indicate that KM is a key factor in achieving organisational success and is particularly important in view of the nation's shift to a knowledge economy as envisaged by Malaysia's K-Economy Master Plan 2003. In addition, the Economic Planning Unit of Prime Minister's Department, Malaysia has also approved this research to be conducted in Malaysia *(UPE: 40/200/19/2321).*

As part of my research, I would like to conduct preliminary interviews with IT Managers in a few key Malaysian listed organisations with the objectives to explore the current scenario of KM in Malaysia and investigate the appropriateness and relevancy of certain organisational factors for IT use in the context of the organisations' KM. The role of the interviews is to collect preliminary data only, as a major phase of data collection will follow later. The interview will take approximately 40 minutes.

The data collected from this study will be presented in aggregate form together with results gathered from other organisations whereby the confidentiality of all organisations and participants will be assured at all times. No identifying information will be presented in the thesis and publications emanating from it. Thus, no one apart from my supervisors and I will have access to any confidential information gathered. A copy of the proposed interview questions is attached for your perusal.

As a token of appreciation for your participation, you will receive an approved final report of the research undertaken. If you have any further queries please do not hesitate to contact me either by email: fadhilah.aman@postgrad.curtin.edu.au or telephone +614 49193177(mobile). I look forward to receiving a positive response from you soon.

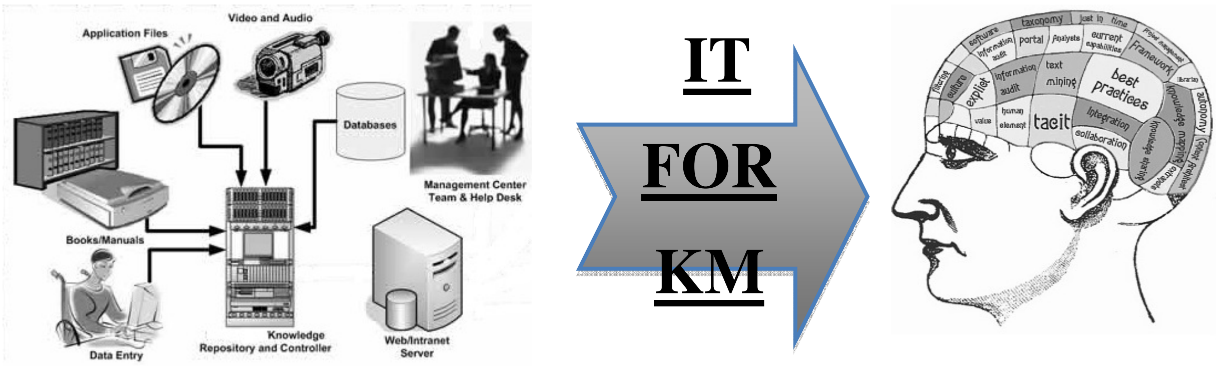
Thank you and best regards.

Yours faithfully,
Fadhilah Aman
PhD Candidate
School of Information Systems, Curtin University of Technology,
Perth, Western Australia.

This research is being overseen and guided by Dr. Ashley Aitken, and approved by the Curtin University Human Research Ethics Committee (IS-08_15). If needed, verification of approval can be obtained by writing to the Curtin University Human Research Ethics Committee c/o, Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth 6845, or telephone +618 9266 2784 ,or email hrec@curtin.edu.au

Appendix B: Interview protocol

Information Technology Use for Knowledge Management



Definitions of some key terms

Knowledge – from the information systems perspective, is defined as 'justified personal belief that increases an individual's capability to take effective action' (Alavi and Leidner 1999b, p. 5). Knowledge in the organisation includes encoded knowledge, habitual knowledge, scientific knowledge, collaboration knowledge, process knowledge and communal knowledge. Knowledge can take many forms, for example, knowledge can be located in people's heads, in an electronic form, or in a physical document.

Table 1 Examples of 'knowledge' and 'information' in an organisation

Examples of Knowledge	Examples of Information
Best practices	Test reports
Work processes/practices	Operation reports
Lessons learned	Sales reports
Design rules	Market reports
Solutions to problems	Financial reports
Common sense	
Good judgment	
Intuition	
Know-how	
Expertise	

Knowledge management—is defined as the systematic and organised effort to acquire, organise, and communicate knowledge in ways that employees may make use of it to be more effective and productive.

Knowledge management activities—are defined as the activities that allow organisations to manage knowledge (e.g. on-the-job training, brainstorming, online forum discussion, learning from observation, etc).

Knowledge creation—is defined as the generation of knowledge either by individuals or groups in an organisation, and also the acquisition of knowledge from external sources such as customers, suppliers, competitors and the business markets.

Knowledge storage—is defined as the recording of knowledge in a medium from which it can later be accessed by individuals or groups in an organisation.

Knowledge transfer—is defined as the sharing, transferring, disseminating, deploying, and diffusing knowledge between individuals, groups, or organisations.

Knowledge application—is defined as employees' exploitation of individual and organisational knowledge, which has been created, stored and shared/transferred, which creates value to the organisation.

Section 1: Stage of Knowledge Management Implementation	
The following questions seek to gain an understanding of the organisation's KM implementation stage.	
1) Does your organisation have a formal KM programme?	
2) If yes, how long has your formal KM programme existed? Number of years	
3) If yes, is your KM programme: - Organisation wide (centrally managed or coordinated)? - Located within a division or business unit or department only? - Other (please specify)?	

4) In your organisation, who is primarily responsible for the KM programme? - CEO or President? - Chief Operations Officer or Operations Department? - Chief Information Officer or Information Technology Manager? - CKO or KM Champion or Leader? - Head of Business or Functional Unit such as operations, HR, OD, training? - Other?	
5) In your organisation the nature of KM efforts are often more - Systematic (formal, well organised)? - Ad hoc?	
6) Can you describe the knowledge management activities that are currently employed in your organisation as part of your KM programme? (E.g. communities of practice, best practice transfer, lesson learned process, collaboration process, knowledge retention process, etc.)	

Section 2: Information Technology Role in Knowledge Management	
The following questions seek to gain an understanding of the role of IT in the organisation's KM.	
7) Can you describe your IT department's strategy, if any, in supporting KM in your organisation?	
8) Can you describe the role of IT in your organisation's KM programme?	
9) Can you indicate the IT-based tools and applications currently employed to support KM activities in your organisation? Knowledge Management Systems (e.g. online forums, content management system, or CMS, knowledge maps, etc. with purpose to find knowledge across organisation) Expertise Locator Systems (e.g. pointers to experts, skills 'yellow pages', etc. which allow users to search for experts across organisation) Collaboration Systems (e.g. collaboration software, groupware, email, IM, videoconferencing, etc. with purpose to support collaboration in teams and communities of practice) Workflow Systems (e.g. workflow management software, process modelling tools, etc. with purpose to automate business processes) Expert Systems (e.g. case-based reasoning applications, help desk applications, customer service applications) Intelligent agents (e.g. business intelligence applications, customer relationship management applications) Computer-based Training (e.g. online training) Others?	

Section 3: Organisational factors influencing the use of IT for KM	
The following questions seek to gain an understanding of the importance of a number of identified organisational factors on the extent of IT use for KM in the organisation.	
10) How important do you think **management's support and commitment** is in determining the extent of IT use for KM in your organisation? (This can be seen in management's endorsement of the use of IT for KM by allocating sufficient funds for IT to support KM, encouraging employees to use IT for KM, etc.)	Not important / Less important / Important / Very important 1 / 2 / 3 / 4
11) In your opinion, how important is offering **rewards and incentives** to encourage the use of IT to contribute, share, transfer, and apply knowledge in your organisation?	Not important / Less important / Important / Very important 1 / 2 / 3 / 4
12) In your opinion, how important is a **knowledge sharing culture** in motivating the use of IT to support KM activities in your organisation?	Not important / Less important / Important / Very important 1 / 2 / 3 / 4
13) How important do you think having a **knowledge classification system** that allows the categorisation of knowledge and specifies suitable formats of knowledge representation on the extent of IT use for KM in your organisation?	Not important / Less important / Important / Very important 1 / 2 / 3 / 4
14) In your opinion, how important are **policies, procedures and guidelines** to facilitate and encourage IT use in supporting KM activities in your organisation?	Not important / Less important / Important / Very important 1 / 2 / 3 / 4
15) In your opinion, what **other factors** could enhance the use of IT with regards to your organisation's KM programmes?	

General Section	
16) Thinking about your entire KM programme, what do you see as the key operational practices or management techniques that contribute to the use of IT tools and applications to support KM in your organisation, if any? Please list the top three	
17) Are there any other comments you would like to make in regards to the matters raised in this interview?	

Thank You!

Thank you for taking the time to participate in this interview. I will keep you informed of the progress and, as promised, provide your organisation with a copy of the approved final report of the research.

Further Information

If you have any further information or would like to discuss any matter further with me, please do not hesitate to contact me at:

Ms. Fadhilah Aman
Phone +618 9458 7418
Mobile +614 4919 3177
Email fadhilah.aman@postgrad.curtin.edu.au

Appendix C: Survey invitation email

Dear [FIRST_NAME] [LAST_NAME],

Introduction: My name is Fadhilah Aman and I am a PhD candidate at the Department of Information Systems, Curtin University of Technology undertaking research on the use of Information Technology (IT) for Knowledge Management (KM) in Malaysian organisations. I would appreciate it if you could take part in this voluntary, anonymous, and confidential online survey requiring the opinion from an IT or KM manager in your organisation.

Importance and Purpose of Research: This research is approved and supported by the Economic Planning Unit of the Prime Minister's Department, Malaysia (UPE: 40/200/19/2321 - contact person Ms. Munirah). Your opinion is very important for this research to further the understanding of the use of IT for KM in Malaysian organisations, and to provide a sufficient guide in implementing KM strategies that could enhance organisations' potential in achieving a knowledge-based economy with the aid of IT. Currently little is known about the subject, so you are encouraged to take part and be as accurate as you can in your answers. This research is part of a doctoral research project and the results will be reported in managerial and academic journals, and as a doctoral thesis.

Confidentiality: This research is being conducted in accordance with Curtin University of Technology's Code of Conduct and your responses will be reported in aggregate form only and will not be identifiable with you personally, or with your organisation. The survey contains no personal details so you cannot be identified from them.

Respondent's responsibilities: The online survey has three sections, with 11 main questions in the first section, 4 main questions in the second section, and 2 main questions in the last section. Most questions are multiple-choice and it should take about 20-25 minutes to answer all of them. We know that people respond more accurately to questionnaires when they think carefully about their answers, search their memory, and take time in answering, therefore please do so when answering the questions in this survey.

Token of appreciation: Your assistance in providing the information required by the survey is greatly appreciated and as a token of appreciation, those who had participated and completed the survey will receive an approved final report of the research when the doctoral thesis is completed. *There is a section at the end of the survey where you can leave your email address.*

Questions or Comments: If you have any queries or comments regarding this research please contact Ms. Fadhilah Aman by email (fadhilah.aman@postgrad.curtin.edu.au) or call +614 4919 3177 (mobile).

Please click on the link below to take the survey:

<SURVEY_LINK>

Thank you for agreeing to take part in this survey and your assistance is greatly appreciated.

Yours faithfully,

Fadhilah Aman
PhD Candidate
School of Information Systems
Curtin University of Technology, Perth, Australia.

This research is being overseen and guided by Dr. Ashley Aitken, and approved by the Curtin University Human Research Ethics Committee (IS-08_15). If needed, verification of approval can be obtained by writing to the Curtin University Human Research Ethics Committee c/o, Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth 6845, or telephone +618 9266 2784 ,or email hrec@curtin.edu.au.

Appendix D: Information and consent form for the interview

Curtin
University of Technology

This study is being conducted by Fadhilah Aman, a PhD candidate at the Department of Information Systems, Curtin University of Technology, Australia. The purpose of this study is to investigate the factors influencing the use of IT for KM in Malaysian listed organisations.

You can help in this study by consenting to participate in a preliminary interview. It is anticipated that the time to complete the interview will be no more than 60 minutes. Contained in the interview are questions about your perceived opinions on the current KM practices and issues that affect the use of IT use for KM in your organisation.

With your permission, the interview shall be recorded to assist with transcription of your responses. No questions of a personal nature will be asked, and no personal identifying data of yourself as the participant or identifying data of the organisation to which you are affiliated to will be made in the research report and publications emanating from it. You are free to withdraw consent and to discontinue participation in the interview at any time.

It is anticipated that the full study will be completed by the end of October 2010 and access to a summary of the study should be available in November 2010. You will be contacted and provided with this summary as soon as it is available.

This research is being overseen and guided by Dr. Ashley Aitken, as the research supervisor, and approved by the Curtin University Human Research Ethics Committee (IS-08_15). If needed, verification of approval can be obtained by writing to the Curtin University Human Research Ethics Committee c/o, Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth 6845, or telephone +618 9266 2784 ,or email hrec@curtin.edu.au.

Your cooperation and generosity in participating in this study is highly valued and appreciated.

Thank you,

Fadhilah Aman

I, the participant have read and understood the information contained in this 'Information and Consent Form' and have had all questions pertaining to this study answered to my satisfaction. I hereby agree to participate in this study, realising that I may withdraw at any time. I also agree that information and research data gathered for this study will be used in the analysis of organisational factors for IT use for KM in Malaysian listed organisations, and will be used in aggregate statistics. No personal identifying data of myself as the participant or identifying data of the organisation to which I am affiliated to will be made in the research report.

______________________________ Date: ________________

Participant or authorised representative

______________________________ Date: ________________

Researcher: Fadhilah Aman

Appendix E: Ethics clearance form

MINUTE

Curtin
UNIVERSITY OF TECHNOLOGY

To	Fadhilah Aman
From	Francesca Vallini
Subject	Protocol Approval IS_08_15
Date	27 October 2008
Copy	

School of Information Systems

Human Research Ethics Committee

TELEPHONE 9266 7027
FACSIMILE 9266 7348
EMAIL
Francesca.Vallini@curtin.edu.au

Dear Fadhilah

Thank you for your "Form C Application for Approval of Research with Minimal Risk (Ethical Requirements)" for the project titled **"ON THE EFFECTIVE USE OF INFORMATION TECHNOLOGY FOR KNOWLEDGE MANAGEMENT IN MALAYSIAN PUBLICLY-LISTED ORGANISATIONS"**. On behalf of the Human Research Ethics Committee I am authorised to inform you that the project is approved.

Approval of this project is for a period of 12 months from **24.10.08** to **24.10.09**.

If at any time during the twelve months changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately. The approval number for your project is **IS_08_15**. *Please quote this number in any future correspondence.*

Please find attached your protocol details together with the application form/cover sheet.

F. Vallini

Francesca Vallini
Coordinator for Human Research Ethics
School of Information Systems

This study has been approved by the Curtin University Human Research Ethics Committee. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.

Appendix F: Survey questionnaire

2%

General Instruction

Please answer the questions to the best of your knowledge. Most of the questions require your view or opinion measured on a five-point scale.

Definitions of some Key Terms

For the purpose of this survey, respondents should apply the following definitions:

1. *Knowledge* is defined as "justified personal belief that increases an individual's capability to take effective action". Knowledge in an organisation can take many forms; for example, knowledge can be located in people's heads, in an electronic form, or in a physical document.

Examples of knowledge in the organisation include (but are not limited to) best practices, work processes, lessons learned, design rules, solutions to problems, common sense, good judgment, intuition, know-how, and expertise.

Note: Items such as company reports, for example, test/operation/sales/market/financial reports, are considered as 'information' and not 'knowledge'.

2. *Knowledge Management (KM)* is defined as the systematic and organised effort to acquire, organise, and communicate knowledge in ways that employees may make use of it to be more effective and productive.

3. *Knowledge Management Activities* are defined as activities that allow organisations to manage knowledge (e.g. on-the-job training, brainstorming session, online forum discussion, presentation of lessons learned from completed projects, etc).

Please start with the survey now by clicking on the Continue button below.

Continue

Please contact fadhilah.aman@postgrad.curtin.edu.au if you have any questions regarding this survey.

Section 1: IT use for KM and various organisational factors

The statements in this section seek to measure the extent of Information Technology (IT) use and the various factors of IT use for Knowledge Management (KM) in your organisation. Please read each statement carefully, and then indicate the extent to which you agree or disagree with the statement by clicking on one of the circles.

1. The use of IT for knowledge creation

In my organisation,

	Strongly Disagree	2	3	4	Strongly Agree
IT-based systems are used to acquire knowledge about new product/services within our industry.	○	○	○	○	○
IT-based systems are used to acquire knowledge about competitors within our industry.	○	○	○	○	○
IT-based systems (e.g. chat groups, online discussion forums) are used to integrate different sources and types of knowledge.	○	○	○	○	○

2. The use of IT for knowledge storage

In my organisation,

	Strongly Disagree	2	3	4	Strongly Agree
IT-based systems (e.g. knowledge repository, document management system) are used to store individual and organisational knowledge.	○	○	○	○	○
IT-based systems (e.g. collaboration software) are used to store knowledge obtained from collaboration of teams.	○	○	○	○	○
IT-based systems (e.g. knowledge database) are used to store lessons learned from completed projects.	○	○	○	○	○
IT-based systems (e.g. product design databases) are used to store knowledge of the design of products.	○	○	○	○	○

3. The use of IT for knowledge transfer

In my organisation,

	Strongly Disagree	2	3	4	Strongly Agree
IT-based systems (e.g. web portals, intranets, online forums) are used to share knowledge throughout the organisation.	○	○	○	○	○
IT-based systems (e.g. document management systems, online expert communities) are used to transfer organisational knowledge between individuals.	○	○	○	○	○
IT-based systems (e.g. electronic meeting software, video conferencing) are used to allow people in multiple locations to learn as a group from a single source.	○	○	○	○	○

Continue

Please contact fadhilah.aman@postgrad.curtin.edu.au if you have any questions regarding this survey.

4. The use of IT for knowledge application

In my organisation,

	Strongly Disagree	2	3	4	Strongly Agree
IT-based systems (e.g. help desk systems, troubleshooting systems, expert systems) are used to apply knowledge in solving new problems.	○	○	○	○	○
IT-based systems (e.g. experts locator systems) are used to match sources of knowledge with problems and challenges.	○	○	○	○	○
IT-based systems (e.g. simulation and modelling tools) are used to apply knowledge in development of new products/services.	○	○	○	○	○
IT-based systems (e.g. business intelligence, competitive intelligence tools) are used to generate new opportunities with our partners.	○	○	○	○	○

5. Knowledge classification in the organisation

	Strongly Disagree	2	3	4	Strongly Agree
Management in my organisation has taken measures to determine the type of knowledge that we need.	○	○	○	○	○
My organisation has a taxonomy or classification system for knowledge.	○	○	○	○	○
Management in my organisation uses a clear distinction between knowledge (e.g. best practices, lessons learned) and information (e.g. operations/sales reports)	○	○	○	○	○

6. Perceived benefits of using IT for knowledge management

In my organisation ...

	Strongly Disagree	2	3	4	Strongly Agree
IT enables knowledge to be shared easily to improve job performance.	○	○	○	○	○
IT enables efficient collaboration between people from different departments to improve productivity.	○	○	○	○	○
IT enables effective searches of system, database, or individual having specific knowledge.	○	○	○	○	○
Knowledge networks (e.g. groupware, intranet, virtual communities) enable efficient exchange of knowledge among employees.	○	○	○	○	○

7. Perceived ease of use of IT for knowledge management

	Strongly Disagree	2	3	4	Strongly Agree	N/A
It is easy to deposit knowledge into the knowledge database.	○	○	○	○	○	○
It is easy to obtain the relevant knowledge by using IT.	○	○	○	○	○	○
It is easy to use IT to manage knowledge using the procedure and/or guidelines provided.	○	○	○	○	○	○

Continue

Please contact fadhilah.aman@postgrad.curtin.edu.au if you have any questions regarding this survey.

8. Knowledge sharing culture

	Strongly Disagree	2	3	4	Strongly Agree
People within my organisation value an individual's experience and knowledge for organisation's success.					
My organisation has systematic means of sharing knowledge to make decisions.					
It is a normal practice in my organisation to use IT to expedite knowledge sharing.					

	Strongly Disagree	2	3	4	Strongly Agree	N/A
People within my organisation value and encourage contributions made to the knowledge database.						

9. Policies and procedures on the use of IT for knowledge management

	Strongly Disagree	2	3	4	Strongly Agree
My organisation provides procedures and/or guidelines to facilitate the use of IT to manage knowledge.					

	Strongly Disagree	2	3	4	Strongly Agree	N/A
My organisation has clear policies for IT use in contributing knowledge to the knowledge database.						
My organisation has clear policies for IT use in accessing knowledge in the knowledge database.						

10. Rewards and incentives for knowledge management

Management in my organisation ...

	Strongly Disagree	2	3	4	Strongly Agree
provides a standardised reward system to induce knowledge sharing.					
provides incentives that encourage the use of IT to share knowledge with others.					
provides incentives for those who use IT to collaborate with others from different departments.					
rates performance base on employee's contribution and sharing of knowledge with others.					

11. Management support and commitment

The management in my organisation...

	Strongly Disagree	2	3	4	Strongly Agree
clearly communicates the importance of using IT to support knowledge management activities.					
allocates dedicated personnel to lead the use of IT in managing knowledge.					
allocates sufficient funds and resources to support IT infrastructure for knowledge management.					
provides adequate training for employees to use IT in managing knowledge effectively.					

Section 2: Organisational Knowledge Management Processes

The statements in this section seek to measure the extent of knowledge management (KM) processes in your organisation. Please read each statement carefully, and then indicate the extent to which you agree or disagree by clicking one of the circles in each row.

1. Knowledge creation

My organisation has ...

	Strongly Disagree	2	3	4	Strongly Agree
processes for inter-organisational collaboration	○	○	○	○	○
processes for combining existing knowledge into new knowledge	○	○	○	○	○
processes for acquiring knowledge about new products/services within our industry	○	○	○	○	○
processes for benchmarking organisational performance	○	○	○	○	○

2. Knowledge storage

My organisation has ...

	Strongly Disagree	2	3	4	Strongly Agree
processes for organising knowledge	○	○	○	○	○
processes for replacing outdated knowledge	○	○	○	○	○
processes for filtering the right and relevant knowledge	○	○	○	○	○
processes for recording knowledge in a medium from which it can later be retrieved by employees	○	○	○	○	○

3. Knowledge transfer

In my organisation the following processes are engaged to share knowledge:

	Strongly Disagree	2	3	4	Strongly Agree
On-the-job training	○	○	○	○	○
Face-to-face meetings	○	○	○	○	○
Brainstorming retreats or camps	○	○	○	○	○
Cooperative projects across departments	○	○	○	○	○

Continue

Please contact fadhilah.aman@postgrad.curtin.edu.au if you have any questions regarding this survey.

4. Knowledge application

My organisation ...

	Strongly Disagree	2	3	4	Strongly Agree
uses shared knowledge to improve efficiency	○	○	○	○	○
ensures effective interpretation and application of knowledge	○	○	○	○	○
quickly links sources of knowledge in solving problems	○	○	○	○	○
has processes for applying knowledge in development of new products/services	○	○	○	○	○

Section 3: Demographics

Organisation Size

Please indicate your organisation size by selecting the total number of employee in your organisation.*

- ○ Less than 50 employees
- ○ 50 - 100 employees
- ○ 101 - 500 employees
- ○ More than 500 employees

Type of industry

Please indicate your organisation's type of industry.*

- ○ Manufacturing
- ○ IT services
- ○ Financial services
- ○ Business related services
- ○ Telecommunications
- ○ Agriculture
- ○ Construction
- ○ Oil & gas
- ○ Property development & real estate
- ○ Transportation & logistics
- ○ Infrastructure & utilities
- ○ Other

Please indicate your job title/position in your organisation.

Are there any other comments you would like to make in regards to the matters raised in this survey?

Note: Please leave an email address below if you would like a copy of the research report be sent to you. Thank you.

Submit

Appendix G: Descriptive statistics of all indicators

	N	Minimum	Maximum	Mean	Std. Deviation
IT_KC01	168	1.00	5.00	3.9520	.95283
IT_KC02	168	1.00	5.00	3.5927	1.07311
IT_KC03	168	1.00	5.00	3.3274	1.11332
IT_KS01	168	1.00	5.00	3.8690	.93219
IT_KS02	168	1.00	5.00	3.4762	1.06637
IT_KS03	168	1.00	5.00	3.3512	1.17427
IT_KS04	168	1.00	5.00	3.5807	1.06849
IT_KT01	168	1.00	5.00	3.9286	1.06984
IT_KT02	168	1.00	5.00	3.5536	1.07089
IT_KT03	168	1.00	5.00	3.4167	1.24013
IT_KA01	168	1.00	5.00	3.4762	1.11039
IT_KA02	168	1.00	5.00	2.9699	1.17063
IT_KA03	168	1.00	5.00	3.2500	1.18246
IT_KA04	168	1.00	5.00	3.1983	1.08458
K_Cls01	168	1.00	5.00	3.3988	.96116
K_Cls02	168	1.00	5.00	2.8631	1.02031
K_Cls03	168	1.00	5.00	3.1905	1.03213
PB01	168	1.00	5.00	4.1250	.96146
PB02	168	1.00	5.00	4.1369	.89527
PB03	168	1.00	5.00	3.5655	1.08136
PB04	168	1.00	5.00	3.7798	1.00553
PE01	168	1.00	5.00	3.1399	1.09217
PE02	168	1.00	5.00	3.2099	.82416
PE03	168	1.00	5.00	3.5515	.81532
KSC01	168	1.00	5.00	3.8036	.89749
KSC02	168	1.00	5.00	3.2679	.91869
KSC03	168	1.00	5.00	3.2321	1.05520
KSC04	168	1.00	5.00	3.4090	1.06864
PP01	168	1.00	5.00	3.2024	1.10827
PP02	168	1.00	5.00	3.1667	1.11316
PP03	168	1.00	5.00	3.2988	1.07853
RI01	168	1.00	5.00	2.3652	1.07981
RI02	168	1.00	5.00	2.3832	1.05953
RI03	168	1.00	5.00	2.3233	1.02232
RI04	168	1.00	5.00	2.6346	1.14442
MSC01	168	1.00	5.00	3.1786	1.14422
MSC02	168	1.00	5.00	3.1488	1.18695
MSC03	168	1.00	5.00	3.0595	1.11443
MSC04	168	1.00	5.00	3.0357	1.12080
KC01	168	1.00	5.00	3.1429	1.01064
KC02	168	1.00	5.00	3.0461	.96241
KC03	168	1.00	5.00	3.1615	.94974
KC04	168	1.00	5.00	3.1795	1.03995
KS01	168	1.00	5.00	3.0476	1.07118
KS02	168	1.00	5.00	2.8869	1.05209

	N	Minimum	Maximum	Mean	Std. Deviation
KS03	168	1.00	5.00	2.8929	1.01507
KS04	168	1.00	5.00	3.1012	1.03032
KT01	168	1.00	5.00	3.8095	.97853
KT02	168	1.00	5.00	3.8036	.84243
KT03	168	1.00	5.00	3.1726	1.11601
KT04	168	1.00	5.00	3.4464	1.01344
KA01	168	1.00	5.00	3.6667	.97678
KA02	168	1.00	5.00	3.4226	.99998
KA03	168	1.00	5.00	3.3810	1.03709
KA04	168	1.00	5.00	3.3571	1.04558
Orgn_Size	168	1.00	4.00	2.9345	1.10057
Industry	168	1.00	12.00	4.0893	3.28092
Valid N (listwise)	168				

Appendix H: Measuring item labels used in study calculations

Item code	Item wording
IT use for knowledge creation	
	In my organisation…
IT_KC01	IT-based systems are used to acquire knowledge about new product/services within our industry
IT_KC02	IT-based systems are used to acquire knowledge about competitors within our industry
IT_KC03	IT-based systems (e.g. chat groups, blogs, online discussion forums) are used to integrate different sources and types of knowledge
IT use for knowledge storage	
	In my organisation…
IT_KS01	IT-based systems (e.g. knowledge repository, document management system) are used to store individual and organisational knowledge
IT_KS02	IT-based systems (e.g. collaboration software) are used to store knowledge obtained from collaboration of teams
IT_KS03	IT-based systems (e.g. knowledge database) are used to store lessons learned from completed projects
IT_KS04	IT-based systems (e.g. product design databases) are used to store knowledge of the design of products
IT use for knowledge transfer	
	In my organisation…
IT_KT01	IT-based systems (e.g. web portals, intranets, online forums) are used to share knowledge throughout the organisation
IT_KT02	IT-based systems (e.g. document management systems, online expert communities) are used to transfer organisational knowledge between individuals
IT_KT03	IT-based systems (e.g. electronic meeting software, video conferencing) are used to allow people in multiple locations to learn as a group from a single source
IT use for knowledge application	
	In my organisation…
IT_KA01	IT-based systems (e.g. help desk systems, troubleshooting systems, expert systems) are used to apply knowledge in solving new problems
IT_KA02	IT-based systems (e.g. experts locator systems) are used to match sources of knowledge with problems and challenges
IT_KA03	IT-based systems (e.g. simulation and modelling tools) are used to apply knowledge in development of new products/services
IT_KA04	IT-based systems (e.g. business intelligence, competitive intelligence tools) are used to generate new opportunities with our partners
Knowledge creation	
	My organisation has…
KC01	processes for inter-organisational collaboration
KC02	processes for combining existing knowledge into new knowledge
KC03	processes for acquiring knowledge about new products/services within our industry
KC04	processes for benchmarking organisational performance
Knowledge storage	
	My organisation has…
KS01	processes for organising knowledge
KS02	processes for replacing outdated knowledge
KS03	processes for filtering the right and relevant knowledge
KS04	processes for recording knowledge in a medium from which it can later be retrieved by employees
Knowledge transfer	
	In my organisation the following processes are engaged to share knowledge:
KT01	On-the-job training
KT02	Face-to-face meetings
KT03	Brainstorming retreats or camps
KT04	Cooperative projects across departments
Knowledge application	
	My organisation…
KA01	uses shared knowledge to improve efficiency
KA02	ensures effective interpretation and application of knowledge
KA03	quickly links sources of knowledge in solving problems
KA04	has processes for applying knowledge in development of new products/services
Knowledge classification in the organisation	
K_Cls01	Management in my organisation has taken measures to determine the type of knowledge that we need
K_Cls02	My organisation has a taxonomy or classification system for knowledge
K_Cls03	Management in my organisation uses a clear distinction between knowledge (e.g. best practices, lessons learned) and information (e.g. operations/sales reports)
Perceived benefits of using IT for KM	
PB01	IT enables knowledge to be shared easily to improve job performance
PB02	IT enables efficient collaboration between people from different departments to improve productivity
PB03	IT enables effective searches of system, database, or individual having specific knowledge

Item code	Item wording
PB04	knowledge networks (e.g. groupware, intranet, virtual communities) enable efficient exchange of knowledge among employees
Perceived ease of use of IT for KM	
PE01	It is easy to deposit knowledge into the knowledge database
PE02	It is easy to get the relevant knowledge by using IT
PE03	It is easy to use IT to manage knowledge using the procedures and/or guidelines provided
Knowledge sharing culture	
KSC01	People within my organisation value an individual's experience and knowledge for organisation's success
KSC02	My organisation has systematic means of sharing knowledge to make decisions
KSC03	It is a normal practice in my organisation to use IT to expedite knowledge sharing
KSC04	People within my organisation value and encourage contributions made to the knowledge database
Policies and procedures on IT use for KM	
PP01	My organisation provides procedures and/or guidelines to facilitate the use of IT to manage knowledge
PP02	My organisation has clear policies for IT use in contributing knowledge to the knowledge database
PP03	My organisation has clear policies for IT use in accessing knowledge in the knowledge database
Rewards and incentives for KM	
	Management in my organisation…
RI01	provides a standardised reward system to induce knowledge sharing
RI02	provides incentives that encourage the use of IT to share knowledge with others
RI03	provides incentives for those who use IT to collaborate with others from different departments
RI04	rates performance based on employee's contribution and sharing of knowledge with others
Management support and commitment in the use of IT for KM	
	The management in my organisation...
MSC01	clearly communicates the importance of using IT to support knowledge management activities
MSC02	allocates dedicated personnel to lead the use of IT in managing knowledge
MSC03	allocates sufficient funds and resources to support IT infrastructure for knowledge management
MSC04	provides adequate training for employees to use IT in managing knowledge effectively

Appendix I: PLS bootstrap output for measurement model analysis

Output results with Construct Level sign change preprocessing:
Bootstrap raw data generated for Prof Mohammed Quaddus, PhD
Number of cases in full model: 168
Number of cases per sample: 168
Number of samples generated: 100
Number of good samples: 100

Outer Model Loadings:
==

	Original sample estimate	Mean of subsamples	Standard error	T-Statistic
IT_KCrea:				
(Composite Reliability = 0.843 , AVE = 0.642)				
IT_KC01	0.7983	0.7940	0.0249	32.0590
IT_KC02	0.8593	0.8606	0.0198	43.4298
IT_KC03	0.7415	0.7423	0.0325	22.7815
IT_KStor:				
(Composite Reliability = 0.917 , AVE = 0.734)				
IT_KS01	0.8219	0.8254	0.0301	27.3000
IT_KS02	0.8863	0.8859	0.0196	45.3258
IT_KS03	0.8655	0.8661	0.0251	34.4905
IT_KS04	0.8529	0.8555	0.0253	33.6789
IT_KTran:				
(Composite Reliability = 0.898 , AVE = 0.747)				
IT_KT01	0.8971	0.8979	0.0138	65.1313
IT_KT02	0.8844	0.8852	0.0191	46.2689
IT_KT03	0.8080	0.8084	0.0273	29.6469
IT_KAppl:				
(Composite Reliability = 0.900 , AVE = 0.693)				
IT_KA01	0.8364	0.8402	0.0281	29.8002
IT_KA02	0.8811	0.8878	0.0186	47.3559
IT_KA03	0.7820	0.7853	0.0393	19.9074
IT_KA04	0.8282	0.8354	0.0263	31.4690
K_Creati:				
(Composite Reliability = 0.938 , AVE = 0.790)				
KC01	0.8868	0.8822	0.0268	33.0756
KC02	0.9037	0.9047	0.0156	57.9011
KC03	0.9136	0.9146	0.0142	64.5516
KC04	0.8499	0.8504	0.0266	31.9027
K_Storag:				
(Composite Reliability = 0.956 , AVE = 0.843)				
KS01	0.9144	0.9171	0.0169	54.0836
KS02	0.9186	0.9193	0.0156	58.8015
KS03	0.9325	0.9305	0.0119	78.2646
KS04	0.9079	0.9071	0.0153	59.2703
K_Transf:				
(Composite Reliability = 0.896 , AVE = 0.684)				
KT01	0.8146	0.8130	0.0317	25.7372
KT02	0.8182	0.8151	0.0327	25.0322
KT03	0.8192	0.8154	0.0294	27.9084
KT04	0.8555	0.8557	0.0212	40.3302
K_Applic:				
(Composite Reliability = 0.957 , AVE = 0.846)				
KA01	0.8972	0.8946	0.0198	45.2217
KA02	0.9440	0.9434	0.0090	105.0351
KA03	0.9403	0.9377	0.0133	70.5243
KA04	0.8970	0.8946	0.0227	39.5555
Policy_P:				
(Composite Reliability = 0.958 , AVE = 0.884)				
PP01	0.9064	0.9060	0.0174	52.1143
PP02	0.9622	0.9617	0.0065	148.8823
PP03	0.9505	0.9495	0.0097	98.3371

Pcvd_Ben:
(Composite Reliability = 0.909 , AVE = 0.715)

PB01	0.8638	0.8687	0.0201	42.9380
PB02	0.8509	0.8495	0.0379	22.4623
PB03	0.7985	0.8009	0.0398	20.0718
PB04	0.8667	0.8756	0.0278	31.1572

Pcvd_Eas:
(Composite Reliability = 0.849 , AVE = 0.654)

PE01	0.8094	0.8090	0.0370	21.8558
PE02	0.8732	0.8744	0.0212	41.1364
PE03	0.7373	0.7394	0.0371	19.8552

Reward_I:
(Composite Reliability = 0.942 , AVE = 0.804)

RI01	0.9142	0.9153	0.0164	55.6692
RI02	0.9375	0.9358	0.0108	86.6857
RI03	0.9254	0.9270	0.0150	61.5942
RI04	0.8024	0.8027	0.0465	17.2457

Mgmt_Sup:
(Composite Reliability = 0.954 , AVE = 0.838)

MSC01	0.8948	0.9005	0.0172	52.1057
MSC02	0.9115	0.9139	0.0148	61.3998
MSC03	0.9227	0.9258	0.0157	58.9302
MSC04	0.9324	0.9354	0.0111	84.0313

K_Classi:
(Composite Reliability = 0.902 , AVE = 0.755)

K_Cls01	0.8526	0.8570	0.0338	25.1960
K_Cls02	0.8891	0.8920	0.0167	53.3166
K_Cls03	0.8647	0.8688	0.0228	38.0079

KShr_Cul:
(Composite Reliability = 0.901 , AVE = 0.695)

KSC01	0.8065	0.8111	0.0424	19.0252
KSC02	0.8737	0.8756	0.0226	38.7083
KSC03	0.8104	0.8142	0.0271	29.9329
KSC04	0.8415	0.8442	0.0224	37.4906

==

Appendix J: PLS bootstrap output for structural model analysis

Output results with Construct Level sign change preprocessing:
Bootstrap raw data generated for Prof Mohammed Quaddus, PhD
Number of cases in full model: 168
Number of cases per sample: 168
Number of samples generated: 100
Number of good samples: 100

Path Coefficients Table (Original Sample Estimate):

	Policy_P	Pcvd_Ben	Pcvd_Eas	Reward_I	Mgmt_Sup	K_Classi	Knowledg	IT_Use_f	KM_Proce
Policy_P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pcvd_Ben	0.0000	0.0000	0.1760	0.0000	0.0000	0.4130	0.0000	0.0000	0.0000
Pcvd_Eas	0.5400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Reward_I	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mgmt_Sup	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K_Classi	0.0000	0.0000	0.0000	0.0000	0.6770	0.0000	0.0000	0.0000	0.0000
Knowledg	0.0000	0.0000	0.0000	0.0000	0.7130	0.0000	0.0000	0.0000	0.0000
IT_Use_f	0.1160	0.1970	0.0310	0.0490	0.0530	0.2390	0.2060	0.0000	0.2650
KM_Proce	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Path Coefficients Table (Mean of Subsamples):

	Policy_P	Pcvd_Ben	Pcvd_Eas	Reward_I	Mgmt_Sup	K_Classi	Knowledg	IT_Use_f	KM_Proce
Policy_P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pcvd_Ben	0.0000	0.0000	0.1838	0.0000	0.0000	0.4094	0.0000	0.0000	0.0000
Pcvd_Eas	0.5555	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Reward_I	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mgmt_Sup	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K_Classi	0.0000	0.0000	0.0000	0.0000	0.6829	0.0000	0.0000	0.0000	0.0000
Knowledg	0.0000	0.0000	0.0000	0.0000	0.7187	0.0000	0.0000	0.0000	0.0000
IT_Use_f	0.1195	0.1883	0.0197	0.0403	0.0639	0.2266	0.2129	0.0000	0.2892
KM_Proce	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Path Coefficients Table (Standard Error):

	Policy_P	Pcvd_Ben	Pcvd_Eas	Reward_I	Mgmt_Sup	K_Classi	Knowledg	IT_Use_f	KM_Proce
Policy_P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pcvd_Ben	0.0000	0.0000	0.0794	0.0000	0.0000	0.0824	0.0000	0.0000	0.0000
Pcvd_Eas	0.0604	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Reward_I	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mgmt_Sup	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K_Classi	0.0000	0.0000	0.0000	0.0000	0.0426	0.0000	0.0000	0.0000	0.0000
Knowledg	0.0000	0.0000	0.0000	0.0000	0.0348	0.0000	0.0000	0.0000	0.0000
IT_Use_f	0.0863	0.0733	0.0626	0.0568	0.0885	0.0769	0.0940	0.0000	0.0848
KM_Proce	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Path Coefficients Table (T-Statistic)

	Policy_P	Pcvd_Ben	Pcvd_Eas	Reward_I	Mgmt_Sup	K_Classi	Knowledg	IT_Use_f	KM_Proce
Policy_P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pcvd_Ben	0.0000	0.0000	2.2178	0.0000	0.0000	5.0149	0.0000	0.0000	0.0000
Pcvd_Eas	8.9333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Reward_I	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mgmt_Sup	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
K_Classi	0.0000	0.0000	0.0000	0.0000	15.9078	0.0000	0.0000	0.0000	0.0000
Knowledg	0.0000	0.0000	0.0000	0.0000	20.5037	0.0000	0.0000	0.0000	0.0000
IT_Use_f	1.3439	2.6860	0.4953	0.8632	0.5986	3.1069	2.1921	0.0000	3.1261
KM_Proce	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000

Appendix K: PLS graphic output with control variables